POULTRY BREEDING

BY MILLER PURVIS

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MILLER PURVIS.

Poultry Breeding

A Complete Guide for Keepers of Poultry

By
MILLER PURVIS
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LIST OF ILLUSTRATIONS.

	PAGE
RHODE ISLAND REDS.....	13
SILVER WYANDOTTES	13, 15
BARRED PLYMOUTH ROCKS.....	13, 15, 35, 39, 59
COLUMBIAN WYANDOTTES	15, 31, 35
BUFF PLYMOUTH ROCKS.....	19
BUFF COCHIN	19, 47
SILVER GRAY DORKING.....	19
SILVER PENCILED WYANDOTTE.....	19, 43
WHITE WYANDOTTES	21, 25
LIGHT BRAHMAS	21, 27, 51
WHITE COCHIN BANTAM.....	25, 51
WHITE PLYMOUTH ROCKS.....	25, 39, 59
GOLDEN DUCKWING BANTAM.....	25
BLACK ORPINGTONS	27, 61
BUFF WYANDOTTES	27, 39, 43
WHITE LEGHORNS	27, 215
BLACK MINORCA	35, 65, 69
BROWN LEGHORN	39, 65, 69
SILVER PENCILED PLYMOUTH ROCK.....	43
WHITE CORNISH	43
BLACK COCHIN	47
WHITE COCHIN	47
WHITE LANGSHAN	47
BUFF COCHIN BANTAM.....	51
SILVER DUCKWING BANTAM.....	55
ORPINGTON TYPES	55
JUBILEE ORPINGTON	59
BLACK LANGSHAN	59, 157
BUFF ORPINGTONS	61
WHITE POLISH	65

	PAGE
ROSE COMB BLACK MINORCA.....	69
ROSE COMB WHITE LEGHORN.....	69
BUFF PLYMOUTH ROCK.....	69
SILVER SPANGLED HAMBURGS.....	73
BROOD COOP FOR HEN AND CHICKS.....	80
WIRE-COVERED SHELTER COOP.....	80
BROOD COOP WITH WIRE NETTING RUN.....	80
BROOD HOUSE FOR WEANED CHICKS.....	80
SMALL BROODER HOUSE.....	85
FIRELESS BROODER	85
BROODER HOUSE PLANS.....	90, 91
PEKIN DUCKS ON A LONG ISLAND FARM.....	111
PEKIN DUCKS	115
MUSCOVY DUCKS	119
INDIAN RUNNER DUCKS.....	119
EGG, SECTION OF AN.....	134
RANGE FOR CHICKENS.....	143
CALIFORNIA POULTRY RANCHES AND HOUSES.....	151, 174
AFRICAN GEESE	175
BROWN CHINA GEESE.....	175
WHITE CHINA GEESE.....	175
EMBDEN GEESE	175, 179, 183
WILD GEESE	179
GEESE AT GETTYSBURG.....	183
GUINEAS AND CHICKENS.....	187
PIANO BOX POULTRY HOUSES.....	191
INCUBATORS, OLD AND NEW TYPES OF.....	195
PENNSYLVANIA EGG FARM.. ..	199
SHADY YARD FOR FOWLS.....	207
WANING CHICKS, PLAN FOR.....	207
HATCHING HOUSE FOR HENS.....	224
LINE-BREEDING CHART	232
MARKING SYSTEM	235
DRESSED POULTRY READY FOR MARKET.....	237
CRATES FOR SHIPPING DRESSED POULTRY.....	247
NEST BOX FOR HENS.....	247

LIST OF ILLUSTRATIONS.

5

	PAGE
FORCE-FEED HOPPER	247
DARKENED NEST	247
OPEN-FRONT POULTRY HOUSE.....	255
ILLINOIS POULTRY HOUSE.....	255
CURTAIN-FRONT LAYING HOUSE.....	258, 259, 260, 261
MINNESOTA POULTRY HOUSE.....	263
POULTRY HOUSE FOR SOUTH OR PACIFIC COAST.....	265
HOUSE WITH ALLEYWAY ON NORTH SIDE.....	267
HOUSES MADE FROM PIANO BOXES.....	269
TRAPNEST, PLAN FOR.....	301
BOURBON RED TURKEY.....	305
BLACK TURKEY TOM.....	305
WHITE TURKEY TOM.....	305
BRONZE TURKEY TOMS.....	305
WHITE TURKEYS	309

FOREWORD.

In February, 1882, the writer bought his first setting of eggs from pure-bred hens. From that day to the present, the dominant interest of his life has been centered in the poultry industry. With the experience of these years to look back to, and with access to the conclusions reached by poultry investigators, the task that the writer set himself to do was so to condense and arrange a vast mess of information that it would be readily available. Thus it happens that while the words used are almost entirely his own there are many ideas in this book which originated with others. Proper credit has been given for the ideas so appropriated, but the writer desires to make formal acknowledgment for the help received from Prof. James E. Rice, Prof. Horace Atwood, Prof. James Dryden, J. L. Nix, Prof. Graham of Canada, Prof. F. L. Stoneburn and others whose work has been consulted. Without their work this book would have been impossible. The arrangement of topics in alphabetical order will, it is believed, meet with general approval. The illustrations are from photographs taken by the writer for the most part, although a few are from photographs of fowls of exceptional quality secured from other sources. This book has not been written to read consecutively but rather to furnish information in every emergency in a form which makes it quickly available.

In the hope that this book will be of practical value to all who are interested in poultry, the author submits it as a cheerful service.

February, 1910.

M. P.

POULTRY BREEDING.

AGE OF BREEDING STOCK.—While there is much to indicate that pullets are as valuable as older hens as breeders, it is a general opinion among poultrymen that hens more than a year old are better for this purpose than yearlings. It is certain that hens past their second summer-lay larger eggs than pullets and it would seem that the older hens would be more fully matured.

ANIMAL FEEDS.—The hen is a meat-eater. A bulletin by Prof. James Dryden, of the Oregon Experiment Station, gives the following concerning animal feeds for fowls: "Animal feed of some kind is necessary to fowls to maintain their health and vigor and make them productive of either meat or eggs. A knowledge of this has done more to increase the poultryman's profits than any other thing in poultry feeding. The scarcity of eggs in winter is largely due to lack of animal feed. The fact that when chickens are given the liberty of fields in summer they find feed in the form of bugs, angleworms, grasshoppers and other insects, escapes the notice of the farmer, and in the winter he does not see the necessity of feeding it. In most parts of the country in winter chickens are unable to obtain animal feed in the fields, especially in sections where snow covers the ground. In western Oregon, with its mild winters, they find many angleworms, especially during the rainy season. But in most sections, if not in all, fowls must be liberally fed with animal feed for best results.

"There are a number of ways in which animal feed may be fed. Fresh, lean meat is undoubtedly the best kind of

animal feed. It is the lean meat that furnishes the protein, but there is no objection to having the lean mixed with a little fat; this may be an advantage at times. Fresh meat scraps from the butchers' stalls are an excellent egg-maker. Some butchers keep a bone-cutter and sell the meat and bones ready ground and cut up. Where one has a sufficient number of hens, say 25 or more, it will pay to buy a good bone-cutter and cut the bones. The scraps contain a large proportion of bones, and fowls eat these very greedily as well as the meat. They furnish the mineral matter necessary for the bone-making as well as the egg shells. Skimmilk will take the place of other animal feed if it is fed liberally enough. The trouble with skimmilk is that it is not concentrated enough; that is, it is too largely water. In other words, in 100 pounds of skimmilk there are only 10 pounds of feed. Even with milk kept before them all the time, laying hens will not get enough of it to supply the demand for animal feed. If wet mashies are fed, by using skimmilk to wet the mash they will get more of it in this way. By feeding it clabbered the fowls will get more feed out of it. Probably the best way to feed milk is to make 'cottage cheese' of it. This is a splendid feed when properly made. In this form fowls will consume enough to meet the demand for animal feed. Our dairy department makes it in this way:

"Set a can of skimmilk in a place having a temperature of 75° to 80°. In 18 to 24 hours the milk will coagulate (thicken). Then break up into pieces the size of peas or smaller; set the can in a pail of hot water, stirring the curd until a temperature of 85° or 90° is reached; hold this temperature 15 to 20 minutes, without stirring. Then pour the contents of the can into a cotton sack and hang it up where it can drain off. The milk should not be

boiled. Salt it a little. It will keep a day or two. Beef scrap is the most convenient shape in which to feed animal feed. This is a by-product of the large packing houses, and contains meat and bones in varying proportions which have gone through a boiling process and then have been dried. It contains, therefore, little moisture as compared with fresh meat scraps. It varies considerably in composition, but should contain 50 to 60 per cent of protein. Beef scrap varies also in quality. It should be light-colored with a meaty odor and somewhat oily to the touch. When boiling water is poured over it it should have a fresh meaty odor. If it gives off a putrid odor do not use it."

Prof. Dryden estimates that 30 pounds of skimmilk, 12 pounds of cut-bone or 8 pounds of beef scrap have the same value.

AVERAGE EGG PRODUCTION.—According to the census of 1890 the average production of eggs by the hens of the United States is 65 each. In Canada the result of carefully prepared statistics gave approximately the same number.

BEEF SCRAP VS. GREEN BONES.—Six very careful, separate recent tests to compare the nutritive value of beef scrap or meatmeal and cut green bones showed in favor of the beef scrap three times and in favor of cut green bones three times. This indicates that the difference in value is a negligible quantity. As beef scrap and meatmeal can be kept in warm weather, and sufficient bought for several months' use, while cut green bones spoil almost at once, it is evident that the poultryman will find it more convenient to use the beef scrap, unless he can secure a daily supply of cut green bone without inconvenience.

BONE.—Bone either coarsely crushed, so fowls can swallow it, or ground into meal, is a valuable component of the rations of fowls. Bone furnishes lime for egg shells, phosphorus for nerve and bone material and some nutriments in the shape of protein, if they are not too old.

BREEDS OF FOWLS.—The American Poultry Association recognizes 56 distinct breeds of fowls in this country. Of these 39 are domestic fowls of the order Gallinacea, or—more commonly, “chickens,” 1 of turkeys, 10 of ducks and 6 of geese. In this country shape is considered in distinguishing the breed and color the variety. The several breeds are much broken up into varieties, as to most of them, although there are a few breeds of which there is but one variety. For convenience in classification the breeds are first separated into “classes,” the country of their origin or some other peculiarity being used in designating the class to which a given breed belongs. In the classes we have the following:

Chickens.—American, Asiatic, Mediterranean, English, Polish, French, Dutch, Games and Game Bantams, Oriental Games and Bantams, Ornamental Bantams, Miscellaneous.

Turkeys.—One breed.

Ducks.—Pekin, Aylesbury, Rouen, Cayuga, Call, East India, Crested, Muscovy, Indian Runner, Swedish.

Geese.—Emden, Toulouse, African, Chinese, Wild or Canadian, Egyptian.

American Class.—In this class there are the following breeds and their varieties:

Plymouth Rocks.—Six varieties, as follows: Barred, White, Buff, Silver Penciled, Columbian.

Wyandottes.—Silver, Golden, White, Buff, Black, Partridge, Silver Penciled, Columbian.

1 and 2, Rhode Island Reds. 3, Silver Wyandotte. 4, Barred Plymouth Rock.

Javas.—Black, Mottled.

Dominiques.—One variety, Rose Comb.

Rhode Island Reds.—Single Comb, Rose Comb.

Buckeyes.—One variety.

American Class.—The breeds in the American class and their varieties are all of American origin, having been made by crossing foreign varieties or having been bred up from indiscriminate mixing of other varieties.

Plymouth Rocks.—The first mention of the Plymouth Rock fowl which we have been able to find is a description which appeared in "The Boston Cultivator" for Aug. 25, 1849, and copied into a book entitled "The American Poultry Yard," which was written by D. J. Browne and published in New York in 1860. The article copied from was written by Dr. J. C. Bennett, who says: "I have given this name (Plymouth Rock) to a very extra breed of fowls, which I have produced by crossing a cockerel of Baylies' importation of Cochín China with a hen, a cross between the fawn-colored Dorking, the great Malay and the wild India. Her weight is 6 pounds and 7 ounces. The Plymouth Rock fowl then is in reality one-half Cochín China, one-fourth fawn-colored Dorking, one-eighth great Malay and one-eighth wild India, having five primitive bloods, Shanghæ, Malay, game, Turkish and India, traceable by referring to the history of these breeds and their crosses, respectively. The pullets commenced laying when 5 months old, proving superior layers. Their eggs are of medium size, rich and a reddish-yellow in color. Their plumage is rich and variegated; the cockerels are usually red or speckled, the pullets darkish-brown."

This description does not apply in any way to the Plymouth Rock of today. Plymouth Rocks were again

1. Barred Plymouth Rocks. 2, Columbian Wyandottes. 3, Silver Wyandottes.

mentioned in "The New England Farmer" under date of Nov. 24, 1849, in a report of a Boston poultry show held Nov. 15 and 16 of that year. The reporter evidently had a very poor opinion of the new breed, as he dismissed it in these words: "This is a new variety, recently formed at Plymouth, and which has gained an early, and we think, a short-lived fame, unless their intrinsic properties excel their appearance. But few of this race were shown and some of them were very good in appearance."

The next mention of a breed of fowls called Plymouth Rock was about twenty years later, when the "Poultry Bulletin" of New York mentioned them, so it appears that the prophecy of the Boston reporter was well-founded. It is probable that about 1870 several American poultry breeders brought out a Dominique-colored fowl calling it Plymouth Rock. As nearly as can be learned the breed as we now have it was originated from a mixture of Dominiques, Black Spanish, White Cochin, Buff Cochin, Black Java and a breed now lost, known as the White Birmingham fowls.

It became immensely popular after its second introduction and immediately was taken up and improvement began. As a fowl for farmers it occupies a leading place, although it is ~~hard~~ to breed to Standard requirements. The hens are quite good layers and the chicks mature at an early age; mature cocks weigh $9\frac{1}{2}$ pounds and mature hens weigh $7\frac{1}{2}$ pounds.

The White Plymouth Rock was introduced by a Mr. Frost of Maine, about 1880. The mixed lineage of the original variety caused it to throw white and black chicks and those of mixed colors, and there is no doubt that White Plymouth Rocks originated from sports of the original barred variety.

Buff Plymouth Rocks were first exhibited at Worcester, Mass., at a poultry show by the late Rollin G. Buffington, who told the writer that he got his first stock in the Little Compton district of Rhode Island from the same stock that has since been named Rhode Island Reds.

Partridge Plymouth Rocks followed the Buffs, coming about ten years later. They were doubtless produced by crossing Buff Plymouth Rocks and Partridge Cochins, or were selected from Partridge Wyandottes on account of their single combs and named after the popular Plymouth Rocks to attract more favorable attention to them. They are not very widely bred.

Silver Penciled Plymouth Rocks have probably very little real Plymouth Rock blood in them. At least one very good strain of them was originated by Mr. Wittman of Pennsylvania, who used Dark Brahma and Silver Gray Dorkings in making his strain. These were admitted to the Standard in 1907.

The latest variety to be named after the Plymouth Rock is the Columbian Plymouth Rock. This variety is probably a selection of Single Comb Columbian Wyandottes, selected and bred to Plymouth Rock shape. A few men are breeding a variety which they call Golden Barred or Buff Barred Plymouth Rocks. This has never been offered for recognition. It is largely of pure Plymouth Rock blood, the bars being white and a golden buff, making a very attractive combination.

Wyandottes.—No other breed has been the subject of so much controversy as the Wyandottes. Apparently they appeared in two different places at almost the same time. That they were deliberately built up is beyond belief and there is no evidence that such is the case. It is probable that the foundation blood was Dark Brahma and

Silver Spangled Hamburg, but who first made this cross it is not known. They were called Hambletonians, Ambrights and American Sebrights when they were first brought to notice. At the time they came up for recognition by the American Poultry Association (about 1882) they were named Wyandottes at the suggestion of a Mr. Houdlette. Luther Whittaker of Michigan and John P. Ray of New York were among the earliest breeders, and to them is due much of the credit for perfecting the breed and forming it into its present shape. The original Wyandottes were the variety now known as Silver Wyandottes, and for several years no other variety was known. Wyandottes are one pound lighter in weight than Plymouth Rocks, mature cocks weighing $8\frac{1}{2}$ pounds and mature hens $6\frac{1}{2}$ pounds. They feather out almost immediately after hatching and grow up symmetrical and distinctively Wyandotte in shape without passing through the stage where they seem awkward and long of leg. They are very hardy, their close-fitting rose combs saving them from suffering from frost as do breeds with larger single combs. The hens are very good layers, especially in winter, when they are properly housed and fed. Their blocky, plump bodies make them favorite market fowls.

The distinctive color characteristic of the Silver Wyandotte, as the original variety is now called, is that the feathers of the hen are white with a narrow edging or lacing of deep black around the edge. This lacing should be as narrow as possible, extend entirely around the edge of the feather and should be clear black without any white "frosting" on the outer edge. The breast of the cock is of the same color, while other parts of the body are silvery white, the neck or hackle and saddle feathers

1, Buff Plymouth Rock. 2, Buff Cochins. 3, Silver Gray Dorking. 4, Silver-Penciled Wyandotte.

having a black stripe through the center, while the tail is a greenish black.

Golden Wyandottes appeared in about 1885. They were of the same color as the Silver variety, except that the white is replaced by a deep golden color. They originated in northern Illinois or southern Wisconsin, a Mr. McKen first bringing good specimens to notice. For a while they were quite popular, but of late years they do not seem to be making much progress. In all practical qualities they are as good as the original variety, and seem easier to breed true to color. It has been claimed that the golden color came from a breed locally known as Winnebagoes, now extinct.

White Wyandottes followed the Golden variety. They are of pure Wyandotte blood, having been bred from sports of the silver variety. They have become very popular and are one of the leading varieties of this country.

Black Wyandottes were originated from a selection of the darkest of the Silver variety. The writer bred them as long ago as 1889. They have never become very popular, although they are among the best layers in the Wyandotte family.

Partridge Wyandottes are of the same color as the Partridge Cochin. They were admitted to the Standard in 1900. For a time they bade fair to take a leading place among the popular breeds, but they failed to hold their position, and comparatively few of them are now bred. They possess many good qualities, but have failed to attract any considerable number of admirers.

The Columbian Wyandotte is the latest member of this family to secure recognition. It was originated by a Mr. Briggs of Rhode Island from crosses which seem to have

1, White Wyandottes. 2, Light Brahmas.

been made accidentally. Since their introduction other strains have been originated by the use of Light Brahmas and White Wyandottes. In color the Columbian is identical with the Light Brahmas, and it has become very popular.

Two varieties of the Wyandotte family that have attracted considerable attention are the Buff Laced, the plumage being buff with a white lacing, and Violettes, a variety in which the ground of the plumage is buff with blue lacing. Neither of these varieties is bred in this country except by a few breeders.

Javas.—This is an American production, but its origin is lost in impenetrable mystery. No tenable theory of the foundation bloodlines has been advanced. It is characterized by a long, flat back, deep body and long keel. At one time it was the candidate for the first position among American varieties, but for several years it has lost ground and good specimens are now hard to find. Javas were at one time bred in three varieties—Black, White and Mottled. After White Plymouth Rocks were brought out they so closely resembled White Javas that the American Poultry Association declared the two varieties practically the same and dropped the White Javas from the Standard with the understanding that breeders of White Javas might consider them White Plymouth Rocks.

Mottled Javas are black and white in color, the black predominating. But very few of them are now bred. They are a hardy and prolific breed, and were it not for prejudice which exists in this country against a black fowl they would no doubt have maintained their position among the leading favorites.

Dominiques.—Among all the breeds of domestic fowls kept in America the Dominique is the oldest. It has been

called the native fowl, although of course it descended from the same original stock from which all our other fowls trace their descent. It has been in this country certainly from the time of the Revolutionary War, or longer. It is a hardy prolific breed, but it has never received the attention it deserves, and is probably the rarest of the American breeds.

Rhode Island Reds are generally considered a new breed, and so they are so far as recognition by the American Poultry Association is concerned; but they are really an old breed, only they were not recognized as a distinct breed until a few years ago. For many years the farmers of the Little Compton district of Rhode Island had been selecting red fowls under the impression that they were hardier than those of any other color. In the first place the sea captains whose homes were along the south shore of Rhode Island had brought from other countries fowls that they picked up in the ports to which they sailed. These fowls came from the Mediterranean ports and from Chinese and Malayan ports. The Mediterranean fowls were called Red Leghorns, being the foundation from which we get the Brown Leghorns of today. From the Malay Peninsula came the large Malay fowls, a pea comb breed of great size and vigor. From China came the old Red Shanghai fowl. The mixing of these breeds went on for many years, and the red fowls of Little Compton were developed from crossing them without regard to anything but the production of red fowls, which could endure the rather severe winter climate of that part of the country. They were of many shades of red and had single, rose and pea combs. The writer has seen in that district flocks of fowls with all styles of combs and of many diverse shapes, running together on the farms. Some were buff,

some cinnamon color and some deep red. Some were long of limb, others showed plainly their Malay parentage, and some were fairly good Leghorns so far as shape was concerned.

The late Dr. N. B. Aldrich was attracted to these fowls and he selected some specimens that met his views of the ideal fowl and began to breed them, introducing them to the public through showing them at some eastern poultry shows. Soon these fowls began to attract very favorable attention, and they are now considered among the best of our general-purpose fowls. The Rhode Island Red is bred in two varieties, the only difference being that one variety has a single comb and the other a rose comb. The mature cock weighs $8\frac{1}{2}$ and the hen $6\frac{1}{2}$ pounds. They are very much esteemed as winter layers and hold a high place as a market fowl. The Rhode Island Red has a long body and a deep breast, the keel coming well forward. The ideal shape is oblong and as near rectangular as it is possible to get a fowl. The general color is red, but the tail feathers are black, and there is some black in the wings. The females also have some black "ticking" on the feathers of the neck.

Buckeyes were first recognized by the American Poultry Association in 1905. They enjoy the distinction of being the only recognized breed of fowls owing its origin to a woman, the originator being Mrs. Nettie Metcalf of Ohio, now of California. She first called her new creation Pea Comb Rhode Island Reds and then asked for their recognition under the name of Buckeye Reds, but the Association gave them the name of Buckeyes when they were admitted to the Standard. They were made by crossing Pea Comb Rhode Island Reds with the Indian game fowl, now known as the Cornish fowl. In

1, White Cochín Bantams. 2, White Plymouth Rock. 3, Silver Wyandotte.
4, Golden Duckwing Bantam. 5, Pair of White Plymouth Rocks.

color they are very much like the Rhode Island Red except that they have a bluish undercolor, a marking that Rhode Island Red breeders try to eliminate from their fowls, although it is hard to do. For all practical purposes the Buckeyes are the same as Rhode Island Reds, being equally valuable as general-purpose fowls.

Asiatic Fowls.—To this class which contains fowls of Asiatic origin, the following breeds and varieties belong:

Brahmas.—Two varieties, Light and Dark. Cochins—four varieties, Buff, Partridge, White, Black. Langshans—Two varieties, White, Black.

Brahmas.—This breed has been the subject of much discussion. It has been claimed that they were bred up from the Chittagongs, a breed introduced from the Far East about the middle of the last century, but this seems hardly probable, as the Brahmas have pea combs, while a copy of the Standard published in 1871, the first Standard ever published in America, describes the Chittagong as being a single combed fowl, although almost exactly identical in color with the Light Brahma, described in the same edition. The writer has seen a mounted specimen of a Light Brahma cock hatched about 1850, which was identical in color and comb with the modern Light Brahma. The sire of this bird was of the same color and was bought from the captain of a ship in the India trade, who brought him from the East Indies, having bought him originally for use on his table during the voyage. The Chittagongs have disappeared and are no longer bred, and it is possible that the two breeds were merged in some cases. The pea comb is a rather persistent characteristic in breeds which are pea-combed and it is not probable that a single-combed breed would produce pea-

1, Black Orpingtons. 2, Light Brahmas. 3, Buff Wyandottes. 4, White Leghorns.

combed progeny, which invariably comes true as to comb, as do the Brahmas.

Light Brahma.—This is a noble bird, the cock weighing 12 pounds and often more. The mature hen weighs $9\frac{1}{2}$ pounds. In this variety the two sexes are colored in the same way, both being mainly white with black stripes in the hackle feathers and black in the wings and tail. Like all the Asiatic class the Light Brahma has feathers down the shank to the ends of the outer toes and almost to the ends of the middle toes. The chicks are slow to mature, reaching full size at 8 or 9 months. The pullets begin to lay at about 7 months. The eggs of Light Brahmas are very large, frequently going above 30 ounces to the dozen and of a rich reddish buff color, much esteemed in some markets. As a market fowl the Light Brahma is considered one of the best, the only objection being the feathers on the shanks. It was at one time our most popular fowl, but its vogue has greatly declined, other and newer varieties having replaced it.

Dark Brahma.—This variety is identical in shape with the Light Brahma, but is not quite so heavy. The males weighing 11 pounds and the females $8\frac{1}{2}$ pounds, one pound less in each case than the Light Brahma. The origin of the Dark Brahma is involved in much doubt. It first attracted public attention in America at a poultry show in New York in 1866, as an importation from England, but it seems that it was before this time sent from this country to England, British breeders having merely improved the fowls sent to that country. As near as can be learned, the Dark Brahma was made up from cross-breeding two Asiatic breeds brought over by ship captains. These breeds were known as Gray Shanghais and Gray Chittagongs.

In color the Dark Brahma cock has silvery white hackle feathers, striped with clear black. The back is a clear silvery white, the saddle feathers being striped like the hackle. The breast is pure black and the tail feathers greenish black. The hen is a clear steel-gray in every part of the body, the feathers being penciled with three narrow black lines, running parallel with the edge of the feather. This variety is beautiful but not very useful, being slow to mature, rather poor layers and persistent sitters. Good specimens are becoming quite rare, and it seems that the breed is destined to die out for lack of attention. Silver Penciled Wyandottes and Silver Penciled Plymouth Rocks are of the same color and American breeders like them better because they are better layers and have clean legs instead of the feathered legs of the Dark Brahma.

Cochin.—The ancestors of the Cochin family appeared in England shortly after the English obtained a foothold in China in 1843. The English found around Shanghai very large fowls of many colors, mostly ranging from almost white to a reddish brown. The Chinese paid no attention to color but simply bred for size and eggs. They were more interested in the food question than in fancy colors. Some of these fowls were sent to England where they were called Shanghais, Cochin Chinas or simply Chinese fowls. Probably about the same time some of the same varieties were brought to America, where they were introduced as Shanghais, Brahma Pootras, Cochin Chinas and as Chinese fowls. It is altogether probable that some of the same blood was used in both the Cochin and the Brahma make-up. It is quite certain that the modern Cochin in this country and in England was made up from crossing the red, yellow and

buff fowls from China. In England the breeder sought a long leg, a stiff vulture hock and an upright carriage. In America the ideal sought was a low, forward carriage, the leg very short, the breast dropping low and the back rising to a distinct rounded cushion just in front of the tail. This makes a very deep-bodied, "chunky" fowl. Add the very heavy leg feathering, concealing the legs and feet, and we have what some one has called "an animated feather ball," which is not a bad description of the show Cochins of today.

The first edition of the American Standard of Perfection (1871) described Buff Cochins, Lemon Cochins, Silver Buff Cochins, Silver Cinnamon Cochins, Cinnamon Cochins, Grouse or Partridge Cochins, Grouse Cochins, White Cochins and Black Cochins. This shows how popular this breed was in that day and how much of a struggle breeders were having to determine just what color they really wanted in the descendants of the original Chinese fowls. Originally the Chinese fowls had both single and rose combs, but breeders finally settled on the single comb. A variety of Pea Comb Partridge Cochins was brought out at one time, but it did not find favor enough to keep it in existence. Breeders finally settled on one shade of buff, and the various shades of red, yellow and buff were merged into one, and the Standard was fixed, calling for a clear golden buff color in every part of the plumage of Buff Cochins. There is always a tendency for black to appear in this variety, but pure buff specimens are not hard to find.

Buff Cochins.—This is not a valuable fowl for eggs or for market, and it has taken its place as a fancier's fowl, bringing high prices and always attracting attention at the shows. The weight of all Cochins except the Blacks

A Likely Group of Columbian Wyandottes Feeding.

are 11 pounds for the cock and $8\frac{1}{2}$ pounds for the hen. In Black Cochins the cock is one-half pound lighter, other weights being the same. Black Cochins are of the same shape as the Buffs, one-half pound lighter in case of the cock, and a brilliant greenish black in every part of the plumage. They have never become very popular, although a great many were bred previous to the early '70s, at which time the introduction of the Langshan gave them a set-back from which they have never recovered.

White Cochin.—This variety is a white replica of the Buff, and probably is descended from selections of the palest buffs, as in the early history of that variety many specimens almost white were found.

Partridge Cochin.—This variety was at one time quite popular, but it has now taken an inferior position in the popular fancy and only a few of them are found. The cock has a brilliant red hackle, each feather striped with black, a red back and saddle, the saddle being striped as is the hackle, deep black breast and greenish-black tail. The hen has a red hackle, rather lighter than that of the cock, each feather striped with black. The primaries in the wings and the main tail feathers are a dull black, while the remainder of the plumage is a rich mahogany red, each feather penciled with three narrow rows of black conforming to the outline of the feather. All the Cochins are persistent sitters and lay but few eggs in a year. It may be said that they lay best in winter when eggs are highest in price, but the smallness of the number who breed them proves that they are not highly esteemed by practical poultry-breeders.

Langshans.—This latest of the Asiatic breeds to be introduced is held to be the most profitable of the Asiatic family. Langshan hens are excellent layers and their

eggs run about 30 ounces to the dozen. The eggs are a rich buff in color and are produced very plentifully in winter. The Langshan was introduced into England in 1871 by Maj. Croad of the English army, who discovered them in the district of Langshan, China, and sent some of them home. At first they did not attract much attention, but later became very popular and were brought to this country where they have held their own very well. The Langshan cock weighs 10 pounds and the hen 7 pounds; they have a few feathers on the shanks but not so many as the Brahmas. They are long of leg, hold their heads high and the males have a high, flowing tail. They are very short in the back. They have been called the "triangular" breed, because a line drawn from the highest point of head and tail to the feet would describe two sides of a triangle, the line from head to tail completing it.

Langshans come in two varieties, White and Black. The Black Langshan is the original variety, and has the distinction of being the only breed of chickens kept in this country which is still bred in all respects as it was by the Chinese poultrykeepers of remote Langshan. The English have bred this variety with such long legs that it resembles a gigantic game fowl, spoiling its beauty entirely. White Langshans are not known in China nor are they popular in this country. They are perhaps derived from a sport of the original variety having blue or willow legs and pure white plumage. Not enough of them are bred to give them an important place among our domestic fowls.

Mediterranean Class.—This class is composed of those breeds of fowls which were first introduced into this country from the countries which border on the Mediterranean. These fowls are all alike in certain character-

istics. They are all non-sitters, being disinclined to sit, although an occasional hen will show signs of broodiness, and once in a while one will sit from two or three days to the full period required for incubation; but such hens are usually the old ones, which are nearing the end of their productiveness. All the breeds in this class are neatly built and of medium size, and all are very prolific layers of pure white eggs. They have large single combs in their original state, but American breeders have bred some of the breeds to produce sub-varieties with rose combs. In every case we believe the rose combs have been produced by crossing with the Hamburgs.

Brown Leghorns.—All that is positively known about the origin of the Brown Leghorn is that it was brought to this country from some Italian port early in the last century. As now bred this variety is not known in Italy. Some authorities claim that the first Italian fowls were introduced about 1835. Others set a later date. A. H. Halstead, an old-time poultry breeder, told the writer that he bought some red fowls from a ship captain in 1847, which the captain had bought in an Italian port, and bred these fowls for several years. They had red breasts, but in other particulars were like our Leghorns of today. I. K. Felch says the white ear lobes of today were secured by crossing with the Spanish fowl and the black breast and deep red color of the cock were secured by crossing with the Black-Breasted Red game cock. Mr. Halstead confirmed this by saying he got disgusted when fanciers began to cross with games and gave up the breed. The writer began to breed this variety in 1882, and at that time there was much trouble with red in the ear lobes, and it was not uncommon for the females to come with the willow colored legs of the game fowl.

1 and 2, Columbian Wyandottes. 3, Black Minorca. 4. Barred Plymouth Rock.

If the Brown Leghorn was introduced as early as 1835, as some claim, it is strange that Bement did not mention them in his "American Poulterer's Companion," published in New York in 1847. In 1850 "The American Fowl Breeder" was published in Boston, as the work of "An Association of Practical Breeders," who it seems should have been familiar with what was being done around Boston; yet this book does not mention Leghorns, although it notes the presence of Spanish and Italian fowls at a poultry show held in Boston in November, 1849. In 1860 "The American Poultry Yard" by D. J. Browne was published in New York, and at that late day no mention is made even of fowls from Italy, although a long list of breeds is given. It is certain that the first Brown Leghorn fowls ever seen in England were sent over from this country in 1872, when Lewis Wright, author of a very voluminous work on poultry, imported some in order to have them portrayed to illustrate his book. The first reference to the Leghorn in American literature is found in "Saunders's Domestic Poultry," published in 1866.

We have for several years been inclined to think that Mr. Halstead's Red Leghorns were the first importations that made an effective impression on American poultry culture. No doubt Italian fowls were brought to this country before he secured his, but they seem to have been absorbed without leaving any distinctive trace of themselves. If a breed as attractive and as prolific as the Brown Leghorn had been introduced as early as 1835 it seems to us that it would have become known to at least one of the three authors of exhaustive poultry books published in this country previous to 1866. Whatever may have been its origin, or whenever its time of introduction

to this country, it remains certain that to the skill of American poultry breeders is due the beauty of the Brown Leghorn of today, as the variety that stands at the head of the Leghorn family, so far as appearances go.

A well-grown Brown Leghorn cock will weigh up to 6 and a hen up to 5 pounds, although these weights are not commonly reached. No standard weight is fixed for them, and size is not considered as being important in this breed. The cock has a large upstanding comb with five serrations, the hackle is a deep, brilliant red with a black stripe down the center of each feather. The back and shoulders are deep red and the saddle is the same as the hackle and the breast is dull black. The primaries are dull black and the main tail feathers a lustrous greenish-black. His carriage is proud and upright and his walk as deliberate as that of a soldier on parade. The Brown Leghorn hen is equipped with a large comb, evenly serrated and drooping gracefully to one side of her head. Her neck is golden yellow with a black stripe down the center of each feather. The breast is a reddish-salmon color and the primaries and main tail feathers are black. The remainder of her body is a soft even brown, finely stippled with short lines of a darker brown. She is trim of body, alert of movement and a splendid layer of pure white eggs of the standard size.

White Leghorns have been known in this country as long as have their brown cousins. They are perhaps a little higher on the leg than the Brown Leghorn, but in all other respects they are of the same shape. In color they are pure white in every part of the body. In comb, weight and prolificacy they are the same as other Leghorns. White Leghorns have been adopted as distinctively the egg-farmer's fowl in this country. Of all the

great egg farms of this country at least 90 per cent of them keep only Single Comb White Leghorns. Their color is perhaps the main reason why they have been chosen.

Buff Leghorns originated in Denmark, where they are called Italiens. Mrs. Lister Kay was probably the first to give them prominence in England and from there they were brought over to America. They were very popular for a few years and are valued yet, but for some reason the great breeders have never taken them up, and they have so far remained a fancier's fowl. In everything that makes for real value Buff Leghorns are equal to any other members of the family, the only difference being their clear, golden buff color, which in its perfection is a beautiful color.

Black Leghorns and **Silver Duckwing Leghorns** are recognized in this country, but very few of them are bred, no large flocks being kept. The Pile Leghorn is bred in England but only an occasional pair is found in this country. Brown, White and Buff Leghorns are also bred with rose combs, the rose comb being the result of a Hamburg cross which has reduced the size of these birds.

Minorcas.—The Minorcas are supposed to be identical with the old Castilian fowls of Spain. It is supposed that the first of them which appeared in England rather more than a century ago were obtained in Spain and mistakenly credited to Minorca. It is known that they were bred in England as long ago as 1780, but they did not attract widespread attention until 1875, when they were brought to notice by an enthusiastic writer, and immediately became popular. Soon after this they were brought to this country and widely introduced. The

1, Brown Leghorn. 2, Barred Plymouth Rock. 3, Buff Wyandotte. 4, White Plymouth Rock.

American prejudice against a black fowl worked harm to them, but now they are regaining some of their old prestige, especially since a prominent breeder sold several specimens at the largest price, with one exception, ever received for a lot of fowls in this country. Single Comb Black Minorca cocks weigh 9 and hens $7\frac{1}{2}$ pounds. The Rose Comb Black Minorca weighs a pound less, as they are smaller than the original variety, which seems to point to the presence of a Black Hamburg cross in this variety.

Minorcas come in solid black and solid white. The white variety has never received much attention in this country, probably because of the White Leghorn taking its place as a layer, the Leghorn having the advantage of yellow skin and legs, while that of the White Minorca is white, Americans preferring yellow-skinned fowls. A description of Black Minorcas will answer for both Black and White, as the sole difference is in color. The Minorca has a very large comb, deeply serrated, upstanding in the case of the cock and drooping flat against the side of the face in the case of the hen. They have rather long necks, stand high on long legs, and have very long, sloping backs. Their earlobes are large and pure white. The Black Minorca has a dark skin, not black but rather grayish, and dark slate shanks. The White Minorca has white skin and pearly white shanks.

Black Spanish Fowls.—This is one of our oldest pure-bred races of fowls. Columella, who wrote in the first century, mentions a breed of fowls, kept in Spain, which had white earlobes and thought more of laying eggs than of sitting. The Black Spanish fowl resembles the Minorca very much, having the same stately carriage, the same large comb and the same iridescent, greenish black

plumage. The main divergence in type is in the face and earlobes. The writer can remember when the Black Spanish fowl had white earlobes exactly like those of the Minorca of today, but now this breed has been bred so as to have a white face and earlobes, the skin of the face having the appearance of fine kid leather. The breed was at one time very popular, but of late years it has dropped back to such an extent that but very few of them are kept, and their economic importance has altogether disappeared. Only now and then is a specimen seen at the largest poultry shows. They are slow to mature, but very good layers, their eggs being very large and pure white. The cock weighs 8 and the hen 6½ pounds.

Andalusians.—The Andalusian is also of Spanish descent. It was introduced into England about 1851, but its advent in this country was not heralded in a way to make a permanent record. Andalusians are a peculiar slaty blue in color, and very good layers of pure white eggs of ordinary size. The cock weighs 6 and the hen 5 pounds. It is supposed that this breed originated from sports from the Minorcas, black and white having been bred together. Cases are known where sports of this color have been thrown by such a cross, and they have Blue Plymouth Rocks and Blue Langshans in England made by a similar color cross. Andalusians are not bred in large numbers in this country. They are very hard to breed to color, throwing white and black chicks and those with red feathers in them. They do not give any promise of becoming more popular, although a profitable fowl to keep.

Anconas.—Anconas are another of the Spanish breeds. They are single-combed, about the size of Leghorns and

mottled black and white in color. They are good layers and hardy. They have white earlobes and yellow skin. The standard shape is the same as the Leghorns.

English Class.—This class is composed of breeds which had their origin in England. These are the Dorkings, three varieties—White, Silver-Gray and Colored: Red-caps, one variety; Orpingtons, 10 varieties, only three of which have been admitted to recognition by the American Poultry Association (Buff, Black and White). Besides these three we have three rose comb varieties in these colors, Spangled and Diamond Jubilee, more commonly called Jubilee Orpingtons, having been given this name because they were introduced the year that the late Queen Victoria celebrated the jubilee year of her reign.

Dorkings.—These are no doubt the oldest pure-bred breed of poultry with which we are acquainted. Some fanciful writers have tried to trace them back to the time of the Roman invasion of Britain. Columella described fowls very like the Dorkings of today, but there is no means of connecting them with the Dorkings we now have. In Brown's "Races of Domestic Poultry" we find the first authentic reference to Dorkings attributed to Bonington Moubray, who wrote a book on poultry breeding in 1815. In this book they were described under the name of "Darkings." It seems that it is not even known when the "a" was changed to "o" in the name. Dorkings vary in weight and the style of the comb, a difference not allowed in any other breed, except a variation in the weights of Single Comb and Rose Comb Black Minorcas.

White Dorkings.—This variety has a rose comb, while the other varieties have single combs. The White Dorking cock weighs $7\frac{1}{2}$ and the hen 6 pounds. The Silver-Gray Dorking cock weighs 8 and the hen $6\frac{1}{2}$ pounds;

1, Buff Wyandotte. 2, Silver Penciled Plymouth Rock. 3, Silver Penciled Wyandotte. 4, White Cornish.

the Colored Dorking cock weighs 9 and the hen 7 pounds. The shape of the Dorking is very striking, the body being very deep and the back very long and level. The tails are heavy with a majestic sweep and the combs of the single comb varieties are large, the comb of the cock standing upright and that of the hen drooping over the side of the face. The White Dorking is pure white, and this variety is very rare in this country.

Silver-Gray Dorking.—This is the favorite in this country, if it can be said that a variety is a favorite when it is rarely seen except in the larger shows. The hackle of the cock is silvery white with some gray which runs into black over the shoulders or cape. The back is silvery white, the breast dull black, the tail greenish black, the upper parts of the wings are white and the primaries are mostly black. The hen of this variety is a beautifully-colored bird. Her hackle is silvery white with a black stripe down the center of the feathers and the breast is salmon-colored, running into an ashy-gray in the lower part, this color extending over the lower and rear parts of the body. The back is an ashen-gray, finely marked with stippling of a deeper gray. The tail is dark, penciled with gray and the wings are grayish.

Colored Dorking.—This variety is rare in this country. Even those who visit the larger poultry shows rarely see specimens. The neck of the cock is a light straw color striped with a wide black stripe; the shoulders or cape are black. The body and fluff are a dull black. The wingbows are light straw-color and the primaries black. The secondaries, which are greenish black, show as a bar across the wings; the tail is a greenish black. The hen may be described as having the color of the Silver-Gray hen, the colors being deeper and black markings show.

Dorkings have five toes, the absence of the fifth toe condemning a bird as not being pure-bred. They are not good layers, but are considered the very best table fowls. They have the white skin characteristic of English fowls. The flesh is very tender and palatable.

Red Caps.—This is an old variety in England, and was very much talked of in this country a few years ago. It probably descended from the same stock as the Golden Spangled Hamburg. This is the view held by Brown in his "Races of Domestic Poultry." They have almost disappeared in this country, from reasons which are not well understood, as they are of good size and reputed to be excellent layers. They are characterized by the immense rose comb they carry. The cock weighs $7\frac{1}{2}$ and the hen 6 pounds. The hackle of the cock is a rich black with a red edge on each feather, the breast is blue black and the body and fluff black. The back is a rich red, saddle feathers deep red with a black stripe, wing red on the upper parts and primaries black. The hen has a deep black neck, the feathers edged with red, body and breast a rich brownish-red, each feather having a black spangle at the outer end; the tail and primaries are dull black; the shanks are slate-colored.

Orpingtons.—Orpingtons were originated by the late William Cook, an English breeder, who brought them out in 1886.

Black Orpington.—This was the first of the Orpington family to be introduced. Mr. Cook made this breed from black sports from Barred Plymouth Rocks, Black Langshans and Black Minorcas. He seems to have had a definite ideal in mind from the first, and when the Black Orpingtons were introduced they at once became great favorites. They are short-legged, deep-breasted, wide-

backed fowls with greenish black plumage all over the body. The Orpington is a fairly good layer, but not by any means a heavy producer, except in some strains of Blacks, which have given a very good account of themselves. They are said to be excellent winter layers, and have met with favor as market fowls on account of the good qualities of their flesh. The Orpington cock weighs 10 and the hen 8 pounds.

Buff Orpingtons.—These were brought out in 1894, and at once arose a fierce discussion in England, many claiming them to be an old variety known as Lincolnshire Buffs, Mr. Cook stoutly maintaining that he had made the breed by a definite system of crossing and had worked for the shape of the Black Orpingtons. The new variety was longer of leg than the Blacks and not so deep in body, but breeders set themselves to work to bring about the desired shape and succeeded to a great extent. In the meantime, the tendency to show black feathers in wing and tail was being bred out, as well as the tendency occasionally to throw white feathers in wing and tail. These defects rapidly are disappearing, and the Buff Orpington has become numerous at the shows, although not yet largely adopted by practical poultrymen.

White Orpingtons are the same as the Buffs in every way, except that they should be pure white in every part of the plumage.

Spangled Orpingtons are mottled black and white. They have the Orpington shape and other characteristics of the breed.

Diamond Jubilee Orpingtons, more commonly called Jubilee Orpingtons, are a mottled breed, the feathers being red, white and black. It is not popular in this country and but few of them are bred. The Spangled and

1, Black Cochins. 2, White Cochins. 3, Buff Cochins. 4, White Langshans.

Jubilee varieties have not yet been admitted to the American Standard of Perfection.

The Polish Class is composed of eight varieties—White-Crested Black, Bearded Golden, Bearded White, Bearded Silver, Buff Laced, Non-Bearded Golden, Non-Bearded Silver and Non-Bearded White. The origin of the Polish fowl is lost in the mists of antiquity. It is characterized by a "topknot" or "crest" of feathers covering the top of the head. This crest grows from a round, bony protuberance on the forward part of the skull, one of the most peculiar departures from the normal to be found in nature and one which has puzzled those who devote their time to discovering the secrets of nature. In the cock this crest is composed of long feathers that flow back over the head, making a round, rather soft mass of plumage. In the hen the feathers of the crest are stiffer and grow more directly at right angles from their base, making a ball-like growth, which is considered very ornamental.

Sixty or 70 years ago a crested breed known as Hamburgs was bred. A crested bird is figured as a Hamburg in "The American Fowl Breeder," published in 1850. Brown says that the breed might have originated around Padua, Italy, as Aldrovandi, who wrote in the sixteenth century, described crested fowls. Darwin called them "Crested or Polish breed." The American Poultry Association assumes that the breed came first from Poland, but it has been almost definitely decided that it did not. In England the breed is still called the Poland fowl, but it is very likely that the name comes from the "poll" which is the most easily distinguished feature of these fowls. The Polish fowl is a very good layer of large white eggs, but is inclined to do most of its laying dur-

ing the summer. The eggs are of standard size and pure white. The hens rarely sit and the breed is considered to be among the non-sitters. While no standard weight is fixed for this breed cocks usually weight from 5 to 6½ and hens 4 to 5 pounds.

White Crested Black Polish.—This fowl is a very striking bird, and the favorite of all the Polish family among fanciers. This variety is intensely black in every part of its plumage except the crest, which, in the best specimens, is pure white, although usually some black feathers appear in the front part of it.

Golden Polish.—This is a golden bay in color and each feather should be laced with a narrow edging of black. The Silver Polish is pure white with the feathers edged with black, as in the case of the Golden variety.

Buff Laced Polish.—These fowls are of a golden buff color, each feather laced with a narrow white edge. The Golden, Silver and White varieties come in two sub-varieties known as Bearded and Non-Bearded. The bearded fowls have a thick muff or "beard" around under the throat. The non-bearded do not. The other varieties are non-bearded.

Dutch Class.—This class was formerly called the Hamburg class. It is composed of six varieties of Hamburgs: Golden Spangled, Silver Spangled, Golden Penciled, Silver Penciled, Black and White.

Hamburgs are exceedingly trim-built fowls, small in size and very active and graceful in their movements. They have been called "Dutch Everlasting Layers," "Mooneys" and "Everyday Layers." Their eggs are small and pure white. Apart from their striking color the Hamburgs are distinguished by rose combs, the spike of which extends straight back from the head instead of

conforming to the shape of the neck, as in the case of the Wyandottes. The color schemes of the varieties almost prove that they are related to the Polish fowls, except that the markings of the Hamburgs are more often perfectly distinct and perfect than is the case with Polish fowls of the same color. This is especially true of the penciled varieties.

Golden Spangled Hamburgs are a rich reddish bay, each feather ending in a round "spangle" of greenish black. The more perfect this spangle the higher the value of the bird, from the fancier's point of view. A crescentic-shaped spangle or one running to a sharp point at the upper end is considered defective. The legs of all Hamburgs are slaty-blue, except in the Blacks, which have leaden-blue or black shanks.

Silver Spangled Hamburgs have the same black markings as the Golden Spangled, but the body color is pure white. This variety is the favorite in this country, and more of them are seen than of all the other varieties combined.

Golden Penciled Hamburgs are of the same body as the Golden Spangled, but instead of spangles each feather is barred or penciled with narrow black bars transversely of the length of the feather, making a very striking arrangement and a very uncommon combination of color. The Silver Penciled Hamburg is identical with the Golden Penciled with the exception of the body color, which is pure white with the distinctive black penciling. Black and White Hamburgs get their names from their color, pure black and pure white respectively.

Hamburgs are of no economic importance of late years, as they are bred by only a few fanciers and cut no figure

1, Light Brahma. 2, White Cochin Bantam. 3, Buff Cochin Bantam.

in the markets, having given way to more practical breeds.

French Class.—This class is composed of three separate breeds, each of one variety coming from France, viz: Houdans, Crevecoeurs and La Fleche. These breeds can not be said to be common, although a considerable number of Houdans are bred in this country and they seem to be gaining in favor to some extent. They are all very good layers, their eggs being large and white. They are also very highly esteemed as table fowls, their flesh being considered as first-class. Authorities disagree on the origin of this breed. It has been claimed that it has both Polish and Dorking blood in it, because it has the crest of the Polish fowl and the five toes of the Dorking. On the other hand, a French writer, M. Perre De La Roo, in his book, "Monographie des Races de Poules," Paris, 1902, points out that neither the crest nor the plumage is similar to those of the Polish fowl. Other authorities claim that the Dorking gets its five toes from French fowls taken over from Normandy by William the Conqueror, while still others try to connect it with fowls bred in Britain since the days of Julius Caesar. Certain it is that it has been bred practically in its present form in the Department of Seine-et-Oise, France, for at least a century, an infusion of Crevecoeur blood having been made in that time, without materially changing it. Brown is inclined to think that the breed was made from crosses of Black Polish, Crevecoeur and a common five-toed breed.

Houdans were introduced into this country in 1859, according to Thomas F. Rigg of Iowa in his "Origin and History of Breeds of Fowls." Later importations were made in the 60's and many since that time. The Houdan

is a mottled fowl, the feathers being black and white, with black predominating. They have a crest and beard similar to the bearded Polish varieties, and five toes, as in the Dorkings. The cock weighs 7 and the hen 6 pounds. They lay very large, white eggs and are considered very good layers. It is not easy to determine why this breed has not become more popular in this country, as it has a rare combination of good qualities in its good laying and fine flesh. While a considerable number are bred they are not by any means popular.

Crevecoeurs are a large solid black fowl coming originally from the neighborhood of Crevecoeur, Department of Calvados, France. They have the crest and muff or beard of the Polish fowl, but are larger. The comb is V-shaped and small. They are held in very high esteem in France, but are rarely seen in this country. Indeed, they are so rare that many poultry breeders, who have been in the business for years, freely declare they never saw a specimen. For this reason they are of no importance to American breeders.

La Fleche fowls are intensely black in every section. They are a large, square-bodied breed, with a peculiar comb, composed of two spikes which stand erect in the head like horns. They are met with only occasionally in this country. They are of so little importance that further attention need not be paid to them.

Games and Game Bantams.—All the varieties of game fowls are put into one class by the American Poultry Association. This association does not recognize any game fowls used for cock-fighting, but only what are known as exhibition games. Pit games—those used in cock-fighting—are not bred pure, the varieties being crossed to suit the fancy of breeders whose only criterion

of excellence is the quality of "standing the gaff," that is, the courage to face an opponent armed with sharp steel spurs in the cock pit and fight as long as it can stand. This brutal sport is not recognized by American poultry breeders as being a legitimate use to which to put fowls; therefore pit game fowls are not recognized. To distinguish between the games and game bantams fanciers usually call the game fowls which grow to ordinary size "Standard" games while they speak of game bantams as "bantams." The only difference in the several varieties between the larger and the bantams is in the size. The "Standard" game weighs 5 to 6 pounds as to the cocks, the hens being a pound or more lighter.

The game fowl has a history running back to the time the original *Gallus Bankiva* or *G. ferruginous* was domesticated by man. No doubt the original purpose of domestication was to breed the cocks for fighting, in accordance with the temper of men in those times, when war was the only work men had to do. The original game fowl was bred on fighting lines. It was set low on its legs, had a massive thigh and a deep muscular breast with a strong leg. In the quaint language of Gervaise Markham who wrote "The Fightinge-Cocke" in 1615: "Hee would bee of proude and uprighte shape with small head, like unto the Spar-hawke, a quick, large eye and a strong, crookt beak. The beame of his leg would be verie strong and, accordinge to his Plome (plumage), blew gray or yellow. For his colour the grey pyle, the red pyle, the yellow pyle, the redde with black breast, is esteemed best."

The red with black breast has continued to be the favorite to this day. In 1849 the British Parliament passed an act forbidding cock-fighting and from that time the

1. Several Orpington Types and a Silver Duckwing Bantam.

exhibition game fowl has been known. The exhibition game has been bred so far away from the old style of fighting cock that except in the matter of color it might be called a new breed. The modern exhibition game is very long of leg and neck, very high in station, carrying its body erect and its head high, with the small "whip" tail carried almost horizontally. As a fowl for economic purposes the game fowl is of no value, as it is nowhere bred for market purposes, the hens not being good layers and the pugnacity of the cocks making them undesirable to the poultryman who seeks peaceable fowls.

Game Class.—This class is composed of the following varieties: Black-Breasted Red, Brown Red, Golden Duckwing, Silver Duckwing, Birchen, Red Pyle, White, Black.

The Game Bantams included in this class are identical in name and color with the above.

Black-Breasted Red Game.—This variety is without doubt the original variety of games. It is almost identical in color with the *Gallus Bankiva* from which it probably descended. The writer has seen a hen of *Gallus Bankiva*, which was mated with a Black-Breasted Red game cock, the chicks being good in color and vigor, the effect of the cross being perceptible only in the matter of the size of the chicks, which were smaller than the mother and larger than the sire. The cock of this variety has a bright red neck, red back and wing bows and a rather short, narrow tail of a greenish black. The breast is a brilliant black and the shanks are dark willow or nearly black. The hen has an orange or lemon-colored neck, each feather with a dull black stripe down the center of each feather. The breast is salmon red and the back a soft grayish-brown. The main tail and wing feathers are dull black. This variety is the favorite with

game fanciers, and is bred to great perfection in this country, although it is strictly an exhibition fowl and there is not probably a single poultry farm in this country where any game variety is kept for market purposes.

The Black-Breasted Red hen lays a tinted egg, not large. She is not counted as one of the good layers, but is among the best mothers, as she will fight for her young to the death. The writer has seen a game hen attack and drive away a hawk which swooped down on a flock of poultry and tried to carry away a chick, although the chick was not a member of the brood owned by the militant hen. While some of the friends of the Brown Leghorn are inclined to deny that game blood has ever been introduced into that variety, there is no doubt that Black-Breasted Red game blood was introduced many years ago. This is shown by the willow legs that a few years ago were often found in Leghorn females, in the occasional appearance of a yellowish tint in the eggs of Brown Leghorns.

Brown Red Games are probably close relatives of the Black-Breasted Reds. The cock has a lemon yellow neck, each feather striped with black, back and saddle lemon, the saddle striped with black; breast black, the feathers laced with lemon; shoulders, primaries and tail black. The thighs are black and the shanks willow or dark willow. The female is dull black except the hackle, which is lemon striped with black, and the breast, which has a lemon lacing around the feathers. The thighs and shanks are nearly black.

Golden Duckwing Games are generally of a golden yellow color with black breast, body, primaries and tail.

Silver Duckwing Games are like the Golden Duckwing in color markings, but the colors are silvery white and

black instead of yellow and black. These differences are of course quite conspicuous.

Birchen Games are very like Silver Duckwings, except that the hackle and saddle of the cock are striped with black and the back of the female is black instead of silvery gray.

Red Pyle Games are rare in this country. They are a mixture of red and white in color the red appearing on the hackle, saddle, back and wing bows, this red running from a reddish yellow to a rather deep red. The female is red on the breast and almost clear white over the remainder of the body.

Game Bantams.—These little birds are exact reproductions of the larger birds of the same name. They have been produced by careful selection and are quite ornamental, but otherwise not of great value, except when kept for pleasure. Their eggs weigh about 14 ounces per dozen, but none of the bantams are good layers. All the bantam varieties of the game class have a standard weight of 22 ounces for cocks and 20 ounces for the hens.

Oriental Games and Game Bantams.—This is another class presumably of oriental origin, which includes Cornish fowls, colored and white, Sumatras, Malays and Malay Bantams.

Cornish Fowl.—With the exception of the Cornish fowls the oriental class may be passed with but little attention. Cornish fowls were formerly called Cornish Indian Games because they were bred for many years in Cornwall and from there spread to other parts of England. Brown is of the opinion that this breed is an English production, formed entirely from a cross of Aseel game, English game and Malay fowls. A few years ago it was introduced into this country and boomed until it

4, Barred Plymouth Rock (Laid 251 Eggs in a Year).

1, White Plymouth Rock. 2, Jubilee Orpington. 3, Black Langshan.

had considerable vogue, but its poor qualities as a layer condemned it in the eyes of many, and it has never become popular. As a table fowl the Cornish is of high quality, having a deep breast, heavy thighs and very solid, firm, sweet flesh.

In color the males are a very deep mahogany, approaching a lustrous black. The hen has a black hackle with a red shaft to the feathers, the remainder of the body being deep mahogany red, each feather penciled with two or three rows of fine black lines conforming to the edges of the feather. Cornish cocks weigh 9 and the hens 6½ pounds. There is a white variety, but it is rarely bred. The Cornish fowl has not yet assumed importance as a market fowl but a specialty club is trying hard to push it into notice.

Sumatras.—Sumatra fowls or Sumatra Games are massive in shape with a peculiarly malignant appearance. They are the most lustrous of all black fowls. They are scarce in this country, not being fancied except as rarities by those who pride themselves on keeping uncommon varieties.

Black-Breasted Red Malays.—This breed is one of the rarest in this country. In general it may be said to carry the colors of the Black-Breasted Red Game. It is not of enough importance to be considered.

Ornamental Bantams.—These little ornamental fowls are put in a class by themselves. The breeds and varieties follow: Sebrights, two varieties—Golden and Silver; Rose Combs, two varieties—White and Black; Booted, one variety—White; Brahma, two varieties—Light and Dark; Cochins, four varieties—Buff, Partridge, Black and White; Japanese, Black-Tailed, White and Black; Polish,

Black and Buff Orpingtons.

four varieties—Bearded White, Buff Laced and Non-Bearded of both these varieties.

Miscellaneous Class.—This is made up of Silkies, Frizzlies and Sultans. Silkies are fowls with soft shaftless plumage. The plumage is white, while the face, comb and wattles are a dirty purple. They are considered of no importance.

Sultans.—This breed might be called a booted Polish breed, as it has feathers down the shanks. It is a white breed of no importance. Why it is retained in the standard of perfection no one seems to know.

Frizzlies are characterized by the disordered appearance of their plumage. The feathers are twisted and turned forward in a way that makes one want to smooth them down. They may be white, black, red or bay, so long as pairs match in the show pen. They are neither ornamental nor useful.

Turkeys.—The turkey is the largest of our domestic fowls, and the only one that can be credited to America. To get its early history, as far as civilized countries are concerned, it is necessary to go back to European records. Until a few years it was thought that its first introduction into Europe occurred about 1524-5, but in Brown's "Races of Domestic Fowls" there is a supplementary note saying that the librarian of the Royal Palace, Madrid, recently (in 1906) discovered that it was introduced into Spain as early as 1500, eight years after the discovery of America. Pedro Nino, a Spanish adventurer, discovered this fowl on the coast of Cumana, north of Venezuela in 1499, and the next year took it to Spain along with such other curiosities as parrots, monkeys and bright-colored birds of other kinds. Turkeys were bred in great numbers by the Aztecs and other nations of Mexico and Cen-

tral America. The bird was not found further south than the mouth of the Orinoco on the east coast but on the west coast it was found as far south as Peru.

How this bird got its name has been a matter of curious speculation and much traditionary lore been put forward as authentic history. As a matter of fact, not a single one of the old writers attribute its origin to Turkey, all agreeing that it came from America. Wright thinks the name might have been given it from the red head and neck. Others suppose that the name comes from the domineering habits of the bird. Unfortunate as the name was, it has been accepted and speculations as to its origin are of no value. The turkey was brought into England in 1521 or 1524. In 1541 it was so highly esteemed that Archbishop Cranmer prohibited the serving of more than one dish of turkey cock at state dinners and the serving of turkey hens was forbidden altogether, as they were too valuable to eat. About 1570 the turkey became the recognized Christmas dish with the English farmer.

It is said that the first turkey was eaten in France at the wedding feast of Charles XII and Elizabeth of Austria, June 27, 1576. A large number of the birds had been sent over from Boston to St. Malo and when the ship reached that port the provincial governor sent a dozen of them to the king's cook. The king was so pleased with them that he began to breed them, and the breed spread rapidly over all France.

It is quite probable that turkeys as domesticated fowls were first bred in this country from fowls brought from Europe, as the northern races of aborigines knew nothing about them except as wild fowls in the forests.

Bronze Turkeys.—This variety as bred today is the

direct descendant of the wild fowl, although seemingly it has decreased somewhat in size, as wild ones weighing 60 pounds are recorded. There were three varieties of turkeys in America at the time of the discovery: the wild turkey from which our Bronze variety comes, a smaller Mexican variety, and still further south a variety which lacked the tuft of hair on the breast but has a crest or aigrette consisting of a single row of feathers on the head. The latter is indigenous to South America and is easily domesticated, but does not endure removal to colder climates.

The Bronze Turkey is the heaviest of all the varieties. It requires two years to get to full weight at which time it should weigh 36 pounds for cocks and 20 pounds for hens.

Narragansetts.—This variety was largely bred around Narragansett Bay a few years ago, but has largely been replaced by the Bronze of late years and pure-bred flocks are hard to find. This variety is not as bright-colored as the Bronze, being more inclined to whites and blacks. It was highly esteemed as a market fowl by the turkey breeders of Rhode Island and Connecticut, but disease began to invade that region and to invigorate the stock Bronze blood was largely mixed into the pure Narragansett flocks. Full-grown Narragansett cocks weigh 30 and the hens 18 pounds.

Buff, Slate and Black.—These varieties are variations bred from selections, all of the color from which they get their names and smaller yet than the breeds already mentioned, adult cocks weighing 27 and the hens 18 pounds.

White Holland.—This variety is another example of misnaming. There is no known reason why it should have been named after a country in Europe, as white

1, White Polish. 2, White Leghorn. 3, R. C. Black Minorca. 4, White Polish.

sports from Bronze Turkeys are by no means rare and these white sports breed true to color. The White Holland was at one time smaller yet than the Buffs, but of late years the standard weight has been 26 pounds for adult cocks and 16 pounds for hens, weights that do not do justice to this variety, as they very frequently outweigh the other small varieties, and not rarely will compare favorably with the Bronze in weight.

Bourbon Reds.—This variety is said to have originated in Kentucky from crossing the Bronze and the Buff varieties. It is of large size, with a deep reddish color, the primaries being white. It is still quite rare, but very fine specimens are sometimes seen at the larger shows.

Ducks.—The American Poultry Association recognizes 10 breeds of ducks, only two having more than one variety. The following are the breeds and varieties: Pekin, Aylesbury, Rouen, Cayuga, Call, two varieties; Gray and White, East India, Crested, Muscovy, two varieties—White and Colored—Indian Runner and Swedish. It is generally conceded that all our breeds of domestic ducks, except the Muscovy, are of Asiatic origin, although this is merely speculation on probabilities. Ducks have been known as domestic fowls since before the beginning of the Christian era. Columella says that the eggs of wild ducks hatched under common hens produce ducklings which soon became tame, and this is as true now as it was 2,000 years ago. The wild Mallard Duck is common from eastern Asia to the western shores of America, and it is quite probable that it was first domesticated in Asia before history began. The duck has always been esteemed for food, and its attractiveness as a bird would have brought it under the rule of man as early as any other wild bird or animal. The larger breeds are very

profitable as market fowls. Almost all the breeds are good layers. Young ducks have been considered a dainty dish from very early times, and much attention has been paid to breeding them.

The white breeds no doubt are descended from albino ducks bred together. That this can be done is a matter of recent record, as an Englishman secured two wild white Mallards and bred a flock of white Mallards from them, noticing that they increased in size under domestication.

Pekin Ducks.—This breed is the favorite in America. It was first brought to this country about 1874, and at once became the favorite breed, a distinction it has maintained up to this time. They are excellent layers and the young make very rapid growth, reaching the weight of 10 pounds to the pair at 10 weeks of age, at which time duck-farmers sell them in the market. This breed came to us in its present form from Pekin, China, where ducks are a very important branch of industry, millions of them being bred along the river. They are creamy white in color, with orange-colored legs and bills. The drake weighs 8 and the hen 7 pounds.

Rouen Ducks.—This breed was probably named for the city of Rouen in France, although there have been various theories about this. It has been claimed that they were once called "Rone" ducks, from the River Rhone and "Roan" from the roan color of the females; but as they have long been bred in the country about Rouen and are known to have been sent from there to England in large numbers, it is altogether likely that they get their name from the city.

The Rouen duck is a beautiful bird, so far as colors go, as it is an exact reproduction of the wild Mallard. The

males have a greenish black neck with a narrow white ring at the lower part where it joins the body. The back is greenish and ash-gray running to a rich green over the rump. The shoulders are gray marked with very fine black lines and the breast is a purplish-brown or claret color, free from admixture. The sides of the body are steel-gray. The wings are grayish-brown mixed with green and across them runs a blue bar with a distinct white edge. The duck is more sober in color, being of light brown, each feather penciled with a darker brown.

Aylesbury Ducks.—This breed gets its name from the vale of Aylesbury in Buckinghamshire, England, where it has been bred to perfection for many years. It is a heavy, quick-maturing, white breed. It was quite a favorite in this country until the Pekin came, when Aylesburys and Pekins were crossed and it has almost disappeared, the hardier Pekin displacing it. The Aylesbury has a white skin and when a yellow-skinned variety like the Pekin became available it could not hold its own.

Cayuga Ducks.—There is a tradition that Cayuga ducks originated on the shores of Lake Cayuga in New York. There seems some foundation for this, as it is known that in 1870 a Mr. Clark bred them in considerable numbers in Cayuga Co., N. Y. It is an intensely black breed. It is supposed that it was made from a cross of some black wild breed and the Rouen, or possibly from some other cross. It might have come from a cross of the East Indian and the Mallard. The drake weighs 8 and the duck 7 pounds. The Cayuga has never been given the credit it deserves and has become so rare that it is hardly to be found, although a few good flocks exist in this country.

Call Ducks.—The two varieties of Call Ducks are bred only by those who keep them for ornament. They are

1, R. C. Black Minorca. 2, Brown Leghorn. 3, R. C. White Leghorn.
4, Buff Plymouth Rock.

the bantams of the duck family. The Gray Call is marked like the Rouen in both sexes and is probably a very near relative of the wild Mallard. White Calls are pure white in every part of the plumage. They are of no importance commercially.

Black East India Ducks are supposed to have originated in India, and were probably the progenitors on one side of the Cayuga. They are pure black. They are rarely seen except in the largest shows, and not always in them.

Crested White Ducks.—This is a pure white breed ornamented by a large crest. They are of unknown origin. Brown does not mention them. Neither are they mentioned in Wright's "Book of Poultry." Beeman in "The American Poulterer's Companion" (1847), describes and figures a Crested Duck, describing them as pure white, black and mixed in color, remarking that the white ones were thought to be better than the colored ones, a clue, perhaps, to the reason why we have them only in white now. Bement disclaims any knowledge of their origin. As the best European writers fail to mention them they may have originated in America. The drakes weigh 8 and the ducks 7 pounds at maturity. They are not bred in large numbers, although they seem to be a fairly good variety. The crests are rarely symmetrical, usually falling to one side.

Muscovy Ducks.—This breed is no doubt of South American origin, as all the evidence points to the fact and they have been found in their wild state in South America. Mention of this breed was made as long ago as 1670. It has been called the Brazilian Duck, and earlier had several other names, such as Indian, Peruvian, Musk, Muscovite, Turkish and Barbary. That it is

a distinct breed is proved by the fact that crosses between the other varieties of ducks and Muscovies are sterile. The Muscovy drake is considerably larger than the duck and is inclined to be quarrelsome with other poultry. These ducks are very strong of wing and delight in flying about, frequently perching on trees and houses. We have them in two varieties in this country—the colored, lustrous blue black broken with white and pure white. They are not highly esteemed as layers, although occasionally a good layer is found among them. The flesh is fairly good when the birds are young, but later is rather coarse and tough. The drake weighs 10 and the duck 7 pounds in good specimens.

Indian Runner Ducks.—This is an old breed perfected in England, although first found in India. Importations have been made from India as lately as 1898, but they have become so well disseminated that it is not necessary to go back to their native country for new blood. This breed is noted for its laying qualities, the ducks frequently laying as many as 200 eggs in a year and a record of 160 eggs is not considered at all remarkable. The eggs are larger than those of hens, but not so large as those of other ducks. The drakes weigh up to 4½ and the ducks to 4 pounds. The prevailing color is a pleasing shade of fawn. They have narrow heads, rather long necks, a very upright carriage and instead of waddling like other ducks they run very rapidly, a trait which gives them their name. While too small to make good market fowls, they are profitable on account of their laying qualities and are rapidly gaining friends in this country. These ducks are almost entirely silent, not being given to the loud and raucous quacking which is a disagreeable feature in keeping other breeds of ducks. They are re-

markably good foragers and range the fields in search of bugs and worms from morning until night.

Geese.—The American Poultry Association recognizes six distinct breeds of geese as follows: Toulouse, Embden, African, Chinese, two varieties—Gray and White; Wild or Canadian and Egyptian. While there are several distinct breeds of wild geese, it is probable that all domestic geese are descended from one variety, the great lag goose (*Anser cinereus*), which has a natural range from western Europe to northern India, and is of the same color as the common gray goose of the farmyards of Europe and America. Crosses with this wild breed are fertile, which is not the case with other wild breeds. The goose has been known as a domestic fowl for at least 4,000 years, as it is figured freely on Egyptian monuments and temples. It is mentioned in ancient literature as any other everyday matter. No class of domestic fowls has changed less from the original wild state than the goose. In color and shape it still carries the sober gray of nature, and the most ancient drawings show it to have been practically of the same shape in ancient times as it is now. The exceptions are the snow-white Embdens, but it must be remembered that the original wild goose had considerable white on it, and the domestic geese of all ages have exhibited a tendency to become pied or parti-colored, so it would not be very hard to breed them pure white by selecting those with most white in their plumage for a few generations.

The goose is the only one of our domestic fowls that is entirely vegetarian in its habits. It is the most cleanly of all our domestic poultry in its selection of feed, and has all through the course of history held a high position in the dietetics of all people.

A Pair of Silver Spangled Hamburgs.

Toulouse Geese.—Toulouse geese are a gray breed, named from the city of Toulouse, France. The sexes are identical in color, grayish above and on the breast running to white under the body and in the rear. Males weigh 20 and females 18 pounds. They are considered good layers, but are not trustworthy as sitters. They are not considered the best market geese, as their flesh is inclined to be coarse and somewhat flabby. They make heavy weights on coarse feed and are much used in feeding for the livers, from which *pate de foi gras* is made.

Embden Geese.—This breed is pure white and gets its name from a town in Hanover, large numbers having been bred there at one time. They are of the same size as the Toulouse and are considered somewhat better as table fowls. This breed owes its present good qualities entirely to English breeders. The progenitors were brought to that country from Hanover about 100 years ago, but they have been greatly improved in size since that time. Brown thinks the Embden of today was produced by crossing a white breed long kept in England with the Hanoverian goose.

The Embden goose of England and America is a grand bird. Its flesh is much esteemed and it is considered a very good layer. The goose begins to lay early and is a very good sitter. It might almost be called a persistent sitter. It is much bred to supply the market with green geese, as the young grow rapidly. If kept for the Christmas trade, it makes heavy weights and finds a very ready sale.

Chinese Geese.—The Chinese goose comes in two varieties, Gray and White. It is the smallest of our domestic geese—and the noisiest. It is esteemed for its small-

ness and when put on exhibition the smallest specimen is awarded the prize, other things being equal. The Chinese goose is a splendid layer and with proper attention there is no doubt that it could be bred up to become profitable for its eggs alone.

Chinese geese have a remarkable knob at the junction of the bill with the skull. This is black and the larger it is the better it is liked. Gray Chinese geese are of the same color in both sexes, the prevailing color being a brownish gray running to a lighter shade on the under parts of the body. The White China is pure white in every section.

African Geese.—This breed is not bred to any extent in this country. It is of the same weight as the Toulouse and of the same general color. The principal differences between the two breeds are that the African has a knob at the base of the bill, similar to that of the Chinese and the throat has a distinct and well-developed dewlap.

Canadian or Wild Geese.—These are the wild geese common to the country. They are not properly to be considered as being among our domestic breeds as they can not be held in check without removing the outer joint of the wing, this operation being known as "pinioning." A few are kept in this country, chiefly as ornaments or to use as decoys in shooting wild geese.

Egyptian Geese.—The Egyptian goose is probably descended from the wild gray goose, which ranges from the Mediterranean to the southern point of Africa. It was probably the ancestors of the modern Egyptian goose pictured by ancient Egyptian sculptors. Males weigh 10 and females 8 pounds. In color the Egyptian is a combination of chestnut, gray, black and buff. It is rarely met with in this country.

BACTERIA IN EGGS.—It is necessary to keep decayed eggs from contact with good ones because the bacteria that cause decay find their way through the shells and infect the good ones in the same box. All eggs contain bacteria but these do no harm as long as the temperature is kept below 38°. The bacteria begin to multiply rapidly above 38° and grow rapidly, decaying quickly.

BEST AGE FOR LAYING.—Very careful tests have established the fact that hens rarely lay as many eggs in their second year of laying as in the first. The difference is great enough to make it an object for the poultryman to try to raise each year enough pullets to take the places of the hens which have finished a year of laying. Pullets hatched in the spring begin laying in the fall, if they have been properly cared for, and by a year from the time they begin laying they have made the best yearly record they ever will make. It may be given as a general rule that a pullet that makes a good record the first year will make a better record as a hen the second year than will be made by a hen of the same age that did not make a good record in her first year. This indicates that the record for the first year of laying may be taken as an indication of the quality of the hen. The Maine Experiment Station tests the pullets the first year and reserves the best of them for breeders the second year, thus always having tested hens in the breeding yards.

BIRD.—The poultryman uses the word "bird" to designate any individual member of his flock of poultry, no matter what the class may be. The plural is used to represent the whole flock in the same manner.

BLACKHEAD IN TURKEYS.—In 1895 Dr. Theobald Smith, then of the Bureau of Animal Industry, re-

ported an infectious disease among poultry, stating that in Rhode Island the disease was known as "blackhead." This disease he called "Infectious Enterohepatitis." Dr. Smith said in his report that it might be well to retain the common name of the disease, although he did not believe all cases of blackhead were the specific diseases he named. Dr. Moore of the Bureau of Animal Industry, who wrote a bulletin the same year for the bureau, retained the name, and although it has been considered an unsatisfactory one it has been used ever since. The disease created havoc among turkeys in Rhode Island and Connecticut and where thousands of turkeys had been raised the business fell off until it was almost ruined. In the meantime this fatal disease began to spread, and at this time it has been found in nearly every state east of the Mississippi and north of the Ohio.

Dr. Cooper Curtice of the Rhode Island, after studying the disease, published several bulletins concerning it, and after he severed his connection with the Rhode Island station Prof. Philip B. Hadley of the same station continued his work. Blackhead is caused by a minute protoplasmic animal which Dr. Smith named *Amoeba meleagridis*, which may be described as "a minute parasitic animal capable of living within the tissues of the turkey its host. It can therefore eat, grow and reproduce itself in large numbers, thereby causing irritations, destruction of the tissues and nearly always the death of the invaded turkeys." Dr. Curtice says:

"Although so elementary in its structure this parasite has practically destroyed the turkey industry of New England and is rapidly depleting western flocks."

The writer has been called on to determine the nature of diseases occurring in flocks of turkeys as far west as

the Dakotas and Missouri and in this way has found the disease in isolated areas in nearly all the mid-west states. The symptoms vary and it is not always easy to diagnose, especially as the dark discoloration of the head is not always present. Indeed we have reason to believe that in the West it rarely appears, except when old birds are attacked, and then not always, nor is it always a symptom of blackhead. In most cases the victims die so quickly after the disease becomes noticeable that no change is observable in the color of the head. Diarrhoea is a reliable symptom of the disease, and in the older of the infected young turkeys droppings stained with yellow is almost characteristic of its attacks. "There is, however, no other sure means of diagnosis than the presence of large sores made in the cecal (blind gut) walls and in the substance of the liver, and in finding the parasites." As the average turkey breeder is not equipped for finding parasites he must confine himself to an examination of the liver of the birds that die. If on the liver are found sores circular or rather annular in character, resembling a ringworm on a human being, the evidence that blackhead is present may be considered conclusive.

As no remedy which produces favorable results has been discovered the turkey breeder must resort to means for preventing it from appearing in his flocks, and it has not yet been demonstrated that any such measures are more than partially effective. Dr. Curtice concluded that the germs of the disease were very frequently found in common fowls (chickens), although only two or three cases had ever appeared among the fowls kept at the Rhode Island station, they seeming to be immune from the effects of the parasites. By removing the eggs from under the hens three or four days before hatching, wip-

ing them with a cloth dampened in 90 per cent alcohol and finishing the hatching in incubators, then brooding the young for a few weeks on a disinfected board floor, the mortality was reduced from 80 per cent to 15 to 20 per cent. Even when the turkeys were kept on new land at a distance from all other poultry, the disease appeared. Since Dr. Curtice made his investigations the Biological Division of the Rhode Island station has been continuing the work, but nothing of importance has been discovered. Slowly the details of the disease are being brought to light, but so far no system of treatment has been discovered that promises to protect turkeys from contracting it or that will halt its progress. The best advice that can be given is for those whose flocks show the presence of the disease to cease to breed turkeys for a few years.

BROOD COOPS.—The illustrations are of several styles of brood coops suitable for housing chicks from the time they are hatched until they are ready to be put into permanent quarters in the fall. The brood house for chicks after weaning is 6'x8' and 6' high at the front. It need not be carefully made, as it is used only in warm weather. A tight roof to keep out the rain, and a wire netting over the window are all that are needed. One poultryman builds houses of this size, making them tight and using them for little flocks of a dozen hens through the winter. He builds them on skids and in the fall hauls them from the fields, where they are set in summer to the house, setting them in a row, facing south. He keeps Wyandottes and cares nothing for winter eggs, as his principal business is selling day-old chicks and broilers and roasters in a nearby city, so he need not prepare for the production of winter eggs.

The other coops need no further explanation than the

WIRE COVERED SHELTER COOP
FOR HEN AND CHICKS

BROOD COOP FOR HEN AND CHICKS

BROOD HOUSE FOR CHICKS AFTER WEANING - 6'x8'

BROOD COOP WITH WIRE NETTING RUN

illustrations give. The writer has built many coops of this kind from the boxes in which cereal foods are packed, buying the boxes for a few cents each and using the lumber without cutting.

BROODERS.—A brooder is an absolute necessity for those who use incubators and brooders are very often used by those who use hens for incubation, because it is easier to rear chicks in a brooder than to let them run with hens. The brooder is safer than a hen as a foster-mother as it is always in one place. It never distributes insect pests to the chicks, unless brought into it from the outside. It is always warm and comfortable for the chick and furnishes a comfortable place at all times. A chick that becomes chilled is often deserted by a mother hen, but if it is being raised in a brooder it learns as soon as it begins to feel at all uncomfortable to run inside until it gets warm. The brooder is rat and weasel-proof and no predatory animal of any kind can get into it to disturb the chicks after it is closed at night. Chicks raised in a brooder never having become chilled and stunted grow better, mature quicker and make better fowls than those raised by natural methods, unless the season is especially favorable.

A large number of chicks in brooders may be cared for by one person with the minimum of labor. The cost of operation is very small per chick and the number of hens that would be required to take care of 100 chicks will lay enough eggs to pay all the cost of keeping the brooder warm. The directions furnished with each brooder are so definite that it would be a waste of space to give definite directions about operating them. They are so simple in construction and so easy to operate that anyone can use them with success.

BROODERS.—BEST SIZES.—The brooders on the market are usually rated as 50-chick size, 100-chick size and so on up to as large as 300-chick size. The capacity of brooders is almost universally overrated by the makers. As a rule the 100-chick size is about the size that should be used for brooding 50 chicks, and this is as many as should be put into the ordinary brooder, or any brooder unless they are to be given the most careful supervision. At the Cornell Experiment Station we have seen a large number of brooders in operation which were used to raise 200 chicks each. These brooders were heated with gasoline and seemed to be giving satisfaction; in fact, Prof. J. E. Rice, the designer, claims that they gave perfect satisfaction. Notwithstanding, we would hesitate to recommend their use on a farm poultry plant or any place where poultryraising was not a special business, taking precedence over all other work.

BROODERS.—FIRELESS.—Within the past few years fireless brooders have come into use and seem to be perfectly adapted to brooding chicks which are hatched at the time in the year that hens usually hatch chickens. They are not recommended for cold weather, but those who use incubators and do not start them until after March 1 can use them with satisfaction. Fireless brooders are not recommended for outdoor use at any time, as they are not built to withstand stormy weather. They may be used in any building, however, as there is no fire about them and they are absolutely safe as far as fire is concerned. The principle of the fireless brooder is to conserve the animal heat of the chickens themselves and keep them warm, much as the mother hen does by supplying them a safe place to hove together, with an opportunity to spread apart if they become too warm. In

the southern states and in the Far West and Southwest this style of brooder may be used exclusively. A fireless brooder is illustrated on page 85 and is described by L. E. Keyser, a Pennsylvania poultryman, as easily made and very satisfactory. This brooder may be made from a cracker or soap box, but it is better if made nearly square. Fig. 1 shows the brooder open with the hover in place and Fig. 2 shows how the hover is made. To make such a brooder procure or make a box of suitable size, say 24" square and 8" deep. On the inside, on right and left sides, nail a cleat the top of which is $4\frac{1}{2}$ " from the bottom of the box. In the side that is to be used for the front cut a hole for the door 8" wide, as shown. Take a strip of burlap which will reach from one side of the door around the side and back of the box, across the other side and to the side of the door opposite the starting place. Have this strip wide enough to reach from the bottom of the box up to the cleats which have been nailed on the sides. Tack one edge lightly around the bottom, draw it up and pack behind it soft straw or hay and tack the upper edge, so the box will be lined below with this packing to keep out the cold. To complete this part of the work tack a strip of common plastering lath around the bottom of the box so as to secure the burlap used as a lining and make a neat job of it. If preferred the lining may be put in before the side cleats are nailed in place and the upper edge secured by tacking the cleats over them firmly.

To make the hover, cut two pieces of lath the length of the box and three pieces $\frac{1}{2}$ " short of the width of it. Lay the two pieces down and fasten the three pieces on them, as shown in Fig. 2. On the side to be used as the front of the hover tack a curtain on the under side of the

long lath, so when the hover is in place this curtain will hang down over the door. Then on the under side tack some heavy material as long as the box and wide enough so that when the edges are tacked to the frame it will sag down about $2\frac{1}{2}$ ". Fig. 2 shows how this is done, the illustration being exaggerated slightly to show the sag in the cloth more plainly. Using the middle piece of the frame as a handle lift it up and set it down on the cleats in the box and the brooder is ready for the chicks, as far as the brooder part is concerned. A lid is used on this brooder that may be propped up when the weather is warm or during the day, as shown in Fig. 1. Before putting the chicks in the brooder cover the bottom with newspaper and over this put a thick coat of chaff, cut clover or short straw. A door is provided for the front of the brooder. For the curtain and hover material Mr. Keyser recommends cotton bed blankets of the quality that costs 50 cents a pair in preference to the more commonly used Shaker flannel. The curtain is slit every 3" so the chicks can easily run out and in. Note that the cleats which support the hover are nailed on the right and left sides of the box and that the hover frame from front to back is $\frac{1}{2}$ " narrower than the width of the box. This leaves $\frac{1}{4}$ " space between the front and back sides of the box and the hover for ventilation. To secure ventilation a $\frac{1}{2}$ " hole is bored in each corner at the back and three $\frac{1}{2}$ " holes are bored in each end and five in the back $\frac{3}{4}$ " from the top. These allow air to circulate in sufficient quantities for the chicks in cold weather and in warm weather the cover is kept lifted, giving free circulation of air. For sudden cold weather a cushion made of feathers, chaff or cotton batting the size of the hover frame is laid on top of the hover at night. Clean the

SMALL BROODER HOUSE

FIRELESS
BROODER

brooder every day and do not put too many chicks in one brooder. Fifty may be kept in one 2' square for two weeks, but it is better to make them a little smaller and put about 25 in each brooder. The chicks require a little attention until they have learned to go into the brooder, when they begin to feel cold. They soon learn this if not allowed to hover together in the sun outside.

Fig. 1 shows a house adapted to keeping two of these brooders in. It is 6'x8' and 5' high in front, the whole front being protected by wire netting, except the space taken up by the door. A muslin curtain is fastened at the top of the opening to roll down in very cold weather. This curtain should have the bottom weighted so as to hold it down when in use. This can be accomplished by fastening a shingling lath of the proper length to the bottom edge, using this to roll the curtain on when it is not in use. In this brooder the chicks rest on the litter in the bottom and push their way under the sag in the hover which keeps them warm. If they get too warm they spread out as chicks do when under a hen. If this brooder is not used too early in the spring it is unnecessary to line it around the sides. The top and the door in front may be hinged with leather hinges. The total cost of such a brooder made from a soap box need not exceed 25 cents to any one who can use a saw and a hammer.

BROODERS — HOME-MADE.—We have used a home-made brooder with perfect success. This was made from a common pine packing box about 30" square and 20" deep. The top was sawed off in such a manner that a sloping roof was put on it, this roof being hinged so it could be lifted up with ease or fastened down with a hasp and staple. On the higher side a door 6" square

was cut and 2" above the bottom on both sides of each corner an auger hole 1" in diameter was bored, making eight of these holes in all. Burlap was then tacked loosely around the inside of the box and the floor was bedded with soft straw. At the tin-shop a galvanized tank was made which was about 12" high and the same in diameter, both ends being closed, except for a gasket in one end through which warm water could be poured. On this end a handle was also placed, so the tank could be lifted with ease. This tank was filled with hot water and covered by drawing over it two burlap sacks, which fitted very loosely around it. The tank was then set in the middle of the floor of the box and it was ready for the chicks. They could cuddle up to the tank without danger of crowding, and if it was too warm there they could sit farther away, the brooder always providing a place suitable to the comfort of the chicks. The tank was put in at evening and left until the next evening. It was then taken out and set on top of the kitchen stove until the water in it was hot and again put in the brooder. For an indoor brooder or for use outdoors after the weather became warm this brooder proved perfectly adapted to the use to which it was put.

BROODERS—INDOOR.—Indoor brooders are designed for use in brooder houses and should never be used outdoors. After permanent warm weather has set in it is often practicable to use indoor brooders in cheaply-built sheds, but by that time outdoor brooders might be used and are better adapted to such uses. It is quite common to protect outdoor brooders with a roof or put them in a shed enclosed on all sides but the south.

BROODERS—OUTDOOR.—Brooders designed for outdoor use work very well if not used during severe

weather. From the time hens naturally sit on into the summer outdoor brooders give very good results, but they should never be used when the weather is too cold to admit of letting the chicks out into the open air every day.

BROODER HOUSES.—Many plans for brooder houses are available to those who read publications devoted to poultry, but all these may be separated into three models. The pipe system houses are heated by a system of hot water pipes controlled by a heating plant located at one end or in the center of the system. The individual brooder house is arranged so as to make it convenient to handle a number of individual brooders of the indoor type. The individual brooder house or, as it is sometimes called, the colony brooder house, is a smaller brooder house designed to accommodate one brooder. Such houses are now usually heated with one of the brooding systems designed to make the house itself the body of the brooder, the manufacturers furnishing only the heating system.

The hot water or pipe system is losing ground because of inherent defects which manufacturers have not been able to eliminate. The principal difficulty seems to be their inflexibility, it being necessary that each section of the house shall be of the same temperature as all others or so nearly so that the difference is not worth considering.

The brooder house designed for the use of individual brooders has many friends and is largely used. It is recommended by a great many leading poultrymen and many have remodeled their brooder houses, changing them from the pipe system to the individual system. This system requires more work perhaps than the pipe

system, but it admits of individual variations in the temperature for the several sections, which is a strong point where chicks of different ages are kept in the same house.

The colony brooder house is convenient for the poultryman who breeds on a smaller scale and who would not be justified in building a large house. With the advent of the separate heating systems plans were brought out by which brooder houses could be made very cheaply. A very good house of this kind has been made by simply laying a piano box flat on the ground, the widest side down, cutting necessary doors and windows in it and attaching one of the heating systems. A brooder house of this kind may be made of any large packing case with but little trouble.

With every brooder house equipment whatever the style may be sent full directions for using the heating plant adopted.

BROODER HOUSE.—A good type of brooder house built a few years ago for the Storrs Experiment Station in Connecticut, by Prof. F. H. Stoneburn, and described by him is shown on pages 90 and 91. This was built for individual brooders and has been found very successful. It is easy to build, cheap and perfectly adapted to be operated conveniently. The house as described was built on a slope, but we have seen one which was built on perfectly level ground, the alley being excavated and drained, but instead of a stone wall in the alley it was lined with concrete, which was water-proofed in the ordinary way with cement mortar. We have seen several brooder houses built on this plan, or a simple modification of it, which seemed to be everything that could be wished in a building of this kind. The slope on which this house was built sloped with an eastern exposure. A better ex-

Section, End and Front Elevations and Perspective of Brooder House.

Detail of Sunken Alleyway and Floor Plan of Brooder House.

posure would be one to the south or southeast. The house is 15'x30' in size with a 4'x5' extension on the east end. This latter is used as an entry permitting the operators to pass in and out of the house at will without exposing the chicks to draughts. An alleyway extends entirely along the north side and the remainder of the floor space is divided into pens. These are 6'x11' in size. An examination of the plans will show that the vital feature of the building is the elevated chick floor, or rather depressed alleyway, the latter being $3\frac{1}{2}'$ below the former. This arrangement secures several advantages. It enables the attendant to care for the brooders without the constant stooping required where they are operated on the floor in the usual manner. It reduces the enclosed airspace fully one-third, affecting a corresponding saving of heat required to maintain a given temperature. The chicks are nearer the ceiling, the warmest part of the room, thus giving them the benefit of all available warmth. Repeated tests showed the difference in temperature at the chick-floor level and the bottom of the alleyway was 14° in favor of the chick-floor. It exposes the smallest possible wall-space to the weather, which is worth considering in wind-swept localities. The only disadvantage is in going into the chick-rooms, the low ceiling making it awkward, but the work was done without serious inconvenience.

The alleyway was formed by digging a trench along the north side of the proposed site of the building. This trench was 4' wide and $3\frac{1}{2}'$ deep. It was walled with stone which are plentiful where it was built. These were joined by a wall of the same height at the west end, the east end being reserved for the doorway. In building the south wall of the alleyway provisions were made

for the lamp-pits for the brooders. These pits were three in number, each $2\frac{1}{2}' \times 5'$ and 1' in depth. They were placed where the partitions in the chick-floor would come in the center of the pit, so two brooders, one each side of the partition, could be operated in one pit. The plans show how these were located. The remainder of the foundation was a plain wall built up so the top was level with the tops of the alley walls. The entire floor was cemented, including the bottom of the lamp-pits. This building was $15' \times 30'$ and was divided into six rooms, each $5' \times 11'$ in size. Because of the small size of the building the frame was constructed of $2'' \times 4''$ material, except the sills, which were $4'' \times 4''$. The walls are $3\frac{1}{2}'$ high and the roof an even span with a rise of 2'. The rafters are tied with collar beams which are spiked on level with $7\frac{1}{2}'$ from the alley floor. The entire frame is covered with $\frac{7}{8}''$ matched boards and covered on the roof with a good quality of roofing and on the sides with one-ply prepared roofing. This gives an absolutely wind-proof building. Eaves troughs are required to carry the roof water away to prevent it from making its way into the alleyway. If the alleyway were drained and cemented the roof water might be allowed to soak into the drains, in a place where the soil was porous, but the eaves trough would be better. The inside is lathed and plastered with fire-proof asbestos plaster board. The plastering is carried across the collar beams, making an attic that is a great help in controlling the temperature. A sliding door opens from each pen into this attic and a door in each gable end makes it possible to regulate the temperature at any time in the year.

In the south side are six windows, one for each pen, each single sash containing six $10'' \times 12''$ lights. These

windows are hinged at the bottom and controlled by cords running to the alleyway. Chick doors 6"x7" in size are also operated by cords. The partition between the alleyway and the rooms and between the rooms are made of 1" wire poultry netting. A door is placed in the partition between each room and the alleyway and the outside door is made wide enough to admit a wheelbarrow which is used to wheel out litter and droppings when the building is cleaned.

Prof. Stoneburn remarks that this building might be made 2' narrower and considerably cheapened by using less expensive lumber, and the entry extension might be dispensed with, but he believes this would result in decreased efficiency. For heating such a house there are several brooder heaters extensively advertised which could be installed with very little trouble. Any manufacturer of incubators would undertake to furnish the heaters and hovers for such a building at a very considerable reduction from the price of a complete brooder, the hovers being all that are absolutely necessary in it.

BROODY HENS.—When a hen shows signs of becoming broody she should be broken of her broodiness at once before she becomes confirmed in the disposition to sit. This may be done without resort to cruelty of any kind. Prepare a slatted crate, large enough for the hen to turn comfortably in, having this slatted on all sides. Put the broody hen into it and support it above the floor or earth on blocks such as pieces of brick or other similar risers. This allows the air to circulate on all sides of the hen, gives her a comfortable place to stand or sit, but leaves no chance for a nest. The perfect circulation of the air around her cools the fever of broodiness and she will soon be cured.

Another way is to put the broody hens of a flock in a pen with a vigorous and active young cockerel. He will not allow them to sit and will cure their broodiness in three or four days, when they may be put back with their mates to get ready to begin laying again.

BROKEN FEATHERS.—It frequently happens that the conspicuous feathers in the wings or tails of exhibition birds become broken by accident in such a way as to injure the show qualities of the birds. If this happens six weeks before the show season the feathers may be plucked out and will renew themselves nicely before time to show. The same process is often used where black fowls show white or gray in primaries or wing feathers. The feathers are plucked out in time to renew themselves before the bird is to be shown. This is not always successful, however, as the writer knows from very recent experience. A Black Minorca cockerel showed white in a primary. This feather was plucked out and when it grew in again there was more white in it than there was in the original feather.

BUMBLE-FOOT.—Bumble-foot is an ulceration arising from a bruise in the sole of the foot in poultry. Its origin is the same as that of a stone bruise on a boy's foot. Heavy breeds which have perches too high from the floor frequently bruise their feet by jumping down on a hard floor. The remedy is to watch the swelling until it becomes somewhat soft in the center and then with a very sharp knife open it freely to release the pus that has formed under the thick skin of the sole of the foot. Wash with castile soap and water and bind up after applying carbolated vaseline. Keep the patient on soft litter away from other fowls for a few days.

BUCKWHEAT.—This is considered a valuable con-

stituent of a ration in winter, as it is fattening, containing the substances that go to maintain vital heat and energy.

CAPONS.—Capons have been a favorite dainty with epicures for several centuries, but it is not known who introduced them. Shakespeare speaks of one of his characters as having a "good round belly with fat capon lined," indicating that the man able to have capon served on his table was likely to present an appearance of being well-fed. It is a common belief that capons make an extraordinary growth after being operated on, but this is a mistake. Capons may possibly make a slightly larger growth than an uncaponized cock would if he were well fed, but the difference is not great in any case. Capons do take on a heavy weight of fat because they become quiet and listless after being caponized and do not take exercise enough to reduce their weight. Caponizing does not tend to increase of weight so much as to the lengthening of the period of growth. It is comparatively easy, for example, to make a Plymouth Rock cock weigh 10 pounds at a year old by feeding heavily, and a capon of the same breed, fed in the same liberal manner, would probably not weigh more than a pound more than the cock at the same age. The advantage of caponizing is that the flesh of the capon retains that tender, sweet and palatable character which makes spring chickens so popular.

Capons usually sell for two or three times the prices of cocks of the same age. As a concrete example a neighbor sold a lot of capons for 21 cents a pound at a time when cocks were selling for 8 cents as the top of the market. Caponizing is slowly gaining favor and more capons appear in the market from year to year. Farmers are conservative and do not readily take the

initiative, so caponizing spreads by slow growth from neighborhood to neighborhood. Some one begins caponizing cockerels and sells them at a very high price compared with the prices paid for other classes of poultry. This induces others to begin caponizing cockerels and a center of production is formed from which city markets draw supplies. Thus in many parts of the country there are isolated points where capons form a considerable item in the poultry receipts, and poultry-keepers in these places make profits accordingly.

There is much ignorance concerning the whole subject. A very large number of people do not understand that a capon may belong to any breed of fowls. They do not understand that a capon is simply an emasculated cockerel. As these words are being written a letter lies on the writer's desk asking him where capons for breeding may be secured. Nor is this a solitary instance.

CAPONIZING.—Caponizing is the art of removing the sexual organs of the males of our domestic fowls in order that they shall not become sexually active and that their growth may be retarded and the quality of their flesh improved. Caponizing is performed with instruments invented for the purpose that may be bought of any dealer in poultry supplies. As full directions are furnished with every set of caponizing instruments sold it is needless here to describe the process.

Caponizing usually is performed about the time cockerels begin to exhibit sexual proclivities, say about the time they begin to crow. The operation seems to be comparatively painless, as birds frequently begin to eat at once after being released after the operation. The operation is comparatively safe, but from 2 to 5 per cent dying from it and these die by bleeding in a few minutes,

leaving them as good for table use as they would have been if bled to death by a cut in the neck, the only difference being that the blood is let out from a different place.

CATARRH.—See Roup.

CHARCOAL FOR POULTRY.—Charcoal is not alone a preventive of disease because of its great capacity for absorbing gases, but it seems to exert a beneficial effect on the growth of fowls to which it is fed. It may be fed in the form of crushed charcoal in a trough where fowls have constant access to it, the pieces being about the size of grains of wheat, or it may be still more finely crushed and mixed with soft feed. Four turkeys were confined in a pen and fed cornmeal, boiled potatoes and oats. Four others were confined in the same way and given the same feed with the addition of one pint of finely-powdered charcoal. They also had a plentiful supply of broken charcoal in their pen. The eight were killed the same day and there was a difference in the quality of their flesh, which was very noticeable, as well as a difference of $1\frac{1}{2}$ pounds in weight in favor of the birds which had been fed charcoal. If it is not convenient to procure charcoal near home it may be made at home. Corncobs piled up and burned until they are each a glowing coal and then doused with water make charcoal of excellent quality.

CHICKS DYING IN THE SHELL.—One of the most serious difficulties incubator users are called upon to meet is the number of chicks that die in the shell after having matured to the stage when they are almost ready to come forth. Prof. E. F. Pernot of the Oregon Experiment Station has published some results of recent investigations into this trouble that seem to point the way to

combating it. He thinks the chicks die from poisoning from the operations of germs growing in the yolks. He succeeded in isolating a bacillus, named *Bacillus* No. 9, which he believes caused the mortality among chicks just before they emerge from the shell or shortly after. He believes newly-laid eggs are free from these germs, but that eggs may become infected after being laid, as the germs pass readily through the shell. He thinks in many cases where chicks die when very young that the bacillus enters the unabsorbed yolk through the umbilicus (navel) before the opening is thoroughly closed, where it finds ideal conditions for development and rapid multiplication. He recommends fumigating incubators before placing them in use. The plan he adopted was to put in the incubator a pint jar containing 4 drams of permanganate of potash in small crystals and 10 cubic centimeters of formaldehyde. On this basis it requires 16 ounces of formaldehyde, 40 per cent strength, and $6\frac{1}{2}$ ounces of permanganate of potash to fumigate 1,000 cubic feet of space. To fumigate an incubator having an egg chamber with 3 cubic feet of space costs about $1\frac{1}{2}$ cents and a brooder having 76 cubic feet of space costs about 7 cents. He tried fumigating incubators by putting in them a small glass dish of formaldehyde as soon as the first egg pipped. Although the fumes of the gas were very strong it did not seem to hurt the chicks in the least, as they grew up hardy and thrifty with very small loss from any disease. This late fumigation would of course not save the chicks that had become infected in the eggs as the gas could not reach them. (See Eggs—Disinfecting and Incubators—Disinfecting.)

CHICKEN POX.—This is a disease in which sores appear on the face and comb of fowls, these sores becoming

filled with pus, scabs forming over them. It is said that a cure may be effected by thoroughly washing the sores with carbolic soap suds and applying carbolated vaseline afterward.

CONTAMINATION.—A great many breeders think that if a hen runs with a male bird of another breed her chicks ever after will show signs of contamination, from copulation with the bird of a strange breed. There is no ground for this belief. Sometimes when a hen is not laying the effects of a copulation made a long time before will be observable in the first eggs she lays, but it is perfectly safe to say that a laying hen will not show any effects of copulation after ten days have passed from the time it occurred. The writer has had many breeds of pure-bred hens and cocks running together out of the hatching season, and he has never noted a single instance of contamination arising from this miscellaneous intercourse.

COOKING FEED.—As a rule it does not pay to cook feeds. Most feeds give better results fed raw. Potatoes are probably better cooked on account of their starchy nature, and when liver or lights are fed they should be cooked to kill any possible disease germs that may be in them.

COPULATION OF TURKEYS.—It is generally agreed that one service by a tom turkey is sufficient to fertilize all the eggs in one clutch or "laying" of a turkey hen. Instances are on record where one service has fertilized all the eggs for the whole season. A hen turkey will lay three clutches if prevented from sitting when she becomes broody.

COST OF FEEDING A HEN A YEAR.—In Bulletin No. 35 of the Oregon Agricultural College we find the

following table showing what a hen should be fed in a year. The table, as will be seen, gives five formulas for a ration, the amount in each being calculated for one hen a year, or the quantity in each formula would make a ration for 365 hens for one day. By estimating the cost of the ingredients in any one ration the poultryman can determine very quickly what it would cost to keep a hen a year at the prices he is charged for feed:

TABLE SHOWING KIND AND QUANTITY OF FEED FOR ONE HEN ONE YEAR OR 365 HENS ONE DAY.

RATION.	No. 1	No. 2	No. 3	No. 4	No. 5
Wheat.. .. .	....	60	30	20	20
Corn.	60	....	....	10	20
Oats..... .	....	....	15	10	10
Bran .... .	....	....	10	10	10
Middlings..... .	....	....	5	5	5
Linseed meal. .... .	....	....	....	5	5
Skimmilk, or..... .	30	30	30	30	30
Cut bones, or..... .	12	12	12	12	12
Beef scrap..... .	8	8	8	8	8
Alfalfa or clover, or..... .	15	15	15	15	15
Kale.	20	20	20	20	20

The foregoing are suggested rations for one hen a year (or 365 hens one day), with the estimated value of each, ration No. 1 being rated as the poorest and No. 5 as the best. The choice of animal feed is left to the breeder in each case, 30 pounds of skimmilk, 12 pounds of cut bone and 8 pounds of beef scrap being estimated as of equal value. Likewise of green feed, 15 pounds green alfalfa or clover being equal to 20 pounds of green kale. (Weights are in pounds.)

In this table Prof. Dryden gives kale as a green feed. This would be available in the Coast States, where it flourishes, but in some of the states where it does not do well cabbage or rape might be used. As clover grows in almost any state and alfalfa in most of the western states

either could be used as suggested without reference to kale.

CRATING FANCY FOWLS.—When fowls are sold for breeding purposes it is very desirable that they should not be injured on their journey to buyers and they should be carefully crated so as to go comfortably and safely. Crates are now easily procurable for this use, but where they are not convenient they may be made of old boxes that can be bought for a few cents at any store. The corners should be reinforced with posts at least 1" square and the sides and top should first be slatted and then covered with thin muslin, as express companies discriminate against a crate made with muslin sides only. Make the crate large enough so the birds enclosed can turn around comfortably and pass each other easily. Make it high enough so they can stand erect with a few inches to spare. If they are going to be on the road more than 30 hours put a tin cup in one corner, nailing it to a post in such a way that the express messenger can fill it with water without difficulty. Also put in the crate a supply of feed for the trip. If the birds are to be several days on the road tie to the crate a small bag of feed and on the top tack a request to the express messenger to feed at noon each day. The writer has shipped breeding fowls to every part of the United States, to Canada and Mexico and has never had one injured on the road in any way. Express messengers take good care of fowls in transit as they have orders to be careful with all breeding stock. (See cut of shipping crate on page 247.)

CROSS-BREEDING.—Poultrymen in this country are prejudiced against cross-breeding pure breeds, although this very often results in fowls better than either of the parent breeds. In England cross-breeding is very com-

mon and cross-bred fowls are offered for sale, their parentage being stated in advertisements. It is not safe to breed cross-bred fowls together, as the resulting progeny is very likely to show the defects of remote parentage, as well as to fail in that uniformity in size and prolificacy that the breeder has reason to anticipate in breeding stock of known blood. Many times a very common flock is bred up to show good quality by introducing pure-bred males, and continuing to breed to pure-bred males, always using the same variety that was used in the beginning. Where this is done it is quite possible within five or six years to breed a flock up to the point where it is practically pure-bred.

DAY-OLD CHICKS, HOW TO CRATE.—The business of shipping day-old chicks to buyers is constantly growing greater. Some breeders ship them in flat trays about the size of berry crates, one tray above another, held apart by tacking strips on each corner. Others separate the chicks in pasteboard holders similar to those used in egg cases. In any event the tops of the trays should be covered with burlap, which gives plenty of air and keeps the chicks warm. Chicks are frequently shipped more than 1,000 miles without injury, but further than this they are liable to become stunted and show the effect later. (See cut of crate on page 247.)

DEAD FOWLS A MENACE.—Dead fowls should be burned or buried deeply at a considerable distance from the poultry range to prevent others of the flock from becoming diseased. It is best to burn such dead fowls, if it is convenient, as the fire absolutely destroys disease germs, while burying them does not always completely destroy them.

DIARRHOEA.—Various forms of diarrhoea frequent-

ly appear among fowls, especially young chicks. The ordinary forms disappear after treatment as a rule, but what is known as white diarrhoea (see White Diarrhoea) has so far not been treated successfully. In fact, no remedy that will even relieve it has been found. For common forms of this disease any one of the following treatments is recommended by government authorities:

1. Subnitrate of bismuth in one to four-grain doses, two or three times a day.
2. Pulverized cinchona bark, one to two grains three times per day.
3. Quinine one-eighth to one-half grain two times per day.
4. Dry feed or cooked and slightly moist feed.

DISEASES OF POULTRY (SYMPTOMS).—It has seemed advisable to treat each disease under the proper alphabetical classification in order that when information is sought it readily may be found. A great many times when fowls show symptoms of sickness the poultryman is at a loss to know what the trouble really is. In order to set him right in this respect we have set down the symptom characteristic of the principal diseases to which fowls are subject. By observing the actions of a sick fowl and consulting the symptoms given, it will be possible in most cases to arrive at a proper diagnosis, although mistakes may be made because so many diseases have practically the same symptoms to those who are not accustomed to observing every detail. However, it is believed that this list of symptoms affords the best plan that can be followed.

Dealing with a sick fowl is a difficult proposition at the best. We are obliged to guess a great many times as to the nature of the disease, as we must depend en-

tirely on symptoms readily observable, as there is no practical means of taking the temperature or judging as to the circulation. In all intestinal diseases the trouble lies in getting medicine to act, as the digestive organs cease to perform their functions and medicine lies inert in the crop, often doing harm rather than good. A great many authorities frankly recommend that a fowl which seems seriously ill be killed to save the remainder of the flock from danger of contracting the disease. Where a fowl is valuable it is quite often feasible to save its life if prompt remedial measures are taken, but a very sick fowl is as likely to die as to recover, no matter what is done for it. Fortunately fowls kept under sanitary conditions, such as dry, light and warm houses, fed sound and wholesome feed and given plenty of exercise, have little tendency to become affected with any disease. It may safely be said that at least three-fourths of the diseases that afflict the fowls are of a kind that easily might be avoided. One who pays any particular attention to his poultry will at once note any departure from the normal. Dullness, lack of activity, a disposition to stand with the head drawn down and the eyes closed, halting in walking, lack of luster in the eyes, congested appearance of the comb, are all noticeable at once, and denote that disease has fastened on the birds showing any one or more than one of these symptoms. If this disposition to droop is accompanied by a diarrhoea the character of the droppings will often give a clue to the nature of the disease. If the droppings are a sulphur yellow the trouble is likely to be a very severe intestinal disease and may be cholera, although this is now very rare. Chalk-white droppings indicate coccidiosis in chicks.

If the fowl seeks isolation the trouble may be cholera

or worms. If the inactivity reaches a stage which may be called stupor, liver trouble or vertigo is indicated, either of these diseases being very hard to combat. If the fowl is very stupid or in a condition of torpor enteritis is indicated. Drowsiness is seen in attacks of atrophy of the liver and pneumonia. Extreme weakness and sluggishness are present in aspergillosis and enteritis.

Extreme emaciation is a symptom of several diseases, but a fowl which has become very much emaciated by disease is never worth saving and should be promptly destroyed.

Fowls frequently make a swallowing motion when they have mucus in their throats, but where this is accompanied by a writhing motion it denotes crop-bound. Staggering motions indicate the last stages of cholera, especially when convulsions follow. Staggering also denotes vertigo.

Lameness is present in liver trouble and rheumatism. Restlessness indicates a feverish condition which may be present with almost any disease. Continued gaping indicates the presence of gape worms.

If the comb is pale the fowl may have anaemia, tuberculosis or enteritis. If it is purplish in color it indicates one stage of enteritis and congestion of the lungs. If yellowish warts appear on the face and wattles chicken pox is indicated.

When feathers drop off parts of the body and the skin is scurfy it is a symptom of favus. Generally rapid breathing indicates lung troubles or some difficulty in the air passages, such as bronchitis. Sneezing or a croaking sound from a chicken shows that it is in danger from roup.

A watery discharge from the nostrils, the gathering

of foam in the corners of the eyes, or a fetid smell, known to poultrymen as the "roup smell," indicates danger from roup. Bloody mucus in the mouth indicates pneumonia. Yellowish patches in the mouth indicate diphtheretic roup, a most dangerous infectuous disease.

A rough condition of the plumage is observable in many diseases and also where body lice are present, but the plumage may be much worn and broken in perfectly healthy fowls.

When fowls present symptoms of disease it is well first to look for mites in the poultry house or lice on the bodies of the birds, as the presence of insect enemies may be shown by several of the symptoms of other diseases, especially when the fowls are worried by large numbers of them.

Fortunately there are but a few diseases common to poultry in this country. These are roup, intestinal diseases, aspergillosis and coccidiosis, which are frequently mistaken for each other, as the symptoms are very similar, chicken pox (often called "sore head") and the weakened condition brought about by parasites. There is an occasional case of worms, but worms are not common. Liver troubles are usually so far along before they are discovered that they are rarely combated with success. Rheumatism is not very common and its presence indicates carelessness on the part of the owner.

Blackhead in turkeys is very fatal and may be looked for whenever turkeys die in numbers, the symptoms being diarrhoea, lassitude and stupor. Sometimes the head turns black.

Roup is not a clearly-defined disease, authorities mixing it up with diphtheria and catarrh, but as all three of these diseases yield to the same treatment we have treated

them as one. Whenever there is an offensive discharge from the nostrils, a swelling on the side of the face, yellowish patches (canker) in the mouth or throat, roup or one of the allied diseases is present and should be treated as directed under "Roup."

Chicken pox or sore head manifests itself by wart-like sores on the comb and face. It is not very common in the North but is quite common in the South and Far West.

Aspergillosis and coccidiosis are indicated by diarrhoea, the droppings being whitish and sticky, great loss of strength, sleepiness or stupor. It is fully discussed in the proper place. Other intestinal diseases, except enteritis, usually yield to treatment without much trouble.

The best medicine is prevention. If fowls are kept in clean houses, which are kept free from insects, have pure water, good feed in variety and are always kept comfortable, disease will very rarely appear.

DISINFECTING EGGS—(See Eggs—Disinfecting to Prevent White Diarrhoea.)

DRINKING FOUNTAIN.—Fill a pan or other shallow vessel with pebbles about 1" in diameter and then pour in water till the vessel is full. Little chicks can drink from such a vessel without danger of getting pushed in and becoming wet and chilled. The pebbles should be scalded twice a week in hot weather.

DRINKING FOUNTAINS.—Drinking fountains may be bought in almost any town, but where they are not found in the stores they may be made very cheaply. A common stone jug with a small hole drilled in it 1" above the bottom may be used for the reservoir. It is easy to punch a hole in a jug with a wire nail, if care is used to tap the nail lightly, so as not to break the jug. Set the jug in a six-quart milk pan, fill with water and cork

tightly. If the cork is tight enough to keep air from entering at the top the water will only run out enough to cover the hole punched in the jug, and as the fowls drink it more will run out, keeping the level the same as long as the water lasts.

Another good drinking fountain is made by making a galvanized iron basin 8" in diameter with sloping sides two inches high. Then have a can made of the same material just large enough to fill the bottom of the basin. Have the can made so it can be corked tightly. Punch a hole in the can so it will be just below the top of the basin when the can is in position. Fill with water, cork tightly and set in a cool place in summer and where it will not freeze in cold weather. The water will always stand at the level of the hole in the can so long as any remains in the can.

A fountain for little chicks is very easily made by melting the top off a tin tomato can, being sure to have the edge smooth and level. In one side cut a V-shaped notch $\frac{1}{4}$ " deep. Fill the can with water and over it put a common coffee saucer upside down. Pick the can up with the right hand and with the left hold the saucer in place and turn over quickly, leaving the can standing upside down in the saucer. This will not empty itself, but the water will run out to the level of the notch in the can, the same as in any other fountain. For little chicks in brooders this is a very convenient way of supplying water.

DUST BATH.—If fowls are confined to a place where they can not find dust to wallow in a boxful of fine, loose soil or road dust should be provided in which they can take a dust bath, as this is necessary to their health, acting as a cleanser and lice-killer. If soil or dust is not

procurable sifted coal ashes will answer, but wood ashes should never be used, as the alkali in them destroys the oil in the plumage and, what is equally objectionable, takes the gloss off the shanks.

DUCKS, PRODUCTION OF.—The breeding and marketing of ducks in a large way is localized in a comparatively small part of this country. In Massachusetts, New York and Pennsylvania are to be found all of our extensive duck raising establishments. The product of these farms (largely green ducks) is consumed in what may be called the northeast corner of the United States.

There is no apparent reason why duck-farms should not be located in almost every state in the Union, but this part of the poultry business has not been developed anywhere but in the localities named, although there is no doubt that it could be made to pay near any large city after the appetite for green ducks had been created. On some farms in the states named ducks are raised in ten thousands and sold at the ages of about 10 weeks as fast as they can be produced, at prices which make the business very profitable.

These great duck-farms are stocked without exception with Pekin ducks, as this breed seems to have obtained an impregnable position in the market as a source of young ducks for summer use. It is true that thousands of ducks annually are marketed in all our large cities, but these are bred in small lots on farms and gathered in the regular course of trade. All breeds of ducks require practically the same treatment, but at this time only two breeds are of commercial importance, the Pekin and the Rouen, and the latter makes no impression on the great market as a factor in supplying the demand. The Indian Runner duck seems to be making very rapid headway as

Pekin Ducks on a Long Island Duck Farm.

an egg-producer, but it is too small to make it a possible rival in the food markets against the large Pekin.

The houses for ducks need not be made as warm as for chickens, but they should be free from drafts. As ducks do not lay in winter and have no combs or wattles to freeze, they may be allowed an outdoor run every day. Particular care should be taken to have the floor of the duck house dry, as ducks fall victims very easily to dampness in sleeping quarters, notwithstanding their aquatic nature. The floor should be kept covered with clean straw and this should be frequently renewed. Ducks are not bothered with lice and mites. They are free from such diseases as roup, catarrh and diphtheria. In fact, ducks are naturally very healthy and if they are given a good house where they can sleep on a dry floor and have a clean run they are not likely to suffer from any disease.

Ducks should have water where they can get it to drink at any time, but it is not necessary that they have water to swim in, although if it is possible to have a small, rapid-flowing brook run through the yards it will be better. The great duck-farms on Long Island are so situated that the yards are built down into the water of an arm of the sea where the tide rises and falls, thus washing the yards daily, the clean sandy bottom of the inlet making an ideal place for ducks to bathe and swim.

As ducks never lay in any certain place until they are ready to go broody, it is necessary to keep them inclosed in the morning until they have laid. Occasionally they delay this until late in the forenoon, and a small yard should be attached to their house so as to give them some liberty until they are let into the larger yards.

In mating breeding ducks not more than 4 ducks should be used for each drake. Very often a drake will take

care of more ducks than this, but this is at the expense of egg fertility. It is not necessary to divide the flock into pens of one drake and his mates, as they can be kept in larger flocks, maintaining the proper proportions of the sexes. In selecting ducks for mating, choose strong, vigorous birds of large size but perfect proportions. An overgrown duck or drake usually lacks in typical shape and these are likely to transmit their defects.

With the colored varieties the difference in the plumage at once marks the difference in the sexes, but with the white breeds the sexes are of the same color. The drake has two feathers of the tail curled over into a short curl, but these are frequently missing, especially in the show-room, where a large male is sometimes offered as a female, the curled feathers being plucked out. The deceit will be at once discovered if the ducks are made to make a noise. The female is the only one of a pair that "quacks." The voice of the male is thin and not at all loud, being more of a chuckle than a distinct call, as is the case with the female.

When well-cared-for ducks begin to lay in the spring they lay very regularly, usually every day for a considerable period. Early-hatched ducks begin to lay in the fall sometimes and lay a few eggs, then stopping until the early months of the year. Early-hatched Indian Runner ducks often begin laying in the fall and continue to lay during the winter and on into the next summer, frequently laying 200 eggs each in a year. Indian Runner ducks often continue to lay well for three years.

Where only a small number of ducks are raised it is best to use hens rather than ducks for hatching, as ducks are not very good mothers in domestication. Duck eggs hatch in 28 days, but the eggs frequently pip in 26 days.

It is much safer to help a duck out of the shell than it is a chicken, but this should not be attempted until it is found that the duckling can not free itself. Duck eggs hatch in incubators fully as well as the eggs of hens, and once a duckling is out of the shell it is quite safe to count on raising it to market age. Young ducks are very hardy and are not troubled with any of the many diseases that afflict young chickens. Sometimes young ducks will contract sore eyes, but washing them with warm water and anointing them with vaseline will usually overcome the trouble at once. Young ducks are voracious eaters, but they should not be fed too much until a week old, after which their feed supply should be governed by the quantity they will eat. When we consider that a Pekin duckling will grow to 5 pounds in 70 days, if properly fed, we readily understand that they must consume a large quantity of feed early in life.

On the great duck-farms the pipe system of brooding is used almost altogether. Ducklings thrive under this system, as they are hardier than young chicks and do not require such careful attention as to temperature. One of the most extensive duck breeders, who lives about 80 miles from New York, says it costs him about 60 cents to bring a 10 weeks duck into market. This covers labor, feeds, cost of marketing and other expenses. Such a duck will be sold in New York for about \$1. As this duck-farmer raised and sold about 40,000 green ducks in one year it will be seen that the business is a very profitable one. The incubators on this farm had a capacity of 24,000 duck eggs, and the average hatches were about 50 per cent, so that about 12,000 ducklings were hatched every four weeks for about three months.

Following are two different methods of feeding young

1, Pekin Drake. 2, Ducks in a Park Lagoon.

ducks to be sold at 10 weeks: From the time of hatching until five days old feed the following mixture: Cracker or bread crumbs and cornmeal, equal parts by measure; hard-boiled eggs, 15 per cent of the crackers and cornmeal; sand 5 per cent of the total. Mix with water or milk and feed four or five times a day. Stale bread crumbs may be substituted for the broken crackers. Mix into a crumbly mass and feed four or five times a day, always remembering to have water where the ducklings can get it while eating. The eggs used are the infertiles tested out of the incubators during the hatch. From five to 20 days feed the following mixture: Wheat bran, by measure 2 parts; cornmeal 1 part; rolled oats 50 per cent of this bulk; beef scrap 5 per cent; sand 5 per cent; green feed 10 per cent. Mix with water to a crumbly mass and feed four times a day. On Long Island the green feed is water grass, a plant that grows in the inlets along the shore, having a peppery taste, ducks being very fond of it. Where this is not available green clover or lettuce, rape, or even tender grass of any kind, oats, rye or any such tender green stuff may be used. It should be cut into short lengths before being mixed with the other feed stuffs.

From 20 to 40 days feed the following mixture: Wheat bran by measure, 2 parts; cornmeal, 1 part; beef scraps, 5 per cent of this bulk; sand, 5 per cent; green feed, 10 per cent. Mix and feed as above.

From 42 to 70 days feed by measure: Wheat bran, 1 part; cornmeal, 2 parts; beef scrap, 10 per cent of this bulk; coarse sand or grit, 5 per cent; green stuff, 10 per cent. Mix and feed as before. Feeding should be done at 6 a. m., 10 a. m., 2 p. m. and 6 p. m.

It is a good plan to have grit accessible to the duck-

lings, and a box of crushed charcoal is valuable, as charcoal seems to help the digestion. On Long Island the method of feeding is as follows. This is perhaps a better system where large numbers of ducks are raised:

From the time of hatching until seven days old, feed equal parts by measure of cornmeal, wheat bran and No. 2 grade flour. This grade of flour is sometimes called "red dog" flour. To this add 10 per cent of the bulk of coarse sand. Mix with water to a crumbly mass and feed four times a day.

From seven to 56 days feed equal parts by measure of cornmeal, wheat bran, and No. 2 flour. 10 per cent of this bulk of beef scrap; 10 per cent of coarse sand and about 12 per cent of green stuff. Mix and feed as before. From 56 to 70 days feed 2 parts by measure of cornmeal; 1 part wheat bran; 1 part No. 2 grade flour; 10 per cent of this bulk beef scrap; 12 per cent green stuff. Mix and feed as before.

It should be remembered that both green stuff and beef scrap are absolutely necessary to the best growth of ducklings, and no one should undertake to raise them without feeding both, as ducks deprived of them never make as good growth as those which are supplied with them. Mix the feed fresh for every day in a trough, and if the weather is hot mix twice a day. Keep the mixing troughs clean and sweet. Feed in troughs, giving at each feed as much as will be eaten clean before the ducks stop eating, and no more. A little observation will show how much to feed.

Ducks that are to be reserved for breeders should not be forced as rapidly as those to be sold in market. While the rations for breeding ducks should be rich in protein, they should not be such as to produce a surplus of fat.

In raising breeding ducks the object is to secure large size, which needs a large frame, thick muscles and great vitality. For this reason less cornmeal is fed and the beef scrap is reduced somewhat. An excellent ration for reserve ducks follows:

Equal parts by measure of cornmeal, wheat bran and green stuff with 5 per cent of beef scrap and 5 per cent coarse sand or grit.

Ducks in laying time do well on the following mixture: Three parts cornmeal; 3 parts wheat bran; 2 parts green stuff; 1 part beef scrap; 1 part No. 2 flour; salt lightly, mix with water and feed twice a day. Give the birds a grass run if possible; if not, give them boiled turnips mixed with cut clover hay.

These rations are calculated for those who keep a large number of ducks. While they are the best that have been devised, those who keep only 40 or 50 ducks on a farm will be able to simplify them to a considerable extent by allowing the ducks to run on grass and hunt bugs and insects about the farm. Ducks are good grasshopper-catchers and industrious insect-hunters, but they should be given beef scrap regularly, even when they have their liberty. Ducks thrive on the whole grains, but those who keep them in large numbers prefer to have most of the grain ground.

Ducks are profitable on the farm, as they are good layers, make weight economically and are always in demand in every market. Such a thing as overstocking the market with ducks has not yet occurred, and many farmers might keep a small breeding flock and raise 100 or more ducks every year to advantage.

Young ducks are invariably marketed dressed. They are killed by running a sharp knife through the brain from

1, Muscovy Ducks. 2 and 3, Indian Runner Ducks.

the top of the mouth, the knife being twisted so as to sever the jugular vein. They are hung up by the feet to bleed, and picked as soon as they cease to struggle, the feathers coming off at that time very easily. The large duck-farms have regular pickers who make good wages picking ducks. As soon as the ducks are picked clean, they are put into very cold water (ice water usually) to plump them, and are then laid on racks to cool, after which they are placed in barrels or boxes with broken ice and sent to market. Old ducks from country places are often sent to market alive, as they are gathered up a few at a time. For any one who has even 50 to sell it will often pay to dress them before sending them to market. They may be scalded, but most markets prefer them dry-picked. The feathers will make quite an item, and dressed ducks usually bring enough more than live ones to pay for the trouble of dressing them. If they are dressed in cold weather, pack them in clean boxes or barrels, which have been lined with clean paper, packing them in so they will not be pressed out of shape, and put a layer of paper between each two layers of ducks. In sending anything to a commission merchant be certain that the merchant is reliable and will deal honestly. Unfortunately the cities are infested with sharks who pose as commission merchants and defraud thousands of people every year. Having selected the merchant, simply mark the goods to him and write him, sending him a duplicate way bill. Tell him how many boxes or barrels you have sent him and what they contain and he will receive, sell and remit for them.

EGGS, BAD-FLAVORED.—Not only will strongly-flavored vegetables, such as onions, garlic and heavy feeding with cabbage give a characteristic flavor to eggs

from hens which feed on such things, but the New York Experiment Station noticed that hens fed a carbonaceous ration laid eggs which were strongly-flavored, although not offensively so. A fairly balanced ration gives the best eggs as well as the most of them.

EGGS.—DISINFECTING.—A correspondent of the "American Poultry World" writes that he has saved hundreds of chicks by disinfecting the eggs with creolin dip. Dr. Woods gives the formula for making this dip as follows: Mix 1 gill of creolin with $8\frac{1}{2}$ quarts of soft water, the solution to be mixed fresh each time before using. The eggs are dipped in this and allowed to drain before being put under the hen or in the incubator.

EGG-EATING.—Hens sometimes acquire the vice of eating their eggs, learning to do this from eating an accidentally broken egg. If one hen learns how to eat eggs the whole flock soon learns from her. Egg shells should never be fed to hens unless they are very finely broken or are mixed with soft feed of some kind. To cure this costly habit cut off the points of the mandibles of the beak, using a very sharp knife. Cut back a little at a time until enough is cut off to leave the tender flesh slightly exposed. As soon as a tiny drop of blood exudes from the cut enough has been removed. Then boil some eggs very hard, selecting those with the thickest shells and put them on the floor of the poultry house, where the hens can easily get at them. They try to break the shells by pecking at them, and this hurts the nerves in the shortened beak so they will give it up after a few trials, and thereafter not try to break an egg. In a short time the beak will grow out into its normal shape and the hens will have forgotten the vice.

In preparing eggs for breaking hens of egg-eating, if

some eggs are opened at each end and the contents blown out, afterward filling the shells with plaster of paris mixed into a paste with water, this will soon become hard and the eggs will be more resistant than boiled ones. Such filled eggs can afterward be used for nest eggs or for "dummies" to put under hens until they have settled down to sit steadily, when they are to be used in hatching.

EGG-PRODUCTION WITHOUT MALES.—It has been quite well established by tests that hens kept separated from male bird will produce more eggs than those that run with males. In one experiment 5 hens, 5 pullets and a cock were put in one pen and 5 hens and 5 pullets in another. All were of the same breed and were given the same care. The experiment continued from January until September. The mated females produced 959 eggs and the unmated ones 972, a difference of 23 in favor of the unmated ones. In another experiment practically the same results were secured. The theory is that unmated hens are not worried by the male and being more quiet retain more energy to be devoted to the production of eggs. In the Australian laying competition, continued year after year with 600 hens, an average egg production of 186 eggs per year has been secured, the hens all being unmated.

EGGS, EFFECT OF THUNDER ON.—There is a tradition that thunder during the period of incubation destroys embryo chicks. This belief is as old as the first century of the Christian era, but is absurd on the face of it, as during the hatching season heavy thunder storms are not at all uncommon and yet we do not hear of any widespread damage from this source. Careful observations have shown that thunder has no appreciable effect on the growth of embryo chicks.

EGG-FOOD.—The best poultrymen do not use egg-foods, as they believe that stimulation at one time leads to loss at another, but a good many think this class of condimental feeds necessary, and we give a formula that is probably as good as any other—certainly as valuable as the so-called egg-foods so freely offered for sale:

Powdered mustard seed	5 ounces
Powdered fenugreek	4 ounces
Sodium sulphate	1 ounce
Table salt, carbonate of iron, red pepper, ground ginger, black antimony and bone meal, of each	$\frac{1}{2}$ ounce
Linseed meal	5 ounces

Mix and keep dry. Use one tablespoonful in each quart of the ground feed used in making mash. Feed two or three times in a week.

EGGS, FLAVOR OF.—Feed affects the flavor of eggs. There is a certain delicate flavor in a fresh egg from a hen fed sound, wholesome feed that is never found in the egg from a hen that has been compelled to dig her feed out of a manure pile or that has had access to decaying animal matter or sour vegetable feed. Hens should never be fed anything that their owner would not eat without fear of disaster if he were really hungry.

EGGS, FEED COST OF.—During 1909 the Kansas State Agricultural College tested two pens of hens with a view to determining the feed cost of eggs. These hens were pure-breds but of unknown pedigree, as there was no record of the performance of their dams as layers. One pen contained 11 Plymouth Rocks and the other 19 White Leghorns. The Plymouth Rocks in the eight months from Feb. 1 to Oct. 1 laid 1,499 eggs, an average of 136 each, at a cost for feed of \$8.81—practically 10 cents each per month. The eggs sold for \$25.56, leaving

a profit above feed cost of \$17.75 or \$1.61 for each hen. One of these hens laid 174 eggs and another 181 during the test. The White Leghorns averaged 152 eggs at a feed cost of 9 cents a month for each fowl and a profit above feed cost of \$1.87 for each hen, the profit above feed cost being \$35.69.

EGGS, FOOD VALUE OF.—It has been asserted that eggs at 25 cents per dozen are cheaper than beef, when nutritive value is compared, but this is not correct. Compared with other foods eggs at 12 cents per dozen are comparatively cheap; at 16 cents per dozen they are fairly expensive and at 25 cents a dozen they are very expensive. Eggs are valuable as furnishing a light, easily digestible nitrogenous food, especially suitable for breakfast or other light meal—an important item for people of sedentary habits. That eggs at 25 cents per dozen are cheaper than meat is true in one sense, because of the smaller amount of money required to purchase a meal. It would require at least $11\frac{1}{4}$ pounds of beef to supply meat for a family of 5 and this would cost 25 cents at 20 cents per pound, while 5 eggs would cost but 10 cents, even if they were worth 24 cents a dozen. If the family were hearty eaters and would require 2 eggs each, the eggs would then cost but 20 cents as against 25 cents for the beef, a saving of 5 cents.

EGGS, NUTRITIVE VALUE OF.—A case is on record where a man lived two weeks with but one egg a day to take the place of both food and water, and at the end of that time was able to walk a considerable distance.

EGGS, HOW TO TEST.—A good many incubator operators, and more who use hens for hatching, pay no attention to testing the eggs and removing the infertile ones or those containing dead germs from the nest or

incubator; but this should always be done, as the infertile eggs or the dead ones may cause loss of some of the fertile eggs. There are numerous egg-testers on the market. They may be procured of any incubator maker. Experts in testing are able to make a very satisfactory test simply by holding the egg by surrounding it with the thumb and forefinger before a strong light. It is best, however, to use a tester. A strong light from a lamp or electric light should be used. The first sign of fertility may be noticed after the first day, as a reddish spot will show about the center of the egg when held before the light in the tester. This spot is quite dim at first but gradually becomes more pronounced until it is quite a deep red in the center. The spot should be about as large as a cent. Two days later a black spot may be observed, this being the rudimentary heart, and a little later "the spider" appears. This is the eyes of the embryo, which appear like a black spot, about the center of the egg, from which extend veins filled with blood to represent the legs of the spider. Later the body of the egg shows increasing opaqueness, with blood veins around the inner side of the shell and still later the egg appears black with semi-transparent spaces at the lower end and the point. The air-space at the point gradually disappears if the chick is growing normally. About the 15th or 16th day a fertile egg shows a large air-space, the remainder being opaque.

If an egg is infertile it remains transparent or as we call it "clear." A very faint pinkish spot rather smaller than a cent may show in an infertile egg which contains a very yellow yolk, but this appearance does not change as time goes on. All such eggs should be removed the 5th day. Later it will be found that some eggs which have

started all right will show a dark spot partly surrounded by a dark-colored ring, without any appearance of veins such as are seen when "the spider" appears. These eggs should also be removed. Germs may continue to die from time to time up to the time the chick is full-formed, but no description can make their appearance plain to the beginner. Learning to recognize dead eggs after 10 days is a matter of experience. Usually the expert operator can detect a dead egg as soon as he takes it in his hand, as he senses the difference in temperature between an egg that is dead and one that contains a living embryo. Eggs should be tested the 5th and the 10th days after they have been put in an incubator or under a hen.

EGGS, RELATION OF FEED TO.—In a bulletin issued by the Oregon Agricultural College, Prof. Dryden says: "The hen puts into the eggs what the poultryman puts into the hen. If the cabinet maker puts oak lumber into a furniture factory it will come out oak but in a different form. If we put wheat or corn into a hen it will come out wheat or corn but in a different form. There is a close relationship between the feed eaten by the hen and the eggs laid. This much we know. At the same time no one can say certainly what kind of feed or feeds will give the best results in egg yield. Chemistry does not tell us. Practical feeders do not tell us. This can only be determined by experimental work which will involve long and careful testing of different feeds and different rations in actual poultry feeding. We know, however, that the egg has a certain combination of elements, and we know that to produce eggs the hen must have feeds containing certain elements that the egg contains. Knowing the composition of eggs, we must study the composition of feeds in order to feed intelligently.

“The composition of the egg never varies appreciably. The hen is an honest manufacturer, and she does not adulterate her product, even though she may be fed adulterated feed. She puts the same kind of feed into each and every egg. If she does not get the right kind of feed she does not make the egg. An egg contains $\frac{1}{4}$ -ounce of protein. If the hen be fed wheat and nothing else she may eat 4 ounces in a day. Of that she will need about 3 ounces to supply bodily needs. This leaves 1 ounce to make eggs from. In the ounce of wheat there is about $\frac{1}{10}$ -ounce of protein. Now supposing the protein is all digested, which is not the case, she will not get half enough protein to make an egg a day. But an egg every two or three days would not be so bad at certain seasons. The egg, however, contains other things. It contains also $1\frac{3}{4}$ -ounce of ash (mineral matter) with which to make shell. An ounce of wheat contains less than $\frac{1}{10}$ as much ash (mineral matter) as one egg contains. The egg also contains fat. It contains less than $\frac{1}{4}$ -ounce of fat, but the wheat would contain $\frac{3}{4}$ -ounce of fat-formers

“What would be the result if the hen were fed wheat alone? She would get enough protein to make about one egg every three days; enough lime (mineral matter, ash) to make one egg every 12 days and enough carbohydrates and fat to make three eggs a day. What will the hen do in this quandary? She could put more fat into the egg to make up for the lack of protein. She could make a counterfeit article but she will not. She must get the right kind of feed or she will not make eggs. It is poor economy to feed wheat alone; the same is true of corn and nearly all the cereals. They are not balanced for egg production.”

EGGS FOR MEDICINAL USES.—In cases of poisoning by salts of lead, mercury, copper and acids, administering the whites of eggs will render them harmless. The whites should be mixed with water and drunk. The albumen in the whites of the eggs is curdled by the poisons and renders them inert for long enough a time to allow an emetic to act. The white of one egg will neutralize 4 grains of bichloride of mercury (corrosive sublimate).

The yolks of eggs, or even the white and yolks rubbed into the hair, make a most excellent stimulant and prevent the hair from falling out. Wash thoroughly in soft water after the eggs have been rubbed into the hair.

The white of an egg is an excellent application to spread over a newly-made burn or scald, especially if the skin is broken. Several coatings should be applied.

Mustard plasters if mixed with whites of eggs will not blister, yet will lose none of their efficiency.

EGGS, METHOD OF PRESERVING.—There are several methods of preserving eggs, but the easiest and best one is known as the waterglass method. Waterglass is a thick, syrup-like fluid technically known as sodium silicate. To preserve eggs by this method boil 9 gallons of water and let it cool. Then add 1 gallon of waterglass and put the solution in a very clean vessel. Stone jars are best, but kegs or barrels which have been scalded until they are very clean and free from odors may be used. Put in the eggs from day to day as they are gathered, being very careful not to use any with cracked or dirty shells; see that every egg is perfectly fresh. If the eggs do not remain beneath the surface of the solution weight them down. Keep the vessel containing the eggs in a cool, dark place and do not disturb it more than nec-

essary. When the eggs are to be used remove them from the solution and wipe them.

Eggs preserved by this method will keep for a year in good condition. April, May and June are the best months for preserving eggs. Those put down during very hot weather do not come out quite so good as those put down earlier in the season. If eggs are put down during the months named use those put down in June first, those in May next and those in April last, as they will keep in about the order named. The cost of preserving eggs by this method will vary from 1 cent to 2 cents a dozen, according to the cost of the waterglass. The average price is probably about \$1 per gallon.

EGGS, PACKING FOR HATCHING.—Eggs for hatching shipped long distances should be very carefully packed in some springy material so as to avoid jarring as much as possible. Bran, chaff, cut straw, cork dust, excelsior and other soft materials are used. Excelsior is best, as it dissipates sudden shocks perfectly and remains elastic during long trips. Each egg is wrapped in paper first, then it is wrapped in a ball of excelsior and laid in the basket, the small end down. When the number to be packed in a basket are all in, they are packed tightly with excelsior and a cloth cover is sewed over the top, under which excelsior is packed closely so as to protect the eggs from being broken. Packed in this way eggs will travel to Europe and hatch well. Some breeders prefer boxes made for the purpose for packing eggs for hatching, but baskets specially made for shipping eggs or the light splint baskets found in most stores, are light, convenient to handle and eggs are transported in them with as little loss as in any other package.

EGGS, PRODUCING GOOD.—Bulletin 140 from the

Department of Agriculture gives the following 14 rules for the production of good eggs:

1. Use hens that produce not alone a goodly number of eggs but those of standard size. Such breeds are Plymouth Rocks, Wyandottes, Rhode Island Reds, Leghorns, Orpingtons and Minorcas.
2. Good housing, regular feeding and, above all, clean, dry nests.
3. Daily gathering of eggs and, when the temperature is above 80°, gathering twice a day.
4. Confining all broody hens as soon as they show symptoms of broodiness.
5. Rejection of all doubtful eggs found in a nest that was not visited the previous day. Such eggs should be used at home where each one can be broken separately.
6. Placing all summer eggs as soon as gathered in the coolest place available.
7. Prevention at all times of moisture coming in contact with the eggs.
8. Disposal of young cockerels before they begin to annoy the hens. Also confining or selling all old male birds except during the hatching season.
9. The using of cracked and dirty eggs at home. Such eggs if consumed when fresh are perfectly wholesome, but when marketed are discriminated against and are likely to become an entire loss.
10. Marketing all eggs at least once a week, and oftener if convenient.
11. Keeping all eggs as cool and dry as possible while on the way to town and while in country stores.
12. Keeping all eggs away from bad odors and out of musty cellars.
13. The use of strong, clean cases and good fillers.
14. The shipping of eggs to the final market once a week and as much oftener as possible.

If every poultryman would follow these rules there would be much less loss between the producer and the consumer. All these losses the producer ultimately pays, as buyers discount prices enough to make good any short-

age from dirty eggs or those which may be found in bad condition as to freshness.

EGGS, SELLING BY WEIGHT.—There is a great difference in the size of eggs. There is a considerable difference in the eggs produced by different breeds. For example, the eggs of Hamburg hens are very much smaller than those of the Light Brahma or Langshan hens. As the composition of all eggs is very much the same it follows that eggs are valuable for food purposes exactly in proportion to their weight. In connection with some experiments the North Carolina Experiment Station recorded the weights per dozen as well as the number laid by pens of several breeds for a period of six months. As a rule the largest eggs were laid by mature hens, and the hens of a given breed laid larger eggs than the pullets of the same breed. The eggs laid by Pekin ducks, both old and young, were heavier than those of any breed of hens, weighing 35.6 ounces per dozen. Of all the breeds tested the largest eggs were laid by Light Brahma hens, weighing 28 ounces per dozen. The Black Langshan and Barred Plymouth Rock hens' eggs weighed a little more than 26 ounces per dozen, while those laid by Single Comb Brown Leghorn, late-hatched Plymouth Rock, White Wyandotte and Buff Cochin hens, ranged from 21.7 to 23.7 ounces per dozen. The Black Minorca pullets laid the heaviest eggs of any of the breeds tested, their eggs weighing 26.5 ounces per dozen. The lightest eggs were laid by Single Comb Brown Leghorn and Silver Wyandotte pullets, their eggs weighing 17.5 and 22.1 ounces per dozen respectively. Barred Plymouth Rock, White Plymouth Rock, White Wyandotte, Black Langshan and Buff Cochin pullets' eggs all weighed not far from 24 ounces per dozen.

At the time these experiments were made the market price of eggs in North Carolina was 13½ cents per dozen. Taking this price as the basis from which to compute values, and assuming that the eggs from the Single Comb Brown Leghorn pullets were worth this, the following table would represent the value of the eggs laid during this experiment, if they had been sold according to their weight:

TABLE SHOWING VALUE OF EGGS IN PROPORTION TO THEIR WEIGHT.

BREED.	Relative value per doz. cents.	Value above market price, per cent.
Single Comb Brown Leghorn pullets.....	13.5	....
Single Comb Brown Leghorn hens.....	16.3	20.7
Silver Wyandotte pullets.....	16.6	23.
Late-hatched Barred Plymouth Rock hens.....	17.6	30.4
White Wyandotte hens.....	17.6	30.4
White Wyandotte pullets.....	17.7	30.4
White Plymouth Rock pullets.	17.7	30.4
Buff Cochin hens.....	17.8	31.8
Black Langshan pullets.....	17.8	31.8
Barred Plymouth Rock pullets.....	18.2	34.8
Barred Plymouth Rock hens.....	19.7	46.
Buff Cochin and Black Langshan pullets.....	19.9	47.2
Black Minorca pullets.....	19.9	47.2
Black Langshan hens.....	20.44	51.4
Light Brahma hens.....	21.6	60.
Pekin ducks, young and old.....	26.7	97.8

The table shows how much difference there is in the value of eggs, but it should not be taken as giving the real size of the eggs of the different breeds mentioned. For example, there are strains of Single Comb Brown Leghorns that lay eggs as large as those of the Plymouth Rock or Wyandotte. So far Iowa is the only state that

has legislated on the weight of eggs. A law in that state provides that eggs shall weigh 24 ounces to the dozen and a buyer who buys by the dozen has a right to demand 24 ounces in weight instead of taking them by count. Two ounces has come to be considered the standard weight for an egg in this country. In Denmark eggs are assorted and sold at different prices, according to weight. The figures given in the table show that it would be more rational to sell eggs by weight than by count.

EGG AND OYSTER SHELLS.—The remarkable similarity in the composition of egg shells and oyster shells is shown by the following analysis of each:

	Egg shell.	Oyster shell.
Animal matter	2.0 per cent	0.5 per cent
Phosphate of lime	1.0 per cent	1.2 per cent
Carbonate of lime.	97.0 per cent	93.3 per cent

It will be seen that the only material difference is in the content of animal matter, this being the membrane lining the shell. It is reasonable to infer from this that oyster shells are very valuable as supplying material for egg shells. Clam shells or sea shells would be of the same value.

EGG, STRUCTURE OF THE.—An egg is most admirably adapted to the environment in which it is likely to be found when expelled from the ovary of the hen. Its circular walls are stronger than the same material would be in any other shape, yet the easiest for the chick to break from the inside. It is bluntly pointed at one end which causes it to roll in a circle if placed on a level or slightly inclined surface or to tend to roll to the center

of the nest with the larger end highest, which is the most favorable position for hatching. The shell is composed of calcareous material arranged in minute crystals between which there are openings through which the air can pass from the outside, and the carbon dioxide, eliminated in the process of incubation, can pass outside.

SECTION OF AN EGG.

A, Shell; B, Airspace; C, Shell Membrane; D, White; E, Vitelline Membrane; F, Yolk; G, Germinal Vesicle; H, Chalaza.

Next the shell is an exceedingly tough fibrous lining, made up of thread-like fibers, crossing each other in every conceivable direction. At the larger end of the eggs this fibrous lining separates into two parts, one of which follows the shape of the shell and the other is depressed so as to form a sack or empty space, called the air-bubble or air-space. Immediately inside the shell membrane, is the white, mostly albumen and water, and suspended in the white is the yolk, which is more than one-third fat

or oil, with a small quantity of coloring matter, albumen and mineral matter. The white of an egg is of different degrees of density. If an egg be boiled hard and dissected with care the layers of the different degrees of density may be peeled off one by one. The yolk is suspended in the center of the white by a sort of a cord of albumen much denser than any other part of it. This cord is known as the chalaza, and is attached to each side of the yolk, extending on one side to the air-space and on the other to the point of the egg. To keep the yolk globular it is surrounded by a very thin membrane, known as the vitelline membrane. The yolk is also made up of several layers surrounding a small white spot from which extends a canal to a spot on the outer circumference of the yolk known as the germinal vesicle. This spot, on the yolks of all eggs, is mistakenly thought by many people to be an indication that the egg has been fertilized, but this is not the case. It is simply the spot where the germ of a fertile egg is attached to the yolk, this germ being of microscopic size. The yolk is so weighted that no matter what position the egg is placed in it immediately turns so this germinal vesicle is on the upper side. The chalaza, by which it is attached to either end of the egg, twists one way or the other to allow the yolk to turn, but always keeps it suspended in the center of the egg, at the same time acting as a spring to prevent the delicate germ in the fertile egg from being injured by any sudden jar.

EGGS AND INCUBATION.—Prof. Dryden found that the loss in weight of eggs incubated by hens in a dry nest was 14.87 per cent in 18 days. At the Ontario Experiment Farm, Prof. Graham found that eggs incubated under a hen in a nest which was open lost an aver-

age of 10.9 per cent in hatching. The highest evaporation noticed was in nests lined with chaff which were inside a building. This was at the rate of 15.15 per cent. In tests made at the University of Missouri Ecleshymer found that the loss from evaporation was 13 per cent. The loss was controlled so as to reduce it to 9 per cent, yet good chicks were hatched. Then the evaporation was increased to 20 per cent and still good chicks were hatched. These tests led Ecleshymer to conclude that the moisture in an incubator should be controlled so the evaporation would be about 13 per cent.

At the West Virginia Experiment Station Prof. Atwood gave as the result of a number of tests of eggs set under hens a loss by evaporation in the eggs hatched amounting to 16.54 per cent. He tabulated his results and showed that 100 eggs would lose 8.28 ounces the first five days; 12.05 ounces next seven days and 12.44 ounces the next seven days. This computation is made for fertile eggs. Infertile eggs lose slightly less than fertile ones.

EGG, WHAT IS AN?—A chemist would say that an egg is a chemical combination of lime, water, proteids, carbohydrates, fats and ash, of which the lime in the shell is approximately 11.2 per cent, the water, 65.5 per cent, the proteids, 11.9 per cent, the fats, 9.3 per cent and the ash, 9 per cent. The average egg of the hen is 2.27" long, 1.72" in diameter at the largest place and weighs about 2 ounces. This egg is 11 per cent shell, 32 per cent yolk and 57 per cent white. Here the chemist would stop. Prof. Dryden has gone farther. He says: "The only difference between a bushel of wheat and a bushel of eggs is that the eggs are more palatable and more nutritious. They are also more valuable in the market. A pound of eggs is worth from 10 to 30 cents, according to the sea-

son, while a pound of wheat is worth from 1 to 2 cents. By giving the wheat to the hen to market it is converted into a form of food so palatable that it is worth ten times as much as it was in the grain sack. More than this, the hen is thrifty; for every pound of wheat she puts into eggs she puts in a pound of water; and she gets a good price for water. In selling a dozen eggs for 40 cents the poultryman gets 25 cents for the water in them. That is a pretty good price. It is more than the dishonest dairyman gets for the water he puts into his milk."

EPSOM SALTS, PURGATIVE DOSE.—Epsom salts is one of the most useful drugs we have in combating internal diseases in poultry. An ordinary dose is 20 to 30 grains administered in water. The dose for different ages, where quick purgative effect is desired, follows:

AGE OF BIRD.	Amount per bird in grains.	How administered.
1 to 6 weeks.....	10 grains	In feed
5 to 10 weeks.	15 grains	In feed
10 to 15 weeks.....	20 grains	In feed
15 to 26 weeks.....	30 grains	Dissolved in water
6 to 12 months	35 grains	Dissolved in water
1 year and over.....	40-50 grains	Dissolved in water

One ounce apothecary weight is 480 grains. One ounce is a quick purgative dose for 12 mature fowls. An ordinary dose is half this quantity.

EXHIBITING POULTRY.—The exhibitor who best understands how to groom a specimen which he intends to exhibit has the better chance to win high honors. "Grooming or conditioning for the show room is recognized as a part of the education of the breeder of exhibition poultry. When preparing birds for exhibition the

poultryman should first accustom them to being handled. This makes it easy for the judge to examine them without trouble and improves their chances of winning. They should be in perfect physical condition, but not too fat. The standard requires most of the large breeds to weigh in at a certain weight, cutting all that do not reach this weight. The large breeds are cut for underweight and the bantams for overweight. Birds so fat that they weigh above the standard requirement usually become misshapen on account of the excess of fat and therefore take a lower place than they would if exactly at weight. Judges are required to give the highest award to those specimens nearest standard weight, other things being equal.

Fowls intended for exhibition should be separated from the general flock some time before they are to be shown. The varieties that have feathers on their toes should be kept on soft straw, so that the feathers will not become broken. They should be fed grain alone, as such feed is always used in the showroom, and they should not be subjected to a sudden change of diet at this time. Two or three days before going to a show white fowls should be washed. Have two tubs of warm water in a warm room. Dip the fowl in one of these tubs and then rub good soap into the feathers, taking care to rub with the feathers. Gently manipulate the feathers until the soap has loosened all the dirt and grease in the feathers. Then wipe the bird as dry as possible and dip it into the tub of clean water to rinse out the soap. Rinse all the soap out, wipe the bird again and put it into a very warm room to dry. Many breeders give a third dipping, the last being in a tub of water in which a little pure indigo has been dissolved to clear the color, the

same as a laundry woman blues her white things in washing. When the operation is finished the fowl will be a rather sorry-looking bird, but soon it will begin to preen its feathers and before long it will have them smoothed out in perfect order and be perfectly white. Keep the birds in the drying room until they are perfectly dry, and then put them in a coop in the bottom of which there is a good coat of clean straw.

Dip a bit of flannel in sweet oil and then sprinkle on it a little emery powder and with this polish the beak and shanks. If there is dirt under the scales on the shanks remove this with a toothpick and a little sweet oil. In a vial keep a mixture of 2 parts of sweet oil to 1 part of alcohol and with this wash the face and comb to remove dirt that has collected in the creases and depressions. If the owner is going to the show with his birds this face-washing may be delayed until just before the judge is to examine the birds.

Be careful not to break any of the large feathers in wings or tail. If any small feathers in breast or back are broken or twisted by accident it is perfectly correct to pluck them out. Most exhibitors also pluck out black feathers in Barred Plymouth Rocks and the feathers which show a black speck in all white breeds. There is some dispute about the regularity of this, but there is no doubt about the practice. How far an exhibitor may go without being accused of "faking" is not clearly settled, but it is generally agreed that cleaning a fowl, polishing beak and shanks, cleaning the face and removing any small broken feathers is legitimate. Blueing fowls is discountenanced by many exhibitors, but it is noticeable that none of these has ever exhibited white fowls.

FANCY FOWLS.—This is a common but rather in-

correct term used to designate pure-bred fowls of any kind. The term "fancy" no doubt comes from the custom of calling a breeder of pure-bred fowls a "fancier."

FANCIER.—A breeder of pure-bred fowls of any kind. A breeder of pure-bred dogs is called a "dog fancier" and a breeder of pure-bred pigeons a "pigeon fancier."

FAKING.—Faking the standard defines as any "self-evident attempt to improve a fowl" by clipping its comb, changing the color of the earlobes, staining or splicing feathers, filling up holes from which feathers have been plucked in clean-legged breeds or using any device to deceive the judge in such a way that he will have a more favorable opinion of it than he would have had if it had not been manipulated. This is not held to include washing, oiling the plumage or any legitimate grooming calculated to give the fowl a more cleanly and attractive appearance.

FEATHER-PLUCKING.—No one has ever found out just why hens begin to pluck and eat the feathers from one another. A flock of hens which has animal feed in plenty, green stuff and a variety of grains, rarely acquires the vice, but sometimes it is taken up when every condition for perfect nutrition is correct. Usually the feathers from the neck of the cock begin to disappear, then the hens begin to look ragged from lost and broken feathers and the whole flock begins to look disreputable. Hens rarely pluck one another's feathers in human presence, not because they are smart enough to conceal their wickedness, but because their attention is on the onlooker. If the guilty ones can be discovered by hiding and watching for them it will not be necessary to treat the whole flock. If not, and the flock is a valuable one, every bird in the pen must be treated. The treatment consists in trim-

ming the edges of both upper and lower mandible of the beak, cutting away the translucent, sharp edges until they are flat, cutting the hook on the end of the beak flat also. The lower mandible of a hen shuts into the upper one so when she takes hold of a feather to pluck it out she grips it so tightly that a short kink is made in it. This gives her purchase enough to pull the feather out. If the edges of the mandibles are trimmed flat they will not quite touch at the point and further back there will be only a flat surface. She cannot get a grip on the feather that will hold to pull it out and soon she abandons trying to do so. It will not be long until the mandibles grow out again, but by that time the vice will have been forgotten.

FEATHERS, USES OF.—Large quantities of the hackle and saddle feathers of the red and black breeds, such as the Brown Leghorns, Partridge Cochins and breeds of similar color, are used by fishermen in making flies for luring game fish. Millinery supply houses use numbers of the same kind of feathers, as well as pure white and pure black hackle and saddle feathers in making wings, aigrettes and other ornaments for women's hats. The soft feathers are also used in making boas and feather trimming for garments. Feathers carefully dried and packed in bags bring from 60 cents per pound for pure white goose feathers down to 20 cents for white chicken feathers. This shows that it is worth while to save the feathers from poultry eaten at home.

FEED AND PROFITS.—The most costly feed is not always the most profitable. It is entirely possible to feed such costly feeds that the very best results will mean loss. It is not absolutely necessary to use any certain brand of feed. Grains are largely interchangeable, and

no proprietary mixture has any value above the value of ordinary feeds. No patent so-called egg-food is worth the price asked.

FEEDS AND FEEDING.—With good houses and proper feeding, the poultry business can successfully be carried on in almost any place. Location, exposure as to sunlight, accessibility to markets and even breed are all secondary to these two things. All fowls do well under many varying conditions if properly fed and housed. The products of the poultryyard are of such nature that they can be sent to quite distant markets at comparatively little cost. Irregularities of climate do not count for much if fowls are fed and housed in the proper way. The principal trouble in feeding fowls is that no one seems to be able to determine what a balanced ration for fowls is composed of. We know from experience that the various grains, grasses, vegetables and animal substances of various kinds are all greedily relished by fowls, but the exact combination of the various nutrients has never been determined as exactly as in the case of other stock. So far investigators along this line have assumed that the feeding tables that apply to other stock are approximately the ones that will produce best results in feeding poultry. Prof. Rice of Cornell University has expressed some doubts concerning this. He thinks it possible that a laying hen would do better on a ration that would be considered rather wide for a farm animal, basing his theory on the fact that fowls have a higher temperature than cattle or swine and require rather more carbohydrates to maintain animal heat.

It may be stated with a considerable degree of confidence that a fowl requires a larger proportion of the mineral elements that are found in feed stuffs than other

The Right Sort of Range for Chickens.

farm animals require. Thus the laying hen must have lime in liberal quantities to furnish the material for egg shell, phosphorus and silica in supplying material for feathers and the other mineral elements (usually spoken of as ash) in order to supply the material for eggs, if they are produced in more than the average numbers.

A good laying hen not infrequently produces eggs to a weight that will exceed her own within a period of three months. This rate of production requires a very liberal quantity of feed stuffs so composed that the several components of an egg shall be properly distributed in the feed.

Three methods of feeding fowls are recognized. These are the all-grain, grain and dry mash and grain and wet mash methods. The all-grain method consists of feeding whole grain alone, no ground grain being used. This method is not now considered economical and the most advanced poultrymen do not use it. The grain and wet mash methods consist in feeding whole grain once a day and ground grains, meatmeal or beef scraps and clover or alfalfa meals once a day, with often a feed of vegetables at midday. This method has many advocates and is much used by those poultrymen who adhere to the older methods. The grain and dry mash method consists in feeding whole grain once a day and ground grains, meatmeal and clover or alfalfa meal dry once a day. Very often those who feed "dry mash" put it in a self-feeding hopper and allow the fowls constant access to it.

The time at which grain and mash should be fed is a matter over which poultrymen disagree. Some think the mash should be fed in the morning and the grain in the afternoon. Others reverse the time, while many of the

dry-mash advocates compromise by feeding the ground feed in such a way that it is always before the fowls. The more logical method is to feed the mash in the morning, when wet mash is fed, and the grain in the afternoon. Whole grain naturally digests more slowly than that which is ground, and feeding it in the afternoon or evening gives the fowls full crops of this slowly digesting whole grain to dispose of during the night. Stewart and Atwood of the West Virginia Experiment Station concluded from a careful experiment that it made very little difference whether the mash was fed in the morning or afternoon. The New York Experiment Station carried on an experiment for nearly a year to test the comparative value of whole and ground grain in feeding for eggs. Common hens having a whole grain ration laid much better than did those having ground grain. Leghorn hens consumed 20 per cent more feed when fed whole grain for the same egg production than did similar hens having half their grain ground and moistened. The Hatch Experiment Station experimented with a lot of Plymouth Rock hens, feeding one lot mash in the morning and the other mash in the evening. During the winter the hens having morning mash laid 793 eggs and those having evening mash laid 758 eggs. During the summer the hens having morning mash laid 583 eggs, while those having evening mash laid 570 eggs. In this case, as in others, the time the mash was fed did not seem to make any particular difference in egg production.

In the discussion of feed formulas we shall begin with those for chicks just emerged from the shell, and carry them forward until they arrive at mature age. From this we shall give formulas for feeds for fowls being finished for market and for promoting egg production. The

Maine Experiment Station has probably given as much study to the proper feeding of chicks as any other institution, private or public, in this country. It should be understood that slight variations in methods do not usually produce serious results. One sort of grain may usually be substituted for another without seriously affecting results. For instance, if "pinhead" oatmeal is not available it may be left out of the ration, although its value is undisputed and it should be used if it is procurable at local stores. Broken rice usually can be secured in any town. If not, whole rice of the cheaper grades may be used. Cracked peas will probably be hardest to find in many localities. They are so valuable as a chick feed that they should be used if possible. Many poultry breeders seem to think it a waste of money to feed such costly feeds as "pinhead" oatmeal, cracked peas and broken rice.

While these are comparatively costly the quantity needed by one chick during the time chicks are fed will be so small that the cost should not be considered. Their value has been established by those who breed enough poultry to make it an object for them to economize and they cheerfully pay the price for these feeds. The very poorest economy in raising young poultry is to try to save money by restricting the quantity or quality of feed which will produce the best results. Chicks will grow to maturity on very cheap and coarse feeds, but if they are deprived of any of the elements really needed to promote symmetrical and normal growth they will not be so valuable as if given proper feeds.

The Maine Experiment Station has paid much attention to feeding fowls. We give its methods, as follows:

Method 1.—Infertile eggs are boiled half an hour and

rubbed together with about six times their bulk of rolled oats, the eggs having been put through an ordinary meat chopper. This mixture is fed the first two or three days until the chicks have learned to eat. It is fed with chick grit on the brooder floor, which is covered with clover hay cut short, or clean chaff. Beginning with the third day the chicks are fed a mixture of hard, finely-broken grains, as soon as they can see to eat in the morning. This grain mixture, which we will call mixture No. 1, is composed as follows, all parts being by weight :

Cracked wheat.....	15 parts
Pinhead oats (granulated oat meal).....	10 parts
Fine-screened cracked corn.....	15 parts
Fine cracked peas.....	3 parts
Broken rice.....	2 parts
Chick grit.....	5 parts
Fine charcoal (chick size).....	2 parts

This is fed on the litter on the floor, care being taken to limit the quantity so the chicks will be hungry again by 9 o'clock a. m. At 12:30 the grain mixture is fed again, as in the morning, and at 4:30 or 5 o'clock they are fed all they will eat of the rolled oats and egg mixture. If more convenient, almost any of the commercial grain mixtures for feeding young chicks may be substituted for the mixture described. Where only a small number of chicks are being reared the commercial mixtures are probably as cheap as the mixture given, and it is often more convenient to buy them ready mixed than to buy a small quantity of small grains and mix them at home.

When the chicks are three weeks old the rolled oats and egg mixture is gradually displaced by a mixture (No. 2) having the following composition :

Wheat bran, clean.....	2 parts, by weight
Cornmeal.....	4 parts, by weight
Middlings or "red dog" flour.....	2 parts, by weight
Linseed-meal.....	1 part, by weight
Screened beef scrap.....	2 parts, by weight

This mixture is moistened with water enough to make it fall apart when squeezed in the hand and released. While the rolled oats and egg mixture was fed in tin pans with low sides, the moistened mash was fed in light troughs with low sides. Young chicks like moist mash better than that which is dry, and they will eat more of it in a short time. There is no danger from a properly-made mash twice a day, and as the grain is ground the young birds can eat and digest more of it than of all coarse feed. This is important and should be taken advantage of at the time when young chicks are most susceptible to rapid growth, but development must be moderate for the first two weeks. The digestive organs must be kept in normal condition by the partial use of hard feed, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse. Proper feeding insures vigor at maturity.

About the time the chicks are six weeks old the broken grains are discontinued and the two feeds of hard grain on litter each day are begun, wholly of screened cracked corn and whole wheat. Only corn and wheat that are sound and sweet should be used. This method has always produced very satisfactory results, if the chicks have not been given too much scratch feed, and if the ground feed has been removed immediately after the meal was completed. The sole objection to this method is the labor of mixing the eggs and rolled oats, making the mash and removing the feed dishes at the proper time.

Method 2.—In Method 2 eggs are not used but fine beef scrap is substituted. The mash instead of being fed moist is fed in its dry condition. Early in the morning Mixture 1 is given on litter as in Method 1. At 9 o'clock

they are fed a mixture (No. 3) having the following composition:

Rolled oats.. .. .	2 parts, by weight
Wheat bran.....	2 parts, by weight
Cornmeal	2 parts, by weight
Linseed-meal	$\frac{1}{2}$ part, by weight
Screened beef scrap.....	1 part, by weight

Mixture 3 is given on plates or in troughs and removed after ten minutes' use. At 12:30 Mixture 1 is fed again and at 4:30 or 5 o'clock Mixture 3 is fed again, giving them all they will eat till their bedtime. Mixture 3, being fed dry, the chicks cannot eat it as readily as they can the eggs and rolled oats or Mixture 2, which has been moistened. For this reason it is left for them to feed on longer than when moistened feed is given. The aim is to give them enough at each of the four feeds so their desire for feed may be satisfied at the time, but to be sure that they have nothing left to eat between meals. It is desired to have their crops empty before feeding them again. When treated in this way they will have sharp appetites when the feeder appears and come racing out of the brooder to meet him. If overfed a few times they become debilitated and worthless.

Methods 1 and 2 are designed for feeding chicks which are hatched so early in the spring that it is impossible for them freely to run outdoors.

Method 3.—This method is like Method 1 except that the first feed has the following composition:

Wheat bran.....	4 parts, by weight
Cornmeal.....	$3\frac{1}{2}$ parts, by weight
Linseed-meal.....	$\frac{1}{2}$ part, by weight
Screened beef scrap.....	2 parts, by weight
Alfalfa meal	1 part, by weight

Mixture 5 is scalded and then dry rolled oats are mixed

with it in the proportion to 2 parts rolled oats to 6 of the mixture. The reason for mixing in this way is that it has been found by experience that if the rolled oats are mixed in before scalding the mash has a tendency to become soggy after it is wet. Mixing in the way here outlined has been found greatly to improve the mash. This mash and Mixture 2 are fed as in Method 2 until the chicks are about three weeks old. From three on to six or eight weeks the composition of the mash (Mixture 6) is as follows:

Wheat bran.....	2	parts, by weight
Cornmeal.....	3	parts, by weight
Linseed-meal.....	$\frac{1}{2}$	part, by weight
Daisy flour (a coarse grade).....	1	part, by weight
Beef scrap.....	1	part, by weight

Method 4.—This method is planned for chicks hatched at a time in the year when they may freely run outdoors from the time they are hatched. This time corresponds to April in the latitude of Chicago, earlier south and later north of that city. Under these circumstances Mixture 3 is kept before them at all times with good results. It is kept in protected troughs. With this they have two feeds a day of Mixture 2 in litter, which gives them hard feed enough to insure health, and they can safely pick away at the ground feed—a mouthful or two at a time—when they happen to think of it. The results from this method have always been good, except in raw, cloudy weather. At such times the little birds have been held inside and have hung around the troughs and have overeaten.

Method 5.—This we consider as good as any, if proper attention is paid so as not to clog the appetites of the young birds. It consists in feeding cracked corn, cracked wheat and pinhead oatmeal in the litter four times a day,

1. A Large Poultry Ranch in California. 2. House on Same Ranch.

with beef scrap always in a protected trough where the chicks can get at it. The Maine station recommends millet seed in addition to the ones enumerated, but we are inclined to think millet is not very good for very young chicks. In this we are supported by Prof. Graham of Canada.

Pure water and chick grit should always be accessible to fowls, young or old, and they should have a dry place kept at a comfortable temperature to which they may retire for warmth or sleep. Another method which has proved to be very successful does not require any mixing of wet mashes at any time during the period of chickenhood. It is known as the dry-feed method and is in great favor with many successful poultrymen. By this method the chicks are not fed until they are from 36 to 48 hours old. If they are hatched in an incubator they are left in the machine during this time, or put into well-warmed brooders and allowed to remain in perfect quiet. In fact, no young fowl should be fed until more than 24 hours old, as nature has provided for its wants. It has been determined by J. L. Nix and other investigators that chicks do not acquire the faculty of selecting their feed for about 10 days. Before that time they will pick at almost anything and are likely to swallow anything which is light-colored. This true, it is necessary for the caretaker to select the feed to be given to young chicks in brooders.

The first thing given to chicks under the dry-method is water, pinhead oatmeal and fine chick grit. The grit is necessary so the chicks may have grinding material for their feed, but only a little should be given. Pinhead oatmeal goes by several names locally, besides the one we have used. It is sometimes called "steel-cut" oatmeal

and sometimes "granulated" oatmeal. It may seem a costly feed for chicks, but the quantity used during the time it is fed is a very small item for each individual chick. This pinhead oatmeal constitutes the sole feed of the chicks for the first week. After that half oatmeal and half cracked wheat are used for a week. Then finely-cracked corn and cracked wheat are used and the oatmeal is no longer fed. Do not try to substitute rolled oats for pinhead oatmeal, as the rolled oats are cooked in preparing for market and form a soggy mass (when fed alone) as soon as they get into the crop of the chick. At three weeks a little sweet beef scrap is put before the chicks and they are allowed to become accustomed to it. By the time the chicks are four weeks old whole wheat and cracked corn in the proportion of 1 part corn to 2 parts wheat constitutes the grain feed, and the beef scrap is placed in a protected trough where the chicks can help themselves.

During all this time tender green stuff is given in as large quantities as they will eat. Lawn clippings, green clover cut into short lengths, fresh lettuce leaves, onion tops, radish or mustard leaves, tender young oat or wheat blades, dandelion leaves, rape or any similar tender green stuff, is good for growing chicks and there is no danger of feeding too much. The grain is fed twice a day in such quantities as the chicks will eat clean within half an hour. Besides this, a mixture of equal parts of cornmeal, coarse wheat middlings and linseed oilmeal is kept in a protected trough where the chicks can eat between meals.

For the first two weeks some care must be taken that the chicks do not overeat. After that they safely can be allowed to help themselves, but at no time should grain

be allowed to lie uneaten from one meal to another. When it is observed that the grain is not all eaten less should be fed. The object is to keep the appetite good, but not to allow the chicks to become hungry enough to stop constant growth. Pure water, plenty of chick grit or coarse sand and fine gravel, and a box of charcoal, chick size, should always be kept where the chicks can help themselves.

At the Maine station the chicks hatched in April are moved out on the open range about the middle of June. The time for making this change may be regulated by the weather. In warmer parts of the country the change could be made late in April or some time in May, according as the season was early or late. This is a matter where each one must judge for himself. If the weather is fine the chicks might be moved any time after they were eight weeks old. The change is made by simply moving the portable brooder houses and the chickens out into the grass fields. The method now followed at that station gives the maximum of benefits with the minimum of labor. Two acres are allotted for 1,000 growing chicks and the same land should not be used two years in succession if it is at all convenient to put the chicks on fresh land.

When the chicks are moved to the range the sexes are separated. The method of feeding the pullets is very simple. Separate protected troughs are kept filled with cracked corn, wheat, beef scrap, cracked bone, oyster shell and grit, one kind of feed in a trough, where the pullets can help themselves whenever they desire. Fresh water is kept before them. There are no regular hours for feeding, but care is taken that the troughs are never empty. Since 1905 another trough containing the fol-

lowing mixture has been kept where the pullets had free access to it:

Wheat bran.....	1 part, by weight
Cornmeal.....	2 parts, by weight
Middlings.....	1 part, by weight
Beef scrap.....	1 part, by weight

The result has been satisfactory. This method saves labor in feeding and the chicks do not hang around the troughs and overeat, but help themselves to a little at a time, then going off to hunt insects, and coming back when hunger inclines them to do so. It has been found that chicks allowed to choose for themselves eat just about the same quantity of beef scrap that experience teaches is best for them. The method of feeding cockerels is practically the same as that followed in feeding pullets. About 100 are kept in each flock, the portable brooding houses being large enough comfortably to house this number. Where cockerels are to be sold in the market for food a different method is used toward the last to finish them for sale. It has been found that a special method of fattening pays, as plump soft-fleshed cockerels bring a better price than those picked up from the range without having been specially fed. The grain mixture used is as follows:

Cornmeal	100 pounds
Wheat middlings	100 pounds
Meatmeal	40 pounds

This was fed as a porridge thick enough to drop, but not to run from a spoon.

No one may say positively what method is best in feeding laying hens. We know in a general way the kinds of feed that best promote egg production, but so far almost every investigator has a method of his own, which he

had adopted because it has given him satisfactory results. Apart from a few whose experiments and experience do not carry the weight of very much authority, our investigators say that promoting egg production by any system of feeding is a matter on which they do not feel like speaking positively. We have thought it best to give several methods on the authority of a number of poultry investigators, with full particulars as to the breeds used and the conditions surrounding the work.

It is quite definitely determined that some breeds produce eggs at considerably lower feed-cost than others, but when we begin to discuss the profits derived from keeping one breed or another several factors appear in the problem which involve it in difficulties that leave the whole question open to discussion with good arguments on each side. On the authority of W. S. Thompson, after he had conducted five great egg-laying competitions in Australia, each one extending through an entire year, we have reason for saying that Leghorns produce eggs at a much lower feed-cost than the larger breeds. However, Mr. Thompson does not base his opinion on anything more tangible than daily observations, although being a close observer there is no doubt that his opinion should carry much weight. At the Maine station, where Barred Plymouth Rocks are kept, the method of feeding followed has been found very satisfactory, inasmuch as it secures immunity from overfatness to which this breed is very liable, after reaching maturity. Further than that this method has given good results nothing is claimed for it, nor does it need any other claim to establish it as a good one. It should be remembered that while a full-fed hen can lay to the limit of her capacity it is equally true that the full-feeding of Plymouth Rock

Six Black Langshan Hens that Laid 1,411 Eggs in One-Year Australian Competition.

hens, unless correctly done, results in disaster. Mr. Thompson is a thorough believer in what he calls the "full and plenty" method of feeding; that is, he believes in keeping hens full-fed and his practice is along this line.

We may add that Prof. Rice of Cornell University said he had been able to select the best layers by examining the dressed carcasses of a lot of hens. These hens had been under test and were then killed in order to settle some questions in doubt. Their records were known, and after they were killed he was able to select the best layers by selecting the fattest among the dressed carcasses.

The Maine method follows: Early in the morning for each 100 hens 4 quarts of whole corn is scattered on the litter, which is 6" or 8" deep on the floor. This is not hidden, for the straw is light and dry and enough of the grain is hidden that the hens begin scratching almost at once. At 10 o'clock they are fed in the same way 2 quarts of wheat and 2 quarts of oats. This is all of the regular feeding that is done.

So much has been said against corn as a feed for laying hens that some experiments were made which resulted in the conclusion that whole corn produces as good results as either cracked corn or cornmeal. Besides the whole grain, a dry mash is kept always before the hens. Along one side of the room a protected feed trough is kept supplied with dry meals, mixed together. This dry meal mash has the following composition:

Wheat bran	2 parts, by weight
Cornmeal.....	1 part, by weight
Middlings.....	1 part, by weight
Gluten-meal	1 part, by weight
Linseed-meal.....	1 part, by weight
Beef scrap.	1 part, by weight

Brewers' grains are sometimes substituted for gluten meal in this mash. The several meals in this mash are thoroughly mixed and the troughs are never allowed to become empty. The mixture is constantly before the hens and they are allowed to help themselves. Oyster shell, dry cracked bone, grit and charcoal are kept in other separate protected troughs where they are accessible at all times. A moderate supply of mangels and plenty of clean water are furnished. For the mangels, turnips, cabbage, or other sorts of beets, would make a perfect substitute. About 5 pounds of dry clover hay, cut to $\frac{1}{2}$ " lengths, is fed to each 100 hens every day. For clover hay alfalfa could be substituted to advantage, this not being fed at the Maine station because alfalfa can not be grown in Maine. Clovermeal or alfalfameal used as a part of the dry mash would probably be a satisfactory substitute for the cut hay, but the bulkiness of the hay makes it preferable, as hens need bulk as well as nutritive elements in their feed. When the wheat, oats or corn is given the birds they are always ready for it, although there is an abundance of the dry mash accessible to them. They scratch in the litter for the last grain. It is evident that they like the grain better than the dry mash, although they by no means dislike the latter, for they help themselves to it whenever they need it, and never go to roost with empty crops. They apparently do not like it well enough to gorge themselves on it and sit down, loaf, get overfat and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mash in troughs.

Some of the advantages of this method of feeding are that the troughs may be filled at any convenient time, only guarding against allowing them to become empty,

and the avoidance of the mobbing that always occurs at trough-feeding when that is made the meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is common when a full meal of mash is given at night. The labor is very much less, enabling one person to care for more birds than when a regular evening meal is given.

For green feed in winter and spring mangels are used. They are liked by the birds and when properly harvested and cared for will remain crisp and fresh until spring. They are fed whole by impaling them on projecting nails about 18" above the floor. Care must be taken not to feed them too freely, as they are laxative when too freely used. In Denmark great attention is paid to egg production, the Danish government interesting itself in the improvement of poultry. In a report to the National Poultry Organization Society (England), Edward Brown, F. L. S., gives the following method of feeding White Leghorns on a Danish farm where the hens averaged about 160 eggs each in a year, a record that should be perfectly satisfactory to any one. In the morning a mash is fed. The following is the composition of the mash:

Ground oats	4 parts, by weight
Bran.....	4 parts, by weight
Cornmeal.....	2 parts, by weight
Bonemeal and meat, each.....	$\frac{1}{2}$ part, by weight

This is mixed with skimmilk obtained from a nearby creamery. During the day chopped turnips and alfalfa is fed, as much as the hens will eat. In the evening a mixture of grain of the following composition is fed:

Corn	2 parts, by weight
Wheat	1 part, by weight
Oats	2 parts, by weight
Barley	2 parts, by weight

After considerable experience we have come to the conclusion that wheat and barley may either be used. There is not enough difference in their composition to make any material difference in results. We would never feed barley without having it ground or crushed.

The Kansas Experiment Station gives the following mixtures as being very satisfactory in promoting egg production:

Grain mixture:

Wheat	10 parts, by weight
Corn (cracked preferred)....	10 parts, by weight
Oats	5 parts, by weight

This is thrown in litter on the floor in the morning.

Dry mash mixture:

Middlings.....	6 parts, by weight
Cornmeal.....	6 parts, by weight
Bran	3 parts, by weight
Oilmeal.....	1 part, by weight
Alfalfa-meal.....	1 part, by weight
Beef scrap.....	5 parts, by weight

Feed this in the afternoon in protected troughs, giving as much as the hens will eat. For green feed mangels or sugar beets may be used. Cabbage or rape also are recommended. In winter more alfalfa meal may be substituted if green feed is hard to secure.

California mixture for eggs:

Middlings	2 parts, by weight
Bran	2 parts, by weight
Cornmeal.....	1 part, by weight
Shorts.....	1 part, by weight
Bolted barley.	1 part, by weight
Meatmeal	1 part, by weight
Bonemeal.....	$\frac{1}{2}$ part, by weight

This mixture is the sole grain feed. In connection with this mixture potatoes, cabbage and other vegetable

feed was used. The objection we have to this ration is that it contains no hard grain, and its continued use leaves the digestive organs nothing with which to maintain a healthful condition, as a fowl needs hard feed so as to keep the gizzard in good condition. We would say that this mixture should be alternated with grain once a day.

FEEDS, INTERCHANGEABLE.—It is the consensus of opinion among investigators that the several grains used in feeding poultry may be interchanged without making a material difference in results. This is true so far as using wheat, barley and oats are concerned. These grains may be interchanged if necessary, as they do not vary widely in composition. While they do not altogether take the place of each other it is sometimes better economy to sacrifice something in one direction if by doing so we may make a commensurate gain in another. Thus corn may be scarce and high-priced in one place and wheat low in price. In such cases it would be more economical to feed wheat than corn. In like manner Kaffir-corn may be substituted for the more common sort, or used in the place of wheat or oats, although either wheat or oats is better for laying hens than Kaffir-corn. The poultryman must use his own judgment in such things, for no set rule will apply alike in every place and under all conditions.

Buckwheat makes a very good substitute for corn, but should not be made the sole grain feed, as it is too fattening. This is true of corn also.

FEEDS, NUTRITIVE VALUE.—The nutritive value of feeds can be determined by analysis. Three principal nutritive elements are considered in determining the value of a given feed—protein, carbohydrates and fat.

Other elements are necessary to nutrition, such as sulphur, phosphorus, lime, salt, iron and other minerals. These are the inorganic residue which remains after burning and are known as ash. Burn the body of a fowl and the little pile of ashes that remains will represent all the mineral matter contained in the body. All feed contains these mineral elements, and the feeder need not pay any attention to them, for if the feed is properly constituted as to protein, carbohydrates and fat it will almost always contain sufficient of the mineral elements to supply all the needs of the fowl. It should be remembered, however, that these mineral elements are as important as the three to which so much attention is paid. When a hen is laying regularly her feed may be deficient in lime, because she requires a large quantity of this element in order that she may supply material for egg shells. In order to meet this demand we feed crushed oyster shells or crushed bone. Very often a flock of hens otherwise properly fed fails to lay as many eggs as it might because of a deficiency in lime in the feed. For this reason poultrymen should always keep a supply of oyster shells or crushed bone where laying hens may have constant access to it.

Protein is the most valuable and the most costly part of any ration. All protein-rich feeds are more costly than those which contain a relatively small quantity of this substance. A protein-rich ration is called a "nitrogenous" ration because nitrogen is a large component part of the elements grouped and denominated protein. Protein is that material in feed which goes to make brain matter, nerve cells, vital organs, intestines, tendons, skin, feathers, beak, claws, skin and, in combination with lime, bones and muscle (lean meat). In short, it is largely the

material from which is built up the vital machine we call a fowl. This is also true, of course, of any animate creation from the lowest organism up to man.

While protein is the material from which the machine is made carbohydrate is the fuel which supplies the energy to keep the machine going. Carbohydrates are composed largely of carbon and a carbohydrate-rich ration is denominated a "carbonaceous" ration. Carbohydrates in food becomes fat in a fowl, except that part of it which is used in maintaining vital heat and the energy that is expended in living and moving. The heat of a fowl's body is maintained by the consumption of carbohydrates just as the heat in a steam engine is maintained by the consumption of coal. The sugars, starches and gums that form a part of all feeds are included in the term carbohydrates. These substances first keep vital heat and energy up to the normal standard in a healthy fowl, and any surplus is stored in the body in the shape of fat, which may be stored in the bodily cavities or in the tissues of the body in the shape of minute globules. A properly fattened fowl is tender because the minute fat globules stored in the tissues melt in the process of cooking and leave the fibers of the flesh open and easily cut or masticated.

The fats and oil contained in all feeds are used for the same purpose to which carbohydrates are put. They are consumed by the body in furnishing heat and energy or are stored as fat in the body. In computing a ration the fat content of any feed is multiplied by 2.25 and added to the carbohydrates, as fat is believed to be $2\frac{1}{4}$ times as valuable as carbohydrates for feed purposes.

In order to be able successfully to conduct operations there are some points that a feeder must have fixed in his

mind. Protein, in the absence of carbohydrates, may be consumed in maintaining vital heat and energy or even in producing fat in the body, but carbohydrates never can take the place of protein. This fact should be firmly fixed in mind, as on it depends very often the success of feeding. An animal fed carbohydrates alone would starve

GRAIN FEEDS ARRANGED IN ORDER OF DIGESTIBLE CONTENT
IN 100 POUNDS.

	Dry matter.	Ash or mineral matter.	Protein.	Carbohy- drates.	Nutri- tive ratio.	Manurial value 100 lbs.
Flaxseed	90.8	4.3	20.6	82.3	1: 4	.0657c.
Peas.....	90	2.6	16.8	53.4	1: 3.2	.0548c.
Sunflower seed.....	92.5	2.6	12.1	85.8	1: 7.1	.0428c.
Wheat.....	90	1.8	10.2	73	1: 7.2	.0426c.
Rye	88	1.9	9.9	70	1: 7.1	.0329c.
Wheat screenings.....	88.4	2.9	9.8	55.9	1: 5.6	.0462c.
Oats.....	89	3	9.2	56.8	1: 6.2	.0378c.
Millet.....	86	3.3	8.9	52.2	1: 5.8	.0365c.
Barley.....	89	2.4	8.7	69.2	1: 7.9	.0288c.
Corn.....	89	1.5	7.9	76.4	1: 9.7	.0326c.
Buckwheat.....	87	2	7.7	53.3	1: 6.9	.0247c.
Kaffir corn.....	84.8	1.5	7.8	63.2	1: 8.1	....
Broomcorn.....	85.9	3.4	7.4	54.8	1: 7.4	.0245c.
Sorghum seed.....	87.2	2.1	7	59.1	1: 8.4	.0281c.
Rice.....	87.6	0.4	4.8	73.9	1:15.2	.0175c.

to death—not as quickly as it would if deprived of all feed, but it would starve in the end, because it would have no supply from which to replace bodily waste. It follows that as protein is the most costly part of the feed in any ration we should take care that a ration has enough carbohydrates in it to supply heat and energy and at the same time enough protein to keep the machine in

perfect repair. Any surplus of any elements of nutrition beyond the quantity the body properly can assimilate passes off in the droppings. It will be seen that a surplus of protein is pure waste, and the same is true of carbohydrates. Here is shown the necessity of a ration containing the proper percentage of each of the elements of nutrition. Hence the necessity of feeding a balanced ration.

All feeds contain some woody matter known as fiber, which has no value as feed. For convenience this is counted as carbohydrates. All feeds also contain more or less water. In computing rations this water is not taken into account, as it is simply pure water. The table on the preceding page shows the nutritive value of the several grain feeds used by poultrymen, with the digestible content in 100 pounds.

As a balanced ration for a fowl is about 1 part of protein to 4.6 of carbohydrates, as determined by Wheeler of the New York Experiment Station, it will be seen from referring to the table that no single grain is exactly proportioned as to the requirements of a perfect ration. With the single exception of peas all the grains contain too great a percentage of carbohydrates. Peas being a very expensive feed in this country they are rarely used, as we can furnish the protein to balance the grains much cheaper by using some by-product, such as gluten feed, beef scrap, bloodmeal or oilmeal. The table on the next page gives the nutritive value of the several by-products commonly used in feeding poultry in this country.

In order to promote thrift, produce rapid growth in young fowls and provide elements from which laying hens may secure the materials used in the composition of eggs, thus inducing heavier laying, the poultryman must

feed vegetable feed of some kind. If only grains, by-products and meat feeds are used they do not digest so quickly nor so thoroughly as when fed something coarser and bulkier. The hen resembles the cow in this, as she must have bulk as well as nutritive value in her feed to put it to the best use.

There also seems to be something which escapes the chemist in green feed that adds to its value, as determined by chemical analysis. Among the most available vegetable feeds are mangels or other kinds of beets, tur-

BY-PRODUCTS USED IN FEEDING POULTRY. DIGESTIBLE CONTENT IN 100 POUNDS. (Computations from Cornell University College of Agriculture.)

	Dry matter.	Ash or mineral matter.	Protein.	Carbohy- drates.	Nutri- tive ratio.	Manurial value.
Old-process oil meal....	91	5.3	29.3	48.5	1:1.1	.096c.
Gluten meal... ..	92	8	25.8	65.6	1:2.5	.077c.
Buckwheat middlings..	87	4.8	22	45	1:2.1	.026c.
Gluten feed.....	92	1.1	19.4	63.3	1:3.3	...
Wheat middlings... ..	88	3.8	12.8	60.7	1:1.7	.047c.
Wheat bran.....	88	5.8	11	45.3	1:3.8	.043c.
Alfalfa meal.....	92	7.4	11	42.3	1:3.8	.043c.
Beef scraps.....	89.3	4.1	66.2	33.1	1:0.5	.175c.
Animal meal.	92.7	4.9	32	23	1:0.7	....
Green cut bone	6.5	1.1	18	43	1:2.2	....
Skimmilk	9.4	0.7	2.9	5.9	1:2	....

nips, cabbages, potatoes, green grass, clover or alfalfa cut fine, dandelion tops, lettuce, Swiss chard, dwarf Essex rape, collards, parsley, and all similar tender green stuff. Some of these are procurable only in summer, when they are fed to fowls kept in confinement. The others are fed in winter, either in their natural state or

chopped fine. Sometimes they are cooked soft and mixed with bran or middlings in making a mash, but it seems better to feed them raw. Clover or alfalfa hay makes a very good substitute for green feed in winter, if it has been cut at the proper time and carefully dried, so as to retain all its value. It may be cut into short lengths and fed in that shape or it may be brought in the shape of a fine meal and used as one of the components of a mash, or as hay it may be used for the litter on the floor of the poultry house so the fowls may eat the leaves and smaller stems. The latter is wasteful, but where hay is cheap this does not much matter. The fresh vegetable feeds are very poor in the nutritive elements, being largely water, but this very succulence is apparently the quality in which their greatest value lies. The table gives the nutritive value of several of these vegetable feeds:

VEGETABLE FEEDS USED FOR POULTRY. DIGESTIVE CONTENT
IN 100 POUNDS.

	Dry matter.	Ash.	Protein.	Carbo- hydrates.	Nutritive ratio.
Red clover, green.....	29	2.1	2.9	16.4	1:5.6
Cabbage.....	15	1.4	1.5	9.1	1:5.1
Mangels (beets).....	13	1.1	1.1	10.4	1:5.1
Turnips.....	9.5	0.8	1.1	7.65	1:7.7
Potatoes.....	21	1	0.9	16.5	1:18.3

The animal feeds used for poultry are composed almost entirely of the waste products of packing houses. These are bloodmeal, made from blood dried and ground to a powder, very rich in protein and valuable as a feed for growing chicks or laying hens, if not fed in too large quantities; beef scrap, made from the waste scraps which remain from cutting meat, bloody pieces, the meat from bones and other waste meat. This is first boiled and

then pressed under heavy pressure to extract the fats, after which it is dried and coarsely ground. This also is very rich in protein and a valuable feed.

Green cut bone is almost invariably butcher's bone ground at home in a bone-cutting mill. It is rich in lime, phosphorus and protein, with some fat. This green cut bone is the most valuable of all feeds, but not too much should be fed, as it is laxative when too much of it is fed at a time or when fed too frequently. The following table gives the nutritive value of the several animal feeds:

THE ANIMAL FEED USED FOR POULTRY. DIGESTIBLE NUTRIENTS IN 100 POUNDS.

	Dry matter.	Ash.	Protein.	Carbo- hydrates.	Nutritive ratio.
Bloodmeal.....	92.7	19.7	32	23	1:0.7
Beef scrap.....	89	4.1	66.2	33.3	1:0.5
Green cut bone.....	65	11.5	18	43	1:2.5
Dried fish.....	89.2	39.2	44.1	23.2	1:0.5
Skimmilk.....	9.4	0.7	2.9	5.9	1:2

Dried fish is sometimes used as a poultry feed. It is very rich in protein and contains more phosphorus than ordinary meat feeds, but it is likely to flavor the eggs when fed to laying hens. It is not to be recommended as a regular feed.

Skimmilk is very highly recommended as a poultry feed. While it contains but a low percentage of nutritive elements to its whole bulk, it has been found to be a very cheap nutrient in those places where it could be bought at the price most commonly charged.

FERTILITY AND "HATCHABILITY."—It was found in experiments at the Maine station that hens which laid through the winter laid as large a percentage

of fertile eggs in spring as other hens in the flock, but while these eggs were fertile they lacked what Prof. Rice calls "hatchability," that is, they would not hatch, the germs dying before the end of the period of incubation in a large percentage of them. This would indicate that it is best to discourage winter-laying in breeding stock. If this were done systematically it would be impossible to select the best layers for breeders unless the pullets were tested the first year as layers and the best of them used the second year as breeders.

FERTILITY OF EGGS.—Some experiments were made in Canada to determine how long eggs would remain fertile after the male had been removed from his mates. Ten hens were separated from the male. The eggs laid each day were placed in an incubator and tested. Of the eggs laid the first four days after the male was taken away 70 per cent were fertile; of those laid the fifth day 60 per cent; the seventh 49 per cent; the eighth 12 per cent; the ninth, 2 per cent; the tenth none. A test was made with 6 hens to determine how soon the eggs became fertile after the males were placed with them. On the third day 30 per cent were fertile; on the fourth, 42 per cent; on the fifth, 50 per cent; on the sixth, 60 per cent; on the seventh, 70 per cent; on the eighth, 68 per cent; on the ninth, 70 per cent, and on the tenth, 74 per cent. As rarely more than 75 per cent of the eggs produced under average conditions are fertile, this goes to show that mating a hen 10 days before the eggs are needed for hatching is sufficient.

There is some reason to believe that the effect of mating lasts longer than the figures indicate if hens are not laying at the time of copulation. In one case that came under our observation a pullet that had been running in

A California Poultry Ranch with Eucalyptus Trees in Background.

a yard with a White Leghorn cockerel, from which she was separated in the fall, laid eggs in February that were fertile and showed White Leghorn blood in the chicks hatched from the eggs.

FLAVOR OF EGGS.—At the North Carolina station wild onion tops and bulbs were fed to hens, and the length of time before there was a change in the flavor of the eggs produced by these hens noted, as well as the time that must elapse after the onion feeding was discontinued before the objectionable flavor would disappear. At the beginning of the trial $\frac{1}{2}$ -ounce of chopped onion tops was fed daily to 12 hens of different breeds. Repeated tests did not show any onion flavor in the eggs until the 15th day, when it became distinctly noticeable. The quantity of onion tops was doubled and this fed for four days and then discontinued. The eggs laid while the larger quantity was being fed were so strongly flavored that they could not be used. After discontinuing the onion feeding the flavor became less noticeable and at the end of a week the eggs had returned to the normal flavor.

The main point is that flavor may be fed into eggs. Not only the flavor of onions may be noted in eggs but the feed the hens consume may give the eggs they lay a musty flavor or a rank, disagreeable flavor that comes from the hens scratching grain out of a manure pile. Some years ago the New York station in studying the effect of nitrogenous vs. carbonaceous feeds for poultry reported observations on the effect of different kinds of feeds on the flavor of eggs. One lot of fowls was fed a mixture of wheat shorts, cottonseed-meal and skimmilk; another cracked corn and corn dough. The former ration contained much more nitrogen than the latter. The

hens fed corn laid fewer eggs than those fed the nitrogenous rations, but they were larger. The eggs produced by the nitrogenous ration were of a disagreeable flavor and smell, had small yolks and did not keep well. The flesh of the poultry fed this ration, however, was darker, more succulent and tender than that of the fowls fed the carbonaceous ration.

These experiments show, as did those of the North Carolina station, that feed affects the flavor of eggs. The writer has noted a great many times this tendency of feed to affect the flavor of eggs.

FLOOR FOR POULTRY HOUSES.—Where the poultry house is situated in a dry location it has been found that a hard earthen floor is better than any other. If there is any tendency to dampness a board floor is better than an earthen one. Where a board floor is used the house should be set far enough from the ground to allow the air freely to circulate beneath.

FORCE FEED HOPPER.—On page 247 is an illustration of a force feed hopper modeled after one invented by Prof. Rice. The dotted line at the end indicates how a sheet of galvanized iron is bent and fastened the entire length of the bottom of the hopper. This forces the last grain of the feed in the hopper to the front where the fowls can reach it. A dotted line indicates how a partition may be put in for two kinds of feed.

FOWL.—A fowl is strictly any domesticated bird used for food; therefore ducks, geese and turkeys are really fowls, but the more common usage is to restrict the use of the word to the domestic chicken (*Gallus domesticus*), and we have adopted this usage with few exceptions.

FRACTURES.—Sometimes a valuable fowl gets a leg fractured below the hock (knee) and it is desirable to

save it. Cut a piece of soft leather large enough to go around the leg twice and as wide as from the foot to the hock, dampen it until it is perfectly flexible and bind it on the broken leg in such manner as to make it straight and in a few days it will unite and be as good as ever. Be sure to leave the bandage on the leg until it is perfectly well.

FROZEN COMBS.—When the combs are frozen and the injury is discovered before it has thawed, dip the comb and wattles in very cold water until the frost is drawn out. Then bathe freely with turpentine and anoint with carbolated vaseline. If much swelling occurs with a very sharp knife cut incisions in the comb and wattles on each side, but not very deep. This will let the serum that causes the swelling drain away, and often save the comb and wattles and retain the good appearance of a valuable fowl. If the injury is not discovered at once and the freezing is extensive enough to make it probable that comb or wattles, one or both, will be lost, the most humane thing to do is to cut the injured member off as far as frozen. This is no more painful than the pain of the injury and the wounds thus made will heal over in a few days, while it takes weeks for a frozen comb or wattle to slough off and heal. If a feather plucked from the breast of a bird which has been treated in this way is laid along the cut comb it will stop bleeding at once and usually is perfectly healed in a week, if all that was injured was cut off.

GAPES.—This disease manifests its presence by the disposition of the victims frequently to gasp. It is caused by a peculiar worm, the male and female being joined together. This worm is known as *Syngamus trachealis* and is picked up by young chicks in their rambles in

1. African Geese, 2. Brown China Geese, 3. White China Geese, 4. Embden Geese.

search of feed. It finds lodgment in the trachea and when it is present in numbers it obstructs the passage of air to the lungs, causing the chick to gape, which gives the disease its name. They often become so numerous that they strangle their victims. This worm at maturity passes from the fowl which has been its host and deposits its eggs in the soil where they hatch or lie until picked up by some fowl or bird. As soon as the eggs are deposited in the digestive tract of the fowl which has picked them up they immediately find their way to the trachea. Very often several of these worms are present in a bird that shows no sign of their presence.

There are two methods of destroying these parasites and curing the disease. One is to double a horse hair and push the loop down into the trachea, twist it around a few times and, thus entangling the worms, they can be drawn out. The other is by fumigating with sulphur smoke. The gaping chicks are placed in a basket and covered with a cloth. A little sulphur is thrown on some live coals and the basket passed through the sulphur fumes that arise, quickly swinging it back and forth two or three times. The cloth is then removed from the basket and the gasping chicks are allowed to get their breath, when the treatment is repeated. This must be carefully done or the chicks may be asphyxiated by the fumes. The basket containing them should be moved back and forth with moderate speed.

GEESE.—The breeds of geese have been considered elsewhere. Geese are not as popular as chickens and ducks and there is no place in the country where goose-breeding is made a special business. In some restricted locations the breeding of geese has attained considerable importance and a great many of them are bred, but much

the larger part of the geese which appear in the markets have been gathered a few at a place from the farms of the country. Where wild geese can be procured to cross on tame geese the progeny brings a good price in the market, but such progeny is not fertile and the parents must be obtained in the regular course of breeding on the one side and capture on the other, as wild geese rarely breed in captivity, and when they do they mate in pairs. The common gray goose is not a very profitable bird. In fact, geese are not as profitable as ducks, unless markets are near or there is a market for young geese, which is close at hand. Geese are grazers and will do very well if they have nothing but grass and water during the warm months.

Laying geese should have a little grain but should not be allowed to get too fat. Geese should have plenty of water to drink and a place in which they can bathe frequently. They require very little in the way of housing, a dry shed to protect them from wind and rain being sufficient. The floor should be bedded with straw frequently renewed. The larger breeds lay from 15 to 20 eggs and then become broody, but if removed from their mates for a few days they will forget their broodiness and soon begin to lay again. They will lay three litters or clutches in a season, the last two being from 10 to 15 each.

Goose eggs hatch in about 30 days, sometimes a day or two longer. It is best to hatch them under hens, giving a medium-sized hen about 5 eggs and a large one 7. Some breeders dip the eggs in water about blood-warm two or three days before it is time for them to hatch, but it is doubtful whether this is of any help to the hatch. When the goslings begin to hatch the hen should

be watched in order to save any of the young birds from being trampled to death. As goslings are usually hatched only in warm weather they are often raised without the help of the mother that hatched them. A very quiet old hen may be allowed to run with the goslings that she has hatched, but if the mother hen is cross or uneasy it is better to take her goslings from her and raise them by hand.

Samuel Cushman of Rhode Island was a very successful goose breeder. He gave the following method for feeding young geese which has the merit of simplicity and his success proved it to be practicable:

The young geese are kept dry and warm for 24 hours and are then given grass that is tender and water to eat and drink. Later they are given finely-cracked corn that has been well scalded and are allowed to run on tender grass, the pen confining them being moved to new grass every day. They must be fed often. Much the largest part of their feed should be tender grass and if the weather is stormy they should have freshly-cut green clover, oats, rye or other similar tender green feed supplied to them. They should be protected from rains until the feathers on their backs begin to appear, after which they are perfectly hardy and may be allowed to graze in the fields, coming home at night for their grain feed. Where there are low, wet pasture lands geese may be kept with profit, as they will make such lands return something while other stock would not do well on it. Good farming does not consist in letting lands lie undrained, therefore there is not a great encouragement for the good farmer to keep more than a few geese.

Geese have not been favorites in the markets, but for a few years there has been more inquiry for them, espe-

1, A Fine Pair of Embden Geese. 2, Wild Geese.

cially in those parts where the breeding of turkeys has become precarious on account of the presence of the disease commonly known as black head. The dressing and marketing of geese is not different from that of ducks.

GEESE, WATERTOWN METHOD OF FATTENING.—In the country surrounding Watertown, Wis., a large number of geese is fattened each year by a special process and sold at very high prices. The demand is such that the supply is always quickly taken, and dealers who supply the trade with these geese go so far as to send representatives to buy them direct. The number fattened each year is not large, probably about 3,000, but the method is so simple that it may be followed by any one. This industry was started about 20 years ago by German farmers and they were so successful that others have taken it up and it is growing.

The geese are hatched and raised in the ordinary way, the special feeding requiring about four weeks. The raising of geese is an incident to the diversified farming and the special work comes at a time when other activities are not insistent, making the industry very profitable, filling in a time that would otherwise be wasted.

The average weight attained by these specially fed geese is about 25 pounds each, and the price, which seems to be definitely fixed, depends on the weight. A goose weighing 20 pounds sells at 20 cents per pound; one weighing 25 pounds at 25 cents per pound, the price being 1 cent per pound for each pound the goose weighs. The highest price ever paid was 28 cents per pound for a lot averaging 28 pounds each. These geese go to New York, Chicago, Philadelphia and even as far as San Francisco. The principal buyers are Jewish people who use the oil in the place of lard. The livers of these geese

are the portion most desired, as the system of fattening causes the livers to grow to immense size. The liver will cover a dinner plate heaping full and often weighs as much as $3\frac{1}{2}$ pounds. In France geese are specially fattened in a similar way and the livers are used in making the delicacy known as *pate de foi gras*, a mixture of goose liver and truffles, much prized by epicures who are able to satisfy their appetites at any price. The geese specially fattened in Europe have their feet nailed to the floor so they cannot move, but no such cruel practice is followed in Wisconsin, as the Wisconsin goose fattener merely pens his birds in a limited area. The skin also is prepared as a delicacy and the breast cured and smoked, selling at delicatessens at something like 50 cents per pound to certain people, who have learned to prize it.

After the geese are hatched they are raised in the ordinary way, most farms having a running stream along which the geese graze. They are fed corn and other grains to keep them growing thriftily until about Thanksgiving, when the special process of feeding begins. They are then confined to dry, clean quarters 10 to 15 in a flock, from 8 to 14 square feet being allowed to each goose. Thus a flock of 10 would be confined in a pen of from 8'x10' to one 10'x14', according to convenience or the estimate of the owner as to the best size for the flock.

Geese are naturally timid and shy when allowed to run at large, and the first thing in beginning feeding is to reconcile them to the presence of the feeder. Strangers are not allowed to enter the yards and they are treated in a way to gain their confidence. The feeding or "stuffing," as it is called, is begun gradually, the geese being fed lightly three times a day. Gradually the quantity of feed is increased and the number of meals in a day in-

creased until when on full feed they are literally stuffed every four hours, full feed being reached in about 10 days from the time the process begins.

The feed is cooked and is locally known as "noodles," this feed being composed of 2 parts ground and sifted oats or barley, sifted cornmeal 1 part, and wheat flour 1 part. These are well mixed with warm water into a stiff dough, which is then worked into "noodles" about the size and shape of the small pork sausages that butchers sell under the name of pig sausages. Usually the dough is run through a sausage mill to form the rolls, being clipped into the proper lengths by a pair of sheep shears as it comes from the mill. With the fingers the ends are molded into a dull point. This makes noodles 3" in length and about 1" in diameter. Some feeders bake these noodles and others boil them. Boiling is the favorite practice. They are put into a wire basket the shape of a wash boiler made from the kind of screen wire that ash sifters are made of, and this is set inside a wash boiler, being supported so the bottom of the basket is above the bottom of the boiler. This prevents them from burning. The noodles when thoroughly cooked rise to the surface. The basket is then lifted out and plunged into cold water, which prevents the noodles from sticking together. When so treated they may be heaped into a basket without danger of their sticking together and becoming jammed out of shape. To facilitate feeding there is a small pen in the corner of the goose yard into which a goose is driven. The feeder sits on a low stool, at the entrance of the yard, thus keeping the goose confined. A basket of noodles and a pail of water are ready at his side. The mouth of the goose is opened and a noodle dropped in water is slipped in. The goose will readily swallow

1, Geese on the Gettysburg Battlefield. 2, Embden Geese and Goslings.

enough to satisfy its normal appetite and after this is appeased the feeder gently pokes the noodles down its throat until it is stuffed full. It is then released and immediately it goes to the water trough in the yard and drinks fresh water that is kept in the yards constantly. Thus one by one the whole flock is stuffed, after which the geese are not disturbed until the next feeding time. If at feeding time a goose has not digested all of its previous feed it is given a lighter feed. Occasionally it is deemed best to let a goose miss a feed, especially if it shows any signs of indigestion. Sometimes a goose goes off its feed and must be turned out for a day or two. Some feeders make a regular practice of reducing the allowance occasionally, after they have been on full feed, gradually bringing them back. This will prevent them from becoming "stale" before the process of fattening is finished.

GRAINS, SPROUTED.—Wheat or barley may be sprouted the same as oats and will answer the same purpose.

GREEN FEED AND EGGS.—At the West Virginia station Atwood conducted a test during 360 days with two flocks with 22 White Leghorns in each to determine the value of green feed to promote egg production. The green feed was composed of apples, rape and cabbage. In other respects the feed for the two flocks was the same. Wheat, oats, corn, buckwheat, cornmeal, brown middlings, ground oats, wheat screenings, green cut bone and beef scrap were fed. Of these the flock given green feed consumed 58 pounds each while the flock not receiving green feed consumed 61 pounds each, showing a slight advantage in the matter of costly feeds.

During the 360 days the flock receiving green feed laid an average of 114 eggs each, while those not receiving

green feed averaged only 90 eggs each. As these hens were 5 years old this is a very good showing, the hens having green feed laying a little more than 25 per cent more eggs than those not having the green feed.

GRIT.—Grit is absolutely necessary to the health of fowls. There has been some dispute concerning the use fowls make of grit. The larger number of investigators believe it is used solely to grind hard grains after they have entered the gizzard, but many breeders think the grit furnishes material for feathers, giving them gloss and hardness. Grit may be any hard material except metals. Coarse sand, fine gravel, crushed granite, broken earthenware or even broken glass may be used for this purpose. Young chicks should be given coarse sand or regular chick grit as soon as feeding begins, as they will need it from their first meal.

GUINEA FOWLS.—Guinea fowls seem to have been known to the ancient Romans who called them *Meleagris*, but it is doubtful whether the guinea fowls of ancient times were the same variety that we now know as domestic birds, which have never given up all of their wild traits. The *Meleagris* of Rome may have been a variety of the same species common to eastern Africa, or it may have been the variety now known as the Vulturine Guinea fowl, which is only seen in the largest collections in zoölogical gardens or private collections. We know of but one pair in this country, that being owned by Homer Davenport, the artist. The guinea fowl of our barnyards is identical in color and shape with a variety common to western Africa—the Guinea Coast of slave hunter days. The domestic fowl is slightly larger than the wild one, a difference common where wild animals or birds are brought into domestication.

White sports have been bred together until a white variety is known and a good many farms carry guinea fowls which are partly white. In color the guinea is a grayish blue or rather purple, the feathers being studded with round white dots arranged in symmetrical fashion. These birds are not so large as they seem, rarely weighing more than $3\frac{1}{2}$ pounds each, the cock being slightly heavier than the hen. Cock and hen are identical in color, the cock being slightly coarser about the head. The cock has a clattering cry, which the hens often use, but the hen alone uses the characteristic "buckwheat," "buckwheat" which fancy translates her cry to be, and this only when comfortable and contented.

The guinea is a wanderer and can not be kept with success in confinement. It naturally sleeps on some high perch outdoors and is entirely indifferent to the most severe weather, after it is a few weeks old. It may be taught to sleep in houses with other poultry, if it has been hatched under a hen. A guinea hatched under hens refuses to be weaned and will follow the mother hen until the next spring after hatched, when it mates for itself. We have known guinea hens which were laying to persist in following the hen that had hatched them the year before.

Guineas should be hatched under common hens, as the guinea hen is a very careless mother and except during the most favorable seasons will only bring up a few of the chicks she hatches. Care must be taken to watch young guineas when they hatch or they will almost at once run away and get lost, only to die. They should be confined in a tight pen with sides at least 1' high until they learn to follow the mother hen, which will be in a few days. A young guinea can escape through a mar-

Guineas and a Farm Flock of Poultry.

velously small hole. The pen should be close-built so that no fear of escape need be entertained.

Feed guineas as common chicks would be fed and as soon as they will follow the mother hen give them liberty. As they grow larger they will wander farther and after they get full size they will wander afield, hardly waiting in the morning for feed. Guineaas like to hunt for their own feed, eating weed seeds, green vegetation and insects. They usually begin laying in March or April and will lay until August without sitting, if the eggs are removed from their nests. The guinea hen if brought up with chickens frequently lays in the same nest with common hens, but as often she seeks to hide her nest and must be watched. The guinea hen lays from 70 to more than 100 rather small, sharply-pointed eggs, the shell covered with fine dots of brown. The eggs are too small for market but are of excellent flavor and good for home use.

There is a growing market demand for young guineas and old ones are readily taken when offered. The flesh has a gamey flavor and is often substituted for game birds of the same size. Indeed guinea fowl is growing into such favor that some of the large hotels regularly put it on their bills of fare under its own name. As guineas hunt their own feed during the larger part of the year, and are not heavy eaters at any time, it would be found profitable to raise them in considerable numbers. Guineaas are almost as good and useful for another purpose as a watch dog, as they detect the presence of a stranger at once and, day or night, raise an alarm if any one with whom they are not acquainted comes about the poultry yard. They protect their young from assault with great bravery, all the hens in a flock joining to de-

feat an enemy. Guineas are coming out of the ornamental class and making a place for themselves on farms in many parts of the country.

HENS VS. INCUBATORS.—Some very interesting comparisons between hens and incubators for hatching and breeding chicks were made by Prof. Dryden when in charge of the Utah Experiment Station. A summary of these experiments gives the following results:

From 879 eggs set, incubators hatched 533 chicks, or 60.6 per cent. From 279 eggs set, hens hatched 219 chicks, or 78.8 per cent.

Eliminating eggs broken in the nests, the hens hatched 88.2 per cent of the eggs set. The incubators hatched 78.5 per cent of the fertile eggs set, and the hens 96.5 per cent. Eggs incubated artificially tested out 22.7 per cent infertile, while those incubated by hens tested out 11.8 per cent infertile. The incubators showed 16.6 per cent dead in the shell and the hens 2.8 per cent. Chicks hatched under hens weighed heavier than chicks hatched in incubators. The mortality of hen-hatched chicks brooded in brooders was 10.8 per cent in four weeks, and of incubator hatched chicks 33.5 per cent. The mortality of hen-hatched chicks brooded under hens was 2.2 per cent and of incubator chicks 49.2 per cent. In other tests the mortality was 46.5 per cent for incubator chicks brooded by hens and 58.4 per cent brooded in brooders. Hen-hatched chicks made a greater gain in weight than incubator chicks whether brooded by hens or brooders. In all these tests the eggs used were from the same breeding yards, and alike in every respect.

These conclusions are derived from several separate tests during the whole of the hatching season, and are averages of the several tests. The tests were made at an

elevation of about 5,000 feet above the sea level in a dry climate (Utah).

HOPPER.—The poultryman uses this word to designate any vessel containing dry feed which acts automatically. (See Force Feed Hopper.)

HOUSING.—A few years ago whole books were written concerning houses for poultry, some of these books showing dozens of plans, most of which were uselessly elaborate. We had many systems of ventilation which were explained in such detail that the beginner became confused and could not decide which was best. The result was damp houses, frost-coated walls in winter, roup and other kindred diseases. A great change has been brought about since practical poultrymen, seeking cheapness with satisfaction, have taken up the problem. Where a few years ago it was common to build poultry houses with double and triple walls, supplied in many cases with means for furnishing heat in cold weather, we have now gone back to first principles, and the modern poultry house is a very simple affair. The conclusions derived from careful and long-continued experiments at several experiment stations and on many private plants, agree that air-tight, artificially-heated poultry houses are not necessary in any part of the country and are sources of continual dissatisfaction and loss. The modern poultry house is cheaply built, well-lighted and the best of them have openings in front running from a few square feet to the whole space of the front, protected with wire netting and enclosed with a canvas or muslin curtains in bad weather. Such construction provides abundant ventilation, prevents draughts, secures dryness and maintains the health of the fowls.

It is not always possible to locate a poultry house in an

Houses Made From Piano Boxes,

ideal position, as reference must often be had to the lay of the land as regards other permanent buildings. The very best location is on a southern slope where the land is well drained naturally, so the direct rays of the sun will enter the windows from early morning until late afternoon. Next to a direct southern slope a southeastern exposure is best and then a southwestern. Never face a poultry house to the north, unless absolutely necessary. There is still much diversity of opinion as to the best style of poultry houses. The arguments for and against are taken up in detail under the head of Poultry House Construction. Good housing is one of the cardinal points in successful poultry-keeping. This does not mean costly houses, for the hen cares nothing for architectural effect if she is comfortable. Good poultry houses may be made of very cheap materials and we have seen many examples of houses that were made from the crudest materials which met every need of the fowls housed therein. In the plans given in this book it will be found that convenience and comfort are emphasized. The builder of a poultry house may make it as ornamental as he wishes, but the plans given are thought to be the best that are now in use and any of the houses may be built at comparatively low cost. The point kept in view has been practical utility rather than ornamentation.

INCUBATORS.—Incubators have been known for a great many years—how long it is impossible to say. Curiously incubators were first used with success by people who are not usually considered far advanced in the sciences of civilization. Incubators have been used with success in two countries as far apart as Egypt and China for probably hundreds of years, and notwithstanding the fact that there is no probability that one of these

nations learned the art of incubation from the other the incubators they use are very much alike, being mud ovens heated in Egypt by burning dried camel dung and in China by burning twigs and straw. The incubators themselves are rude mud ovens without any attempt at careful ventilation and without means to regulate the temperature. Not even a thermometer is used to determine the temperature, the operator judging this from his own sensations when he enters the incubator to take care of the eggs. For more than a hundred years scientists have been struggling with the art of incubation in this country and Europe, yet up to this time an unlearned Egyptian fellah or a Chinese coolie is able to produce results the equal of those produced by the best machines of this kind made in any country.

The first mention of the artificial incubation of domestic fowls occurs in the writings of Aristotle. Later Pliny relates that the Roman empress Livia hatched chickens in her bosom, a very doubtful story in the light of our latter-day knowledge that the temperature required to bring chickens to perfection is 5° higher than that of the human body. The first authentic account of artificial incubation outside Egypt and China is of a machine invented by Rene Antoine Ferchault de Reamur, the French inventor, to whose credit stands the thermometer which bears his name. Reamur lived from 1683 to 1757, so the authentic history of artificial incubation in civilized countries extends back at least 150 years. The machine invented by Reamur is figured in "The American Poulterer's Companion" (1847), from which work our illustration is reproduced. Reamur published a work of 500 pages treating on incubation, in which he said the proper temperature was 90°. This must have been according to

the Fahrenheit scale, as Reamur's scale makes 90° equal to something like 225° F., a temperature which would very quickly destroy the life in an egg. It seems curious in face of the statement Reamur succeeded in hatching eggs that he should give the temperature so low, as we know that it requires 103° to hatch chickens in an incubator.

Later M. Dubois improved Reamur's device by making a low room 10' square and heating it from the pipe of a stove below, putting the eggs in wicker baskets and hanging them from the ceiling, raising or lowering the baskets to get the eggs in the proper temperature. M. Copineau tried using hot water pipes along the floor of the room and still later M. Bonnemain invented the first hot-water incubator, illustrated on page 195. In the early years of last century a hatching machine was shown in London called an "Eccaleobion," literally an "invoker of life," which attracted much discussion but soon passed from view.

In 1843 C. Appleyard showed an incubator before the Royal Agricultural Society, but beyond a mere mention of the fact the record does not go. About 1845 a "hatching machine" was exhibited in operation at 160 Nassau St., N. Y., and was visited by thousands. However, this was not the first incubator of record in this country as one was shown in Brooklyn by E. Bayer in 1843. Mr. Bayer seems to have got the temperature about right, as he gave the correct figure as being 101° to 102° F. He called his machine a "polotokian," and claimed to hatch from 75 to 80 per cent of the eggs he put into it, a record which would be perfectly satisfactory even in these days.

A hot-water incubator was exhibited in New York about the same time. It was claimed for this machine

A Modern Incubator.

American Hatching Machine (1845).

Reamur's Incubator.

Dubois' Incubator (About 1750).

that it would hatch all but 2 per cent of the perfect eggs. This shows that the incubator manufacturers of these days have some precedent for the claims they make as to the hatching qualities of their machines. These early incubators seem not to have created any permanent impression, as did the first reaping machine, as there is no direct line of descent from them to the incubators of the present day.

A Mr. Halstead, who was a well-known poultry breeder 50 years ago, invented an incubator known as the "Model," which was a hot-air machine. James Rankin, the originator of the modern system of raising ducks in large numbers, invented a hot-water incubator sometime in the 70's of the last century, and a Mr. Campbell of Pennsylvania put out a machine of the hot-water type a little later. Mr. Campbell's machine was called the "Eureka." It had a clock-work attachment to turn the eggs at regular intervals and an electric alarm to denote when the temperature became too high. Mr. Halstead's machine had an ingenious regulating device that operated by the expansion of air in a cylinder, and Mr. Rankin first used the expansion of water in the tank to regulate the temperature. As none of these machines survived for a very long period, it is evident that they lacked in the essentials that make for success.

Later numerous inventors turned their attention to incubation, and a large number of machines of this kind were offered, many of them being crude and unscientific, although they were sold in large numbers.

There are now two types of machines on the market. One heats the egg-chamber with currents of hot-air or by the radiation of hot-air, and the other heats the egg-chamber by means of hot-water in a tank above the eggs.

For some reason not easy to understand the cheaper styles of the incubators now on the market are built on the hot-water plan and the high-priced ones are hot-air machines. Curiously enough our great egg and duck farms almost invariably use hot-air machines, while the farmers and smaller operators seem inclined to buy hot-water machines. While it is true that a good many thousand hot-air machines are sold singly to farmers and owners of small poultry plants, we do not know of a single large poultry plant equipped with hot-water incubators.

Many devices for regulating the temperature have been tried, but all have been discarded by the modern incubator manufacturer, except the style that controls the heat-valve by a device which takes advantage of the expansion of metals and the one which is controlled by the expansion of ether confined within a brass disc made with two sides, so that when the heat causes the ether to expand the sides of the disc are forced apart, suitable mechanism operating a system of levers to cut off the heat when this occurs. Here again is a sharp distinction. Most if not all of the hot-water incubators use the disc regulator, while all the hot-air machines, which have become standard, except two or three, use the expansion of metals for regulating.

The modern incubator, whether hot-air or hot-water is used in heating, has arrived at a stage where its economic value is acknowledged; it has become one of the essentials of the well-equipped poultry plant, and is rapidly coming to be considered indispensable on the farm, as it saves time and labor and expense. The incubator makes it possible to hatch a large number of chicks at the same time, giving them an equal chance to grow up, bringing them to market size at the same time and allowing of

the maturing of pullets to the laying age at the same time. All the theories that hatching chicks in incubators year after year would eventually destroy the vitality of a flock have been thoroughly disproved and modern poultrymen give the incubator their unqualified approval.

INCUBATION.—While the art of incubation is a very old one, the science of it is just beginning to be understood. The Egyptian or Chinese operator uses his mud oven and successfully hatches chicks without knowing why he uses the methods he does, only knowing that his father and his father's father for generations have done the same thing in the same way with the same results. Strangely enough civilized incubator operators have never undertaken to hatch chickens in an incubator large enough for a man to enter, and today there is probably not a single hatching machine in this country or Europe large enough to allow the operator to enter it and perform his work from the inside. There is no good reason why this is not done, for the temperature is not higher inside an incubator than it often is during the warmest days of summer in almost any state in the Union. We have what are called mammoth incubators in these days, capable of hatching thousands of eggs at a time, but they are controlled and operated entirely from the outside.

Our incubator knowledge has accumulated slowly and through many mistakes. For years it was comparatively easy to hatch chicks in an incubator but hard to raise them after they were hatched. This trouble was attributed to the brooder used in raising them and many experiments were made along this line. When it was decided that brooders were not at fault the trouble was attributed to carbonic acid gas (carbon dioxide) liberated in the process of hatching, and we had incubators made

Views on a Pennsylvania Egg Farm.

with a view to getting this out of the egg-chamber as rapidly as it was formed. Then Graham of Canada, Nix of Pennsylvania, and Dryden of Utah (now of Oregon), began to experiment, and they discovered that there is a greater percentage of carbon dioxide under a sitting hen than there is in any incubator, and they concluded that carbon dioxide was necessary to a good hatch in some way not yet understood.

Later experiments leave the whole subject in much doubt, but have brought out some facts that seem to indicate the proper methods by which vigorous chicks may be hatched with vitality enough to live and mature normally. We know that we can now hatch chicks that are perfectly normal, and this is the point at which incubator operators have been aiming all these years. It seems at this time that scientists were going to get back to very nearly the ancient mud-oven conditions before they get to the place where the greatest success will be achieved with artificial incubation.

Some diseases seem particularly likely to attack chicks hatched in an incubator, and it is now well known that infection may be conveyed through the shell of an egg or even exist in it before it is laid, thus carrying to the embryo chick the germs that lead to its early death. To prevent this, the best practice of the latest investigators is thoroughly to disinfect the eggs and the incubator before hatching is begun. To accomplish this the eggs are wiped with a cloth dampened in alcohol and the incubator is washed with a solution of some antiseptic, such as creolin, every part of the inside and the egg trays washed and then set in the sun to dry.

The process of incubation is interesting, although simple in its essentials. An egg is a very complicated piece

of mechanism, admirably adapted to the circumstances which are likely to surround it from the time it is expelled from the ovary of the hen until the life-germ it contains has completed its growth, becomes a complete chick and has made its way out of the shell.

The egg is so constructed that the living germ it contains is always at the top, no matter how often its position may be changed. This provision of nature gives the germ the benefit of the heat of the body of the mother when the natural process of incubation is going forward, and it follows that the heat of an incubator should be applied from the upper side, and the heat from all incubators is so applied.

A fertile egg will begin to hatch at somewhere near 90° F., but this temperature is not high enough to continue the process of incubation, and an egg exposed to this temperature for some time will merely decay, as the germ dies and decays, communicating the elements of decay to the other parts of the egg.

Many otherwise well-informed people think that the chick is evolved in some curious way from the contents of the shell, but this is not the case. The germ of life that exists in a fertile egg bears the same relation to the remainder of the contents of the shell that the loaf of bread in a baker's window does to the man who shall eat it. When the proper temperature is applied to an egg the germ starts into life and begins to grow into a chick, consuming the contents of the shell as growth proceeds. At the moment of hatching a perfect chick has consumed the contents of the shell, except the yolk of the egg, which is practically unchanged. The last process of incubation is the inclusion of the yolk into the stomach of the chick and the closing of the navel through which

the yolk is admitted to the stomach. When the chick first emerges from the shell the yolk lies in the stomach as feed for the chick until it shall have gained strength to eat for itself, and the process of digestion and assimilation begins at once. The yolk supplies all the feed needed for the first 48 hours, and no chick should be fed until this period has elapsed, as such feeding may so disarrange the digestive system that very serious results may follow.

The first change after the process of incubation has begun is the formation of a tiny blood speck as the heart of the embryo begins to perform its functions. A few hours later this minute speck of blood has divided into a V-shaped form and the circulation has begun. From this rudimentary heart veins begin to branch out and through these the albumen in the white of the egg is changed to blood and this in turn contributes to the growth of the body and vital organs of the chick through the wonderful alchemy of nature. At the end of two days the pulsation of the blood is plainly visible. One branch of this rudimentary circulatory system is the left ventricle of the heart and the other is the great artery. At the 50th hour one auricle of the heart appears and the beating of the heart may be observed. Gradually the blood vessels extend themselves through the umbilical cord and a network of veins is formed which extends along the inner side of the shell through which oxygen must come for the purification of the blood and to make the life processes possible. At this time if a thin-shelled egg be observed through an egg tester the appearance of the embryo will be that of a many-legged insect, the heart being the body and the radiating blood veins the legs.

A series of bulbous masses now begin to show as the beginning of the vertebra, the eyes begin to show, seemingly disproportionally large, and the several sacs which are to develop as the brain may be seen. The wings, skin, thighs, stomach, intestines and liver now begin to develop, and on the fifth day the lungs begin to appear. Two days later the beak, skin and feathers may be distinguished and by the eighth day the beak, wings, thighs, legs and brain begin to assume distinctive form. By the eleventh day the circulation begins to take permanent form and the arterial blood is distinctly brighter than that from the veins. From this time growth is rapid. All the vital organs except the lungs are working, and the body of the chick rounds out to completeness until at the 18th day the complete and perfectly-formed chick lies in the shell, the yolk still being outside the body. At this time the chick is apparently doubled and cramped into the space in the shell in a way completely to prevent it from action, but this is only apparent, as it is in the best possible position to break its way to liberty. The legs are doubled up against its body and the head is tucked under one wing so far that the beak extends beyond the line of the back.

The chick now begins to tap against the inner side of the shell, unavailingly at first, as its blows with its beak are too weak to make any apparent impression. The wing supports the head so as to make it possible for the chick to deliver the strokes of the beak in the same line all the time and finally the shell is broken through. Now the position of the claws is such that by a little exertion they catch into the lining of the shell so as to revolve the chick in the shell. The break once made in the shell, the revolving motion of the body causes a thin line to be

broken around the shell, the larger end of the shell is broken entirely around its circumference and an opening is made through which the chick is able to extricate itself from its narrow prison and struggle out, a weak and helpless creature unable to lift its head or stand on its feet. For several hours it lies half dormant, gathering strength to struggle more and more until finally it is able to stand and walk. Here is seen the wisdom of the chemical composition of the yolk of the egg. While the white of an egg has hardly the faintest trace of fat in it the yolk is one-third fat. The heat of the mother has up to this time kept the fires of life going, but as soon as the chick emerges from the shell it requires fuel with which to maintain vital heat and the fat in the yolk is this fuel.

The whole process of incubation is wonderful and interesting, and one who studies it closely will come to look upon the egg as a most wonderful creation.

INCUBATORS, HOW TO OPERATE.—No incubator produces as good results in hatching eggs as can be produced by using hens; nevertheless incubators are recognized as being more profitable to use than hens. An incubator may be used at any time in the year, giving the poultry breeder an opportunity to hatch his chicks early in the season before hens naturally become broody. With an incubator a large number of chicks may be hatched at one time and the chicks being of the same age have an equal chance to grow up. Again, one man can attend to the hatching of thousands of chicks when incubators are used, while comparatively few sitting hens would occupy his whole time. Where 100 or more chicks are to be hatched in a season an incubator may profitably be used. When those who use incubators extensively can be persuaded to make an estimate of the percentage of the eggs

that hatch when incubated in incubators, they usually put the figure at about 50 per cent. That is, the incubator operator who uses a good machine, selects the eggs with care and gives the machine good attention may reasonably count on getting 50 chicks from every 100 eggs he puts into the machine. It has been estimated that for every 4 eggs put into an incubator one chick may be counted on to arrive at maturity. Very frequently a better result is obtained, but it is not probable that the average is even this high.

This seemingly poor result should not frighten any one from using an incubator, as a careful record of the eggs used for hatching when hens do the incubating would show that the difference between the natural and the artificial method is not very great. The use of good machines and reliable eggs is not all there is to operating an incubator. The following concerning the use of incubators was prepared by special request by J. L. Nix of Pennsylvania who, with Graham of Canada, and Dryden of the Oregon Experiment Station, has been giving the subject of artificial incubation very close attention for several years. Mr. Nix is probably as well known as any other investigator along this line, and his experiments extend over many years of close observation. As a manufacturer of incubators he has been vitally interested in the problems involved in artificial incubation and his conclusions can not be said to go wrong in the matter of the showing made in the number of chicks hatched and their "livability." It will be seen that Mr. Nix quotes Prof. Graham who has collaborated with him in many experiments. Mr. Nix says:

"All those who are interested in raising poultry artificially are anxious to secure all the information possible

on incubation, so they may use the incubators they have intelligently or to familiarize themselves with the art sufficiently to make a wise selection of an incubator when the purchase of equipment is under consideration. Artificial incubation is old as an art but new as a science. Briefly stated, all that is required to hatch eggs artificially is a temperature of $100\frac{2}{5}^{\circ}$ at the center of the egg (101 to 103° by contact). At the same time the eggs should be immersed in still air (quiescent atmosphere) containing moisture of relative humidity from 45 to 70 per cent. This atmosphere should change sufficiently often to carry off the waste gases eliminated by the eggs. Any excess of ventilation beyond this may be deleterious. This is all that is known about artificial incubation at the present time, apart from many things that are known that will not work and have a bad effect on the development of the eggs.

"While the law of incubation seems comparatively simple, yet the proper application of these principles in an incubator is extremely difficult. They require the use of a well-built case to withstand both moisture and changes of outside temperature, a reliable and constant source of heat, a uniform distribution of the heat so each egg gets a uniform quantity, a sensitive and reliable regulation, constant ventilation, the constant supply of humidity to prevent excessive evaporation of the eggs, all so arranged as not to introduce undesirable conditions to work injury to the developing embryo.

"The best method of obtaining the temperature of the center of the egg is with Dr. Wagner's Inovo thermometer. Eggs are run at a temperature of $100\frac{2}{5}^{\circ}$ the entire time of the hatch. To obtain the same degree of heat by contact means 102° in cold weather, 101° in

1. Young Fowls in a Shady Yard. 2. Good Arrangement for Waning Chicks.

warm weather the first week of incubation, 102° the second and 103° the third week. With the hang-up thermometer the readings will run from 103 to 108°, depending on the machine and the season of the year, to obtain the same temperature, the object being the same degree of heat as in natural incubation. The heat should be applied to the top of the eggs from above. Bottom or side heat will not do the work. No incubator using other than top heat ever made a commercial success. The maximum quantity of heat that can be applied with safety is 108° and this not for very long at a time. High temperatures cause too rapid growth and low temperatures retard growth. In either case when extremes of temperature are prolonged the chick dies in the shell. The heat used must be distributed so the eggs will develop equally and will all hatch at once. With bad distribution, hot and cold spots in the egg-chamber, the eggs are greatly weakened and, where variation is too wide, are killed outright.

“The measured quantity of air required to incubate has as yet never been determined, although many workers are engaged on the problem. Eggs placed in tightly-corked bottles in an incubator live but a short time, even in the beginning of incubation. The embryo breathes through the shell until the time of exclusion. Experience has taught the great necessity of ventilation in securing healthy, hardy chicks. Not only must the incubator be ventilated, but the ventilating current must not be contaminated by leaky heaters or bad air in the room where the incubator stands. The embryos are particularly sensitive to gaseous or vapor influences. Prof. Elford at McDonald College found that the vapor of kerosene oil from an ordinary tank in the hatching room reduced the

hatch by 17 per cent. In a room with no ventilation only 11.9 per cent of the eggs hatched and of these 55.5 per cent died the first week. In a well-ventilated room 36.3 per cent hatched and only 9 per cent died the first week, the difference being in the first case $5\frac{1}{3}$ chicks in 30. This shows the influence of bad air outside of the incubator, a trouble easily avoided by free ventilation or piping off the lamp fumes. Prof. Graham found that even in natural incubation vitality was affected by the way the hen was set. The number of chicks alive at the end of four weeks was as follows:

With hens set on the ground.....	52.2 per cent
With hens set on straw in a box.....	43.4 per cent
With hens set in ventilated nest.....	39.1 per cent

"This shows conclusively that natural secretions from the hen's body—as moisture—must be retained even in natural incubation to secure chicks that will live. Where the non-moisture incubator was used, run according to directions without applied moisture in the egg-chamber, while the hatches were fairly good the mortality was high, being over 60 per cent of all chicks hatched, while the number of chicks alive at the end of four weeks out of every 100 set was only 16. These were very good eggs, above the average, and these were the results from 12 tests. By the use of moisture the percentage of living chicks from 13 tests was 32.7 per cent. As the hens averaged 43.7 per cent and 48.7 per cent respectively this shows the difference is due to the missing factor in artificial incubation, this being carbon dioxide or some other volatile agent. By the use of zenoleum, which contains volatile carbon compounds that the eggs absorb, practical results approximate very closely those obtained by natural incubation, and by its use mortality is much re-

duced and the percentage of livable chicks brought up from 32 per cent to 44 and 45 per cent of living chicks at the end of four weeks for every 100 eggs set, which is very close indeed to the results obtained from using hens under the most favorable conditions. Further experience has shown that zenoleum is not always beneficial, as in about one case in ten it is harmful rather than beneficial. Prof. Elford found that zenoleum reduced the hatch about 10 per cent but by the use of volatile salts the hatch was increased 33 per cent, from 51 to 77 per cent of the live germs. The experiments show that during development the embryo is particularly sensitive to outside gas and vapor influences. This is a new field of experimentation and we look for practical results shortly.

COMPARISON OF METHODS IN HATCHING.

HOW TREATED.	Number of eggs set.	Per cent infertile.	Per cent dead in shell fully formed.	Per cent hatched of total eggs set.	Per cent chicks dead in four weeks.	Per cent of live chicks of eggs set.	Number of hatches.
Hens—							
Roomy nests	159	10.7	7	70	30.4	48.7	14
Crowded nests.....	179	15.9	4	50	12.5	43.7	16
Incubators—							
Whole milk and zenoleum	110	19	11	64	21.8	45.5	2
Water, CO ² * and zenoleum.....	44	13.6	11.3	52.2	13	45.4	1
Water and zenoleum	464	32	11.4	52.8	16.7	44	6
Water and CO ² *.....	129	20.1	7.9	48.1	21	38	2
Water only.....	1,221	13.9	11.3	51.9	37	32.7	13
Dry egg-chamber.....	1,406	16.3	12.6	40.7	60.5	16.1	12

* CO² carbon dioxide.

"Speaking of moisture machines and dry machines Prof. Graham says: 'It will be noticed that the moisture

machine has fewer fully formed chicks dead in the shell, it hatches more chicks, a higher per cent of the fertile eggs as well as a higher per cent of all the eggs set. There is a difference of 10.9 per cent of the eggs set or 13.1 per cent of the fertile eggs in favor of moisture. If a comparison be made between the two methods of operating as to percentage of live chicks to the eggs set, we find that all moisture machines average 35.9 per cent, or if we eliminate those in which tarry compounds were used we have an average of 32.3 per cent, whereas all dry machines give but 13.4 per cent, or eliminating one in which the tarry compound was used they then average 12.1 per cent. In other words, 100 eggs hatched in the machine with moisture gave us 30.3 chicks alive at the end of four weeks.'

"Speaking of evaporation and moisture, Prof. Dryden, now of the Oregon Experiment Station, says: 'Tests were started in March, 1907, with a view to determining whether applied moisture in the incubator is necessary. Nine incubators were used in the first test. The machines were all of the same make and size. Six were operated in the basement and three in the room upstairs. They were run in three sets, three machines in a set. In each set one machine was with no moisture, one with a medium amount of moisture and one with a large amount of moisture, or double the amount of the one getting a medium amount. In this way each machine was checked by two others. Great pains were taken to make the conditions in each set the same except in point of moisture. Each set of three machines had the same kind of eggs. The eggs were from different flocks, but the same number from each flock or pen was put in each machine. They were also divided equally as to ages. The moisture was

supplied by pouring water on a tray of sand under the egg tray, the sand tray covering the whole bottom of the incubator. In the machines without moisture a similar tray of dry sand was kept.'

"After giving tables on maximum moisture, medium moisture and non-moisture machines the following is given:

"It will appear from a study of these tables that nearly 100 per cent better hatches were obtained by the use of moisture, and there was no contradiction in all the tests.' Under the 'Weight of Chicks' the following results were found which show that the weight of the chicks varied with the method of hatching: 'In the machines supplied with maximum moisture the chicks weighed 1.185 ounces; in medium moisture machines, 1.159 ounces; in non-moisture machines, 1.072 ounces. Hen-hatched chicks weighed 1.258 ounces. The results of these weighings would indicate that vigor in chicks demands a greater amount of moisture during incubation than the incubator as at present made can furnish.'

"On moisture and germ development another point is verified in favor of the 'hatchability' of the moisture machines. Prof. Dryden says:

"Another point has been brought out in the moisture tests. The evidence is somewhat contradictory, but our tests seem to indicate that proper germ development can not take place where the proper conditions of humidity do not exist. Our records show that a larger number of eggs were tested out of the dry machines as infertile or dead than out of the moist machines.'

"Further under the heading 'Evaporation of Eggs' this statement is made: 'It is plain that artificial incubation is faulty where it does not more closely approach the con-

ditions of natural incubation. In this case the excessive evaporation is undoubtedly due to the dryness of the air in the incubators, because the drier the air the more moisture it will take from the eggs just as more water will be evaporated from a wet bulb thermometer.'

"As a climax to this very careful and extended series of experiments under varying conditions the best endorsement of our own discoveries is unknowingly given in relating facts as they were found from actual experience. Speaking of sand as a means of supplying moisture the bulletin says: 'To show the difference in evaporation from a tray of sand and a pan of water, incubator No. 6, set June 1, was provided with a tray of water instead of sand. The tray was the same as used in the other machines. The loss of weight in the eggs in this machine was 16.13 per cent as against an average of 12.28 per cent for the maximum moisture machines where sand was used. The sand is therefore more effective as an evaporating surface than water.'"

Profs. Graham and Dryden and Mr. Nix are probably the highest authorities we have on artificial incubation, Profs. Graham and Dryden making their experiments in the line of their duties in connection with the experiment stations to which they are attached, and Mr. Nix for his own benefit as a manufacturer of incubators. It will be seen that all of them agree that moisture is necessary to the best results in artificial incubation. However, it is but justice to add that we have used two non-moisture machines with perfect satisfaction and the chicks hatched from them were healthy and vigorous and grew to maturity with no more than the normal loss. These machines were used within two miles of Lake Michigan where the atmosphere is naturally humid and the conditions favor-

able for non-moisture machines. In California, and on the high plateaus of the inter-mountain states, we would not expect as good results from non-moisture machines as from machines supplied with moisture, because of the low humidity of the coast country and the high altitudes of the mountain country. In California we found that a machine capable of evaporating considerable quantities of water produced the best results.

Prof. Dryden's experiments were made at the experiment station at Logan, Utah, at an altitude of probably 5,000 feet above the sea level, which would indicate a very dry atmosphere, as, in fact, they have at that station.

Speaking of turning and cooling the eggs Mr. Nix says: "There is no question that turning and cooling the eggs at regular intervals is essential in obtaining good hatches. Of eggs that are not turned only 10 to 15 per cent will hatch. Turning every 12 hours is the common practice and until the eggs pip, when it should be discontinued, but experiments have shown that in some cases more frequent turning has slightly increased the hatch. Some operators claim that cooling is waste of time, but the experience of operators in general, and our own experience as well, has shown that cooling in moderation is beneficial. It increases the hatch from 10 to 15 per cent and the chicks that are hatched will live better where cooling is practiced."

Egg infection, Mr. Nix thinks, should be guarded against. He says: "One potent cause of poor results in incubation is infected eggs, either with bacteria or with moulds. This infection may take place in the nest, while in storage waiting to be incubated, in the incubator room or in the incubator itself. To avoid infection the eggs should be incubated as soon as possible after being

Six White Leghorn Hens that Laid 1,482 Eggs in One-Year Australian Competition.

laid. Keep the nest boxes clean and fill frequently with fresh straw. Store the eggs in clean packages in a temperature from 40 to 60° if possible. In extremely low temperatures, and when temperatures in storage exceed 75°, deterioration is very rapid. The incubator room must be kept clean and well ventilated. The incubator in many cases must be cleaned and thoroughly disinfected after every hatch, with a good coal-tar disinfectant or a 2 per cent solution of creolin, or the machine can be scrubbed out with hot water and cresol soap. Infection is more likely to occur in a badly-ventilated incubator or poorly-ventilated incubator room. Any condition surrounding the eggs tending to sap their vitality makes them more subject to infection. In extreme cases the careless use of disinfectants in an incubator has been detrimental rather than beneficial to the hatch, probably from using too much of it, as the vapor or odor arising from it after the eggs are in the incubator seems to have a bad effect. (See Incubators, to Disinfect.)

“Successful incubation means good eggs. The greatest, most common cause of poor results or failure in incubation is the use of poor eggs of low vitality. Successful incubation begins long before the eggs are laid. The eggs must be from stock of strong vitality that has never been forced, that is fed all the green feed the fowls will eat and a portion of animal feed as well as grain. While fowls will lay a goodly number of eggs upon grain or even corn diet, yet these eggs are lacking in those feed elements required by the embryo, they hatch poorly and the chicks that hatch will be of impaired vitality and very hard to raise. The condition of the breeding stock, feed, housing and the range should carefully be looked after, as the neglect of any one of these factors may

impair the vitality of the stock to such an extent that the eggs will not give good results in the incubator or under a hen. Eggs only a few days old are much to be preferred to those more than 10 days old, as they deteriorate very rapidly after the first week."

INCUBATORS, HOW TO OPERATE.—Manufacturers of incubators always send with every machine they sell full directions as to operating them. These directions apply only to the machine with which they belong, and should be closely followed, as the manufacturer naturally knows more about his machine than any one else. Some machines have a ventilating system which allows air to circulate more freely than others, and such machines evaporate more moisture than those not so freely ventilated. Other peculiarities of structure require different treatment and all these are important to success; the operator should therefore observe directions. The beginner who thinks he knows better than the manufacturer how an incubator should be operated is very likely to fail. There are a few points on which manufacturers do not agree, and this is our excuse for securing the opinion of Mr. Nix on the factors that make for success.

The best place to operate an incubator is in a dry, well-ventilated cellar. A cellar in which an incubator is being operated should be free from any odors of decaying vegetables, should have a free circulation of air and should not vary widely in temperature throughout the day. Such a cellar makes the operating of an incubator a very simple matter. The next best place is a room in the house which has windows in the north only, so the sun will not shine into it at any time in the day during the weeks that hatching is going on. Should such

places not be available it is entirely possible to operate an incubator in any room, and thousands of chicks are hatched in vacant bed-rooms, kitchens and even living-rooms. The modern incubator is finished so that it does not detract from the appearance of a room, even a well-furnished one.

We have dispensed with all devices for turning the eggs; the best incubators do not have them. The best way to turn eggs in an incubator is by hand, one at a time, or by taking a row of eggs from one side of the tray and with the flat hand gently rolling those remaining in the tray over to the side the eggs were taken from, replacing the eggs which were removed in the space left empty on the side opposite from where they were taken.

It is not necessary to turn eggs half over. The hen merely stirs the eggs under her by running her beak among them, by moving them with her feet and by changing their position by a shaking motion of her body. We believe in cooling eggs. We have had better hatches by following this method. The embryo chick receives its supply of oxygen through the pores of the shell, as its lungs have not developed to the stage of use. If the eggs are cooled down about 15° every day the air inside the shell contracts and to supply the vacuum thus left outside air is drawn into the shell, thus insuring a larger supply of oxygen than would have been possible had not the eggs been cooled.

We turn eggs every morning and evening. Take the egg tray out of the egg chamber and set it on the top of the machine or on a table kept conveniently close to the machine. Shut the door of the machine and then turn the eggs with care, taking about 10 minutes to do it. If the weather is very warm leave the eggs out from 20 to

25 minutes. If quite cool shorten the time to 10 minutes. There is not much danger of destroying the vitality of eggs by cooling them except during the first 10 days, and not as much then as is generally supposed.

Run the incubator for a day or two without eggs in it and get the regulator adjusted before putting the machine to use. When it has been adjusted to 102° then put the eggs in. The temperature will fall immediately, as the cold eggs will cool the egg-chamber almost at once. Do not change the regulator because of this, but let the eggs warm gradually and the temperature will rise again to the proper point.

Do not open the machine unless absolutely necessary, except when turning and cooling the eggs. Many hatches have been spoiled by opening an incubator to show friends how it worked. One would not expect a very good hatch from a hen that was constantly being taken off her nest. Do not turn the eggs until the third day nor after the 18th day. After the first shell is pipped close the egg-drawer and do not open it except for a very urgent reason until the chicks are all hatched. As soon as the chicks begin to break open the shells the moisture inside them escapes into the egg-chamber in the form of vapor, which often obscures the glass in front. This shows that the air inside is saturated with vapor and to open the machine at this time is to cause a sudden drop in the temperature which often chills a chick until it is unable to get out of the shell.

Do not try to help a chick out of the shell. A chick that is not strong enough to get out of the shell without help is not worth saving. Sometimes when a very good hatch is coming off the chicks will gather at the glass in front and pile up, unless there is a nursery underneath

for them to drop into. In such cases it is permissible to open the door and quickly roll the chicks in front out into a basket lined with soft material, but do not do this unless there is danger of losing some chicks.

Chicks often struggle and gasp when they first come from the shell. This is but natural and the struggling gives them strength. Do not try to help them into an easier position at this time. Leave the chicks in the incubator until they are thoroughly dry. If they are left there 24 hours no harm will come to them.

The most successful incubator operators are those who worry the least about their machines. With good eggs and good oil in the lamp the average incubator may be trusted to go on without needing much outside assistance, once it is properly started. Do not forget that the directions given by the maker of the incubator are more reliable than those from any one else. General principles are well enough and every one should understand them, but minute details which are given by the maker should be constantly kept in mind.

INCUBATION, NATURAL METHOD.—Notwithstanding the fact that incubators have been sold in this country by the hundred thousand very much the largest part of the poultry of the country is hatched by hens. This is nature's method, and the ingenuity of man has not yet devised a machine that will produce as good results as can be produced by hens. Artificial methods depend for their popularity on other factors of success than the percentage of eggs hatched and the percentage of the resulting chicks raised to vigorous maturity. Where hens are used it is much better to arrange so as to set several at one time. This brings the chicks off at the same time and they grow up of the same age with

equal chances to get feed and without the dangers that arise from having large and small in the same flock.

It will pay the poultryman who lives in the country to buy broody hens if his own do not become broody so as to enable him to set a number at a time. A broody hen, especially if she is a confirmed old "cluck," is usually not highly valued if the owner has no use for her and may be bought cheaply. If a broody hen is moved after dark and handled carefully she rarely refuses to sit in her new quarters if she is given eggs to occupy her attention and require her care. A room where no other hens are allowed to run, a box-stall in a stable or any other safe and sanitary place where sitting hens may be isolated from their companions, may be used for this purpose. The packing boxes in which canned fruit is packed may be used for nests, selecting those used for packing two dozen three-pound cans. Remove the top and one side except a strip 3" wide at the bottom of the side removed, this strip being left to keep the nest material in the nest. In the bottom of the nest box so made put enough garden soil or sand to make a shallow saucer-shaped nest. Do not make this too much like a bowl. The bottom should be concave enough to cause the eggs naturally to work toward the center but no more. Press this down firmly and cover it with soft straw or hay or any similar nest material. Then replace the top of the box and the nest is ready for use. It is best first to put the hen in the nest and then put the eggs under her, one at a time, letting her arrange them under herself. Turn the opening in the box to the wall and leave the hen to sit in quiet and seclusion for 24 hours. Treat all hens alike.

In the room where the hens are sitting keep a liberal supply of whole grain, corn preferably, a box filled with

dust or coal ashes, a box of grit and a box of charcoal. At a certain time each day put a vessel of fresh water in the room and turn each nest with the opening toward the inside of the room so the hens can come off to feed. If any hen refuses to come off, gently take her off and then turn all the nests with the opening to the wall again, so no hen can return to her nest until the feeding time has passed. If the hens fight, as they usually will for the first day or two, they cannot damage the eggs, and there is no danger that they will hurt each other. After from 20 to 30 minutes turn the nests around again and let the hens return to them, seeing that each hen returns to her own nest. In three or four days they will learn where they belong and return to their own eggs without being interfered with. Repeat this each day until the 19th, after which do not force the hens to leave their nests because as soon as the chicks begin to peep the hens will not want to come off. When the chicks begin to come, watch the nests and visit them every hour or two, taking all the chicks that are hatched away from the hens hatching them, except one. To this hen give all the chicks that are hatched, taking eggs from under her to substitute for the chicks given to her. As soon as the first hen has 15 chicks begin giving the newly-hatched chicks to another hen and so on, giving each hen 15 chicks until the hatch is finished. This usually leaves one or more hens without chicks, and they may be returned to the laying flock to get ready to resume laying.

The day after the hatch is finished the hens with their broods should be removed to the brood coops provided for them. A. C. Hawkins, a veteran poultryman of Massachusetts, hatches many of his chicks with hens, but instead of putting each hen and her brood into a coop by

themselves he puts three hens and 45 chicks into a larger brood coop and lets them run together until the chicks are weaned. We have seen a large number of these triple broods running in his poultry yards, the hens seeming perfectly to agree and the chicks running at the call of either hen without distinction, although they do not heed the call of any hen but the three with which they run. Mr. Hawkins says that putting two hens together always breeds trouble, as the hens fight continually, but three get along without trouble.

Another plan for hatching with hens has been exploited extensively and is used by many poultrymen. The first time we ever saw it in operation was on the poultry farm of Mr. Hawkins. The illustration (Fig. 224) shows how this plan is operated. A long coop is made and divided into compartments 18" square, the divisions of these compartments extending for 10' in front of the coop. These divisions are made solid so as entirely to separate the hens from one another. The outer end and top are covered with poultry wire fencing, except a space at the outer end which is covered with a board hinged to the frame so it can be lifted like a trap door. This serves for an opening through which feed and water can be introduced into the several compartments. The roof of the coop is also hinged at the higher side so it can be lifted up to examine the hens and their nests when necessary. The ground plan and elevation make the manner of constructing such a hatching arrangement so plain that further explanation is unnecessary. Such a hatching coop may be used as a brood coop also, keeping the hen and chicks in it for the first week or two, if necessary, but it is better to provide regular brood coops, such as are described elsewhere in this work.

A Compartment Hatching House for Hens.

INCUBATORS, TO DISINFECT.—Dr. Woods recommends that incubators be thoroughly scrubbed with a solution of one gill of creolin in $8\frac{1}{2}$ quarts of water each time before putting eggs in them to prevent the chicks from contracting white diarrhoea and other bowel troubles. The machine should be thoroughly dried before putting the eggs in. Every part should be scrubbed inside and out, and the egg trays should be especially well done. If the eggs are also disinfected there is very good reason to believe that the ravages of white diarrhoea will be largely diminished.

JUDGING FOWLS.—The art of judging fowls can only be learned by observing an expert judge or being taught by such a judge. It is admitted that the system of judging by the use of a score card is not accurate, and most of the larger shows now have the fowls judged by comparison. Every breed of fowls is given a “scale of points” by the American Poultry Association. All fowls have the same points but the points are not valued alike in all breeds. For instance, the comb of one breed may be valued at 10 points while in another breed the comb may not be valued at more than 3 points. The reason for this difference is that in some breeds it is much harder to get a good comb than in others. So with all sections of the body in all breeds. Those hardest to breed to perfection are given higher values than those easy to breed. Perfection is taken to be 100 points and the requirements in the American Standard of Perfection are made so strict that no fowl could ever by any possible skill of the breeder reach 100 points. A bird which scores 90 points is considered a fairly good one while one scoring 95 points is rare. As a basis to begin with, the body of a fowl is divided into sections as follows: Symmetry,

Weight (in some breeds Size), Head, Comb, Wattles and Ear Lobes, Neck, Back, Breast, Body and Fluff, Wings, Tail, Legs and Toes.

In most of the breeds many of the sections are valued both for color and shape. We will say, for instance, that we have a breed called North Americans—as the copyright on the standard prevents us from using a real breed—and that we want to make a scale of points for it. We proceed as follows:

SCALE OF POINTS.

Symmetry	8
Weight (or Size)	6
Condition.	4
Head—Shape 3, Color 3	6
Comb.	8
Wattles and Ear Lobes—Shape 2, Color 4.....	6
Neck—Shape 3, Color 6.....	9
Back—Shape 6, Color 6	12
Breast—Shape 5, Color 5.	10
Body and Fluff—Shape 3, Color 3.....	6
Wings—Shape 4, Color 6.....	10
Tail—Shape 4, Color 5.	9
Legs and Toes—Shape 3, Color 3.....	6
	100

The judge examines the bird section by section, remembering what the standard requires in each section of the breed and for all defects he finds in shape or color in any section he sets down the deficiency or “cuts” that section for the deficiency as much as he thinks it deserves. When he has gone over the bird in this way he adds up the cuts he has made, subtracts this sum from 100 and the remainder is the “score” of that bird. This is called “judging by the score card.”

When a judge is judging by comparison he goes over the birds without setting down their defects and eliminates from the competition all that are plainly not good

enough to win prizes. He then goes over more carefully the birds still considered eligible and applies the standard requirements, without making any record of his cuts, simply keeping them in mind, until he has selected the best and those that follow in rank of merit, awarding the prizes accordingly.

KAFFIR-CORN.—Kaffir-corn is a good grain feed for fowls. It is about half way between oats and corn in nutritive value, being richer in protein than corn and poorer than oats. The size of the grains makes it a valuable feed for chicks after they are four or five weeks old. It is very much esteemed by pigeon breeders as a feed and poultrymen who live where it can easily be secured would do well to use it rather freely.

KNOWLEDGE OF POULTRY FEEDING.—We have not yet reached the point in our knowledge of poultry feeding where we can say definitely that a certain method of feeding is the best. Yet a knowledge of the best methods and the reason for following these methods, together with a general knowledge of the science of feeding, will help the poultryman very much. Knowledge along these lines will often enable the poultryman to select between two rations and save money while obtaining as good results with a cheaper ration as he would with one costing more.

LAYING HENS, COOK'S SIGN.—William Cook, originator of the Orpington fowls, told the writer that he could select a good laying hen every time by observing the short feathers that grow on each side at the base of the comb. If these feathers curl up and are inclined to point forward the hen is a good layer and if they lie smoothly, the points lying flat, the hen is a poor layer.

LAYING HENS, HOW TO SELECT.—While no given laying type of hen has ever been found, whereby certainty can be assured, some general principles may be applied with considerable chance of guessing correctly. A good-laying hen usually has a comb rather larger than the average of her breed; the comb is bright red; the eye bright; neck rather longer than the average; breast broad and somewhat receding from top to bottom; back long and wider at hips than shoulders; abdomen deep, the lower line being lower than the lower line of the breast; tail well spread; legs wide apart. An examination of the pelvic bones will show that those of a good layer are far apart. The pelvic bones are the two rather pointed bones which may be felt in the rear of body just below and at each side of the vent. In a laying hen the points of these bones will be wide apart. If they are close together the hen is not laying and the chances are that she is not a good layer. If three fingers can be laid between the points of these bones the hen may be taken for a good layer. A good layer, even when not laying, shows the pelvic bones well apart, although not so far as they will be when she is in full lay. If the bones are close together and hard to press apart the chances are that the hen is a very poor layer.

LICE AND MITES.—Lice and mites cause a great deal of loss to poultrymen. Lice and mites are responsible for more loss than all diseases combined. This is not a startling statement to those who understand the extent of the ravages of insect pests. Three kinds of lice live on poultry, completing their whole life cycle on the bodies of their hosts. The common hen louse is very active and dull yellow in color. It has six legs and its head is rounded in front. During the night the lice move

from one fowl to another and thus a whole flock is soon infested. They multiply very rapidly, especially in warm and damp weather. A new generation matures about every three weeks. Two kinds of lice infest the heads of fowls—a small gray one, whitish in color and very small, and a large gray louse frequently found on the heads of chicks and young turkeys.

Body lice do not live on the blood of their victims but they cause so much irritation that diarrhoea and death often follow their presence. The Iowa Experiment Station recommends the following lice powder which anyone can mix: To a mixture of 3 parts gasoline and 1 part crude carbolic acid add as much plaster of paris as it will moisten. This makes a pinkish-brown powder perfectly dry, having the characteristic odor of carbolic acid. Hold a fowl up by the legs and sift the powder down through the feathers and fluff, working it down to the skin. More than one application may be needed to kill off those which hatch after the first application. The second application should be made a week after the first.

Sitting hens should be thoroughly dusted before eggs are put under them. There are many liquid lice-killers, made chiefly from coal-tar or gas-house wastes. A mixture of 1 gallon of kerosene and 1 pound of crude carbolic acid is perfectly effective. This should be painted on the perches and sides of the house, using the mixture plentifully. If a sprayer is handy it is better to spray the mixture on the sides of the house, dropping boards and perches. Every inch of the surface should be touched by the mixture to make the work effective.

Red mites that destroy many fowls are not true lice but blood-sucking spiders. They live on the blood of their victims and when allowed to increase without hind-

rance they multiply amazingly. They live in cracks and crevices of the house and under the perches during the day unless they are very numerous, when some may be found on the fowls at any time. The mixture described will destroy them without fail, if faithfully used. Poultry houses should be painted with this lice-killer at least once in a month, and oftener if lice are found. If there are any present they may be found by lifting up the perches, as they cluster together and are at once revealed by their intense red color, the color being that of the blood on which they have gorged themselves.

Every poultry house should have a dust-box in it, as dust is the natural lice-killer for fowls and if they are furnished with a supply of it lice will rarely get a very good foothold in the flock. The Iowa station gives the following directions for making cresol soap and recommends it for disinfecting and killing lice and mites: Shave one 10-cent cake of laundry soap into 1 pint of soft water; heat or allow to stand until a soap paste is formed; stir in 1 pound of commercial cresol and heat or allow to stand until the soap paste is dissolved; then stir in 1 gallon of kerosene. For a lice-killer use undiluted, painting the perches and sides of the house with a paint brush. If used as a spray add 50 parts of water and stir. This will make a milky fluid which may be used in the sprayer. Cresol is a coal-tar product and druggists supply it.

LIMBERNECK.—This is a disease in which the fowl loses the power to hold its head up, and often the neck is twisted. It is usually caused by eating decaying animal matter, although on rare occasions it may be caused by eating some other poisonous matter. To prevent it bury or burn at once all dead animals or fowls. To

cure it, give the sick fowl an equal quantity of turpentine and olive oil. Give an adult fowl from one to two tablespoonfuls; for a chick from a 10-drop-dose to a teaspoonful according to age. Keep in a warm place and feed rice boiled in milk.

LINE-BREEDING.—The whole subject of line-breeding has been so fully and clearly treated by Prof. H. C. Pierce of the Iowa State College in *THE BREEDER'S GAZETTE* that we reproduce it entire:

“Line-breeding may popularly be defined as systematized inbreeding. It is a system of inbreeding to perpetuate and intensify in their offspring the good qualities of individuals, and at the same time avoid the difficulties and failures that often result from too close inbreeding. Persistent close inbreeding, such as the mating of brother and sister for several generations, often results in impaired fecundity, loss of size, and decrease in constitution and vigor. Cross-breeding or outbreeding, on the other hand, where birds of different varieties or even different strains within a variety are mated together, tends to break down the blood lines and cause variations from the types of the parents.

“In many cases where birds of outstanding excellence but different bloodlines have been mated together the offspring has been decidedly inferior to either of the parents, because the bloodlines did not ‘nick’ to perpetuate their good qualities, but allowed the defects of each to appear. Cross-bred stock, however, usually possesses good fecundity and constitutional vigor.

“Line-breeding therefore endeavors to secure the good properties of both systems without the faults of either. A clear conception of the methods followed in line-breeding may be had by studying a chart (page 232) which

has been drawn from one published several years ago by I. K. Felch, the veteran Light Brahma breeder. In this chart the solid black circles and segments represent the blood elements, and the solid lines that a male has been chosen from the group from which they start. The white circles and segments represent the female blood elements and the dotted lines that the females had been chosen

The Pierce Line-Breeding Chart.

from the group from which they start. The shaded circle represents a scheme for the admission of new blood. Suppose we have two extra good birds which when mated together produce high-class offspring. Then the problem is how to perpetuate the quality of the parents and offspring without the dangers of close inbreeding or of destroying the results of several years of work by violent out-crossing. By following line-breeding three blood-

lines may be developed, one of which shall contain a preponderance of original male blood, one a preponderance of original female blood, and the third equal proportions of original male and female blood.

"In the chart let 1 represent the original male and 2 the original female. Then by crossing 1 and 2 the result is group 3, which possesses equal parts of the blood of 1 and 2. Selecting the best pullet from 3 and mating to her sire 1, group 4 is produced, which contains $\frac{3}{4}$ of the blood of the original sire and $\frac{1}{4}$ of the blood of the original dam. In a like manner the best cockerel from 3 mated to his dam (2) produces group 5, which is made up of $\frac{3}{4}$ of the blood of the original dam and $\frac{1}{4}$ of the original sire. Proceeding in a similar manner by mating the original parents to their offspring in the third generation, we obtain at groups 6 and 7 offspring which contain either $\frac{7}{8}$ the blood of the original sire and $\frac{1}{8}$ the blood of the original dam, or $\frac{7}{8}$ blood of the original dam and $\frac{1}{8}$ blood of the original sire, as the case may be. Thus the blood of the original sire has been practically eliminated from the female line, and the blood of the original dam from the male line. If the original parents were still in breeding condition the blood of each could be intensified to $\frac{15}{16}$ in the fifth generation. To obtain the original cross, however, at any generation after the second, it is only necessary to select parents from corresponding groups on each side of the line. As for instance a cockerel from group 6 mated to pullets from group 7 will produce in the fifth generation group 9, which contains mathematically $\frac{1}{2}$ the blood of the original pair. Similar results can be obtained by selecting parents from 4 and 5, for the fundamental law involved works in the same way.

"The fifth and sixth generations, as shown in the chart, indicate only a few of the possible groups that may be obtained from various matings. Thus if the original sire and dam cannot be used for breeding purposes beyond the fourth generation their blood may be maintained in $13/17$ of its intensity by choosing parents from groups 4 and 6, or 5 and 7, to produce groups 8 and 10 respectively. Then parents chosen from groups 8 and 10 will produce group 13, which is again mathematically $\frac{1}{2}$ the blood of the original pair, and the original offspring again reproduced as far as blood lines are concerned. By choosing parents from 6 and 8 the male line contains in group 12, $27/32$ of the blood of the original sire and $5/32$ of the blood of the original dam. By choosing parents from 7 and 10, $27/32$ of the blood of the original dam, and $5/32$ of the original sire is produced in group 14. If it is deemed advisable to vary the proportions of the bloods of either side in any mating, groups 11 and 15 show that by selecting parents from 8 and 9, or 10 and 9, $21/32$ of the blood of either line and $11/32$ of the other may be obtained. Many other proportions may be worked out by combining different groups.

"If it is advisable at any time to introduce new blood, it may be done satisfactorily by adding a female to any mating desired and distributing the new blood through her progeny. Thus by mating a female of outside blood (N) to male from group 8, there is produced group 16 in which the offspring contains $\frac{1}{2}$ new blood, $13/32$ original sire blood and $3/32$ blood of the original dam. It is a safer course to add new blood through a female than a male, as there is less danger of an entire mating being rendered worthless in case the blood does not combine to good advantage.

"By continually selecting the best individuals in each generation line-breeding offers a system to the careful breeder whereby the quickest and safest improvements may be obtained. It must be remembered, however, that although no brother and sister matings are made, it is a system of inbreeding, and that faults in the stock will be intensified as well as excellencies. Especial care should be taken therefore not to mate together any individuals which have the same faults in common. The practice of buying cockerels of unrelated blood each year to cross upon the breeding flock is a most common practice of out-breeding. This tends to maintain constitutional vigor, but is not conducive to the perfection of type or egg-laying capacity. But as constitutional vigor is the most important factor in the breeding of utility poultry for the man who pays but little attention to his breeding stock the practice should not be too hastily condemned."

MARKING BETWEEN THE TOES.—As soon as the chicks are hatched a hole is punched in the web be-

tween the toes. This hole will remain as long as the chick lives. The cut shows different combinations are possible and by keeping a record a number of different pens may be recorded and their breeding kept straight. Poultry markers for marking chicks in this way are for sale by supply houses, or an ordinary sad-

dlers' punch may be used. The operation is simple and seems quite painless.

MARKETING POULTRY.—It requires some ability in the way of salesmanship to get the best results from marketing poultry as well as to sell anything else. Marketing poultry successfully depends in a great measure on getting the fowls well finished before they are sent to market. If they are to be marketed alive in the general market they should be consigned to some honest commission merchant. The reputation of the merchant should be carefully looked into before making consignments, as the cities are full of swindling commission merchants, although there is no lack of honest ones, if trouble is taken to find them. Having the fowls in prime condition, feed them fully and put them in crates without crowding them in too closely. Many a consignment is shipped at a loss because the fowls are crowded too closely into the shipping crate. Advise the merchant of the shipment and call his attention to the quality of the fowls, so he will understand that they are better than the ordinary ones picked up out of a barnyard. Ship old and young separately so as to get the advantage of the difference in price. Never send a crate of poor fowls to market. Make a reputation for your name and you will soon get the highest prices. If you have any of poor quality to sell dispose of them to the home buyer, as he handles so many thin, skinny birds that a few more or less will make no difference to him.

If the fowls are to be dressed before sending to market take pains to have them look plump and clean. In the great packing houses fowls are dry-picked, and most cities prefer them picked without scalding. The fowls to be dressed are hung up by the feet, each foot being

Well-Fitted Fowls Properly Dressed for the Market.

slipped into a narrow hook which prevents the feet from passing through. These hooks are far enough apart so that when the fowl is hung in them its legs will be well spread. The killer then runs a sharp-pointed knife through the top of the mouth into the brain and giving the blade a turn severs the jugular vein. The bird is deprived of sensation instantly and any struggles it makes are only muscular contractions, of which it has no control or power to feel. In a moment the skin relaxes, the feathers drop slightly and the fowl can easily be picked without tearing the skin.

After the feathers are off the fowl is laid on a cooling board, with its head hanging down until all of the animal heat is cooled out. It is then packed in boxes large enough to hold one dozen fowls. The box is first lined with white paper, then the first layer of fowls is placed in with the feet pressing against the breast and the head neatly tucked under the wing, breasts down. The top layer is then put in, backs down, with heads and feet disposed in the same way, a layer of white paper laid over them and the top nailed down. Before packing, the heads are wiped clear of blood, the feet and legs carefully cleaned and the carcass is arranged so as to present a clean and attractive exterior. The boxes should be clean and bright and the paper with which they are lined white. Dressed poultry is sometimes packed in barrels, but commission merchants prefer boxes. Never put straw in with poultry nor wrap the carcasses in paper.

In the neighborhood of cities and large towns the poultryman who has the ability to sell will often be able to work up a trade with families that will bring him better prices than he can get from merchants. It is best to have regular days to deliver either poultry or eggs, and

take orders one trip for deliveries the next. If one family is satisfied the members tell their friends and the business will increase, if the poultry proves all it should be. In seeking a private trade it is a good plan to have each fowl in a neat pasteboard box by itself, as it makes an attractive package that increases trade. When dealing with families never deliver a fowl that is not in perfect condition. If there are some that are not quite first-class sell them to the stores. It does not require a very large town to use a large quantity of poultry and many poultrymen make a good profit on such a trade.

MASH.—This is ground grain, mixed into a dough with water or milk. Usually the word is used to designate a mixture of ground grain made into a dough before feeding. Later methods have brought into use the words "dry mash" to designate a mixture of ground grain fed dry. There is some difference of opinion as to the relative value of wet and dry mashes. Experiments have shown that for feeding chicks there is not much difference, but in feeding laying hens some careful experiments at Cornell indicate that dry mash was preferable to wet.

MATING.—There is no system of mating cross-bred or mongrel fowls by which any improvement can be brought about because so many bloodlines enter into the composition of such fowls. We assume that no one will try to mate mongrel fowls for the improvement of the flock and proceed on the assumption that this section relates to pure-bred fowls only. In the mating of his breeding pens the poultryman shows how much progress he has made as a breeder. When he has learned so to mate his fowls that he can produce a large percentage of standard fowls and a smaller one of exhibition fowls he has taken his place as an expert breeder. In mating

fowls the object is to improve on both parents. If Darwin's dictum were entirely true we should only need to mate high-class fowls together to produce high-class progeny, but unfortunately the Darwinian rule is weakened by the very large number of exceptions that occur when we try to work by it. There is a law which works to reproduce species, but when we come to work for individual specimens of high quality we find that the law of variation interferes and our best matings produce many inferior or very ordinary specimens, and the best the most skillful breeder can expect is to secure a few excellent birds, a somewhat larger number of good ones, a still larger number of standard birds and many culls, having defects that preclude their use in the breeding pens of a breeder who is careful about his bloodlines, for defects have a way of showing up in an intensified form in the progeny of any kind of stock.

The poultry breeder must contend with several factors. He must be careful in making his matings, that he may secure both shape and color, and must at the same time breed from healthy stock only, for disease also intensifies itself when bred into young stock. A hen that has had a bad case of roup should never be used as a breeder, for the tendency to fall victim to the roup germ will be transmitted to her progeny, and there is reason to believe that such progeny will have less power of resistance to other diseases. So with any other diseases. Use for breeding only such fowls as have a perfect record for health, and especially those which, having good digestive power, are easy to keep.

The poultryman who keeps standard poultry will of course have a copy of the American Standard of Excellence. He cannot very well do business without one.

He should study it and know exactly what it requires in the breed or breeds he keeps. In mating most breeds fowls of high standard quality should be mated together, as a rule, but there are several exceptions. In making the standard, the ideal of the fancier did not coincide with the plans of nature and the poultry-breeder will find it difficult in several breeds to breed standard requirements by breeding standard fowls together. For example, in mating Barred Plymouth Rocks the best breeders find it necessary to make two distinct matings: one to produce cockerels and the other to produce pullets. The tendency of this variety is to produce cockerels much lighter in color than the pullets, yet the standard requires that the birds "shall match in the show pen." This peculiarity in this variety has been explained by Prof. W. J. Spillman, of the Department of Agriculture, he having discovered that the male of this breed transmits barring to both male and female of his descendants, while the female transmits barring only to her male descendants. This peculiarity naturally causes the males to be lighter in color than the females.

In order to get exhibition birds the breeder must practice double mating. To get good cockerels he uses a male of standard color and a female much darker than would pass as a prize-winner in the show room. The male should be perfectly barred to the skin, his color being bright and "snappy," so as to transmit this distinct barring to his male progeny. The female should be several shades darker and the barring should be to the skin. For pullets of good color an opposite mating must be made. Select a male very light in color, yet distinctly barred to the skin. For this purpose the male should be so light that he would not be considered in the show room. The

female mated to him should be standard in color and very distinctly barred to the skin. Very few breeders make what is called a "middle mating" in mating Barred Plymouth Rocks, but such matings produce too many culls, although it must be said that they produce a few very fine birds. Such a mating is made with medium-dark hens and medium-light cocks, the object being to get good chicks of both sexes. Both parents should be perfect in comb and color of eyes and shanks. The eye should be distinctly red and the skin yellow. Avoid hens with willow-colored shanks or those with a number of blue spots on the shanks. Light Brahmas are now bred by double mating by our best breeders. The standard says the primaries shall be black and white, black to predominate. Judges almost invariably prefer the primaries almost entirely black and a prize often hangs on this point.

In selecting breeding stock choose those birds which are strong in this respect in the wing. The tail also should be greenish black, except the coverts, which should be distinctly laced with white. Be very particular that the combs are as near as possible according to standard requirements, especially in the females. In every part of the plumage where black is called for in the standard select birds strong in that part, the black being a brilliant clear black without dullness or rustiness. The skull should be flat and wide, the eyebrows overhanging. The neck should be medium in length, not as long as the Langshan nor as short as the Cochin. Take birds with full, round breast, wide back and great depth of body.

Buff fowls are difficult to breed, as the buff color is a hard one to hold. Either black and white is likely to appear in the tail and primaries. Select males of a clear

buff throughout and females rather reddish in color but stopping short of red. Examine the undercolor and reject any bird with white next the skin.

Brown Leghorns must be double-mated to produce the birds to which judges award first prizes. For breeding cockerels select hens very dark in color. If there is some lacing on the breast so much the better. Keep away from brick color on the wingbows or reddish feathers on the body. See that the shanks are bright yellow. The comb should be evenly serrated and rather small. If it stands erect it is better. The male for cockerel breeding should be dark-red in color with a brilliant black breast. The hackle and saddle should be distinctly striped with black. The comb should be large, perfectly erect, free from thumb marks, evenly serrated and velvety in appearance.

For pullet breeding, select females that are as perfect in color as possible, always avoiding brick color in wingbows or back. The feathers should be free from shafting; that is, the shafts of the feathers on the back should be black instead of light in color. The breast should be a deep salmon-red, the comb heavy, but thin, lopping to one side. Mate such hens with a male which has a yellow hackle and saddle, without striping in the saddle. If there is a little show of red in the breast the cock will be all the better for pullet breeding. In both sexes be particular that the undercolor in mating for either cockerels or pullets is dark, avoiding any appearance of white. If the male used is a cockerel not more than a year old see that there is no white in his face. Choose typical shape in both sexes. The hock should show at least half an inch below the line of the body, as one fault in this variety is the shortness of the upper half of the leg.

Black fowls have a fashion of coming with white in their plumage. This goes to the extent that black varieties not infrequently throw pure white chicks. In selecting breeding stock take particular pains to exclude any bird with more than the faintest showing of gray at the tips of the larger feathers of wing, and it is better if they are absolutely black. The ideal color of black fowls is brilliant black with a greenish iridescence. These breeds have a tendency to come purple instead of showing this greenish sheen. This purple often shows as a purple or plum-colored barring on the feathers. This is quite objectionable.

To establish a strain of fowls that will throw a large percentage of high-class birds is the ambition of every poultry fancier. To do this inbreeding or line-breeding, as some prefer to call it is practiced. This method of breeding intensifies the blood and reduces the chances of having the chicks come with faults, because it reduces the number of ancestors to which any particular chick may run back. Inbreeding requires great care in selecting the breeding stock in order to avoid any tendency to inheritable diseases or faults in color or shape.

MILK ALBUMEN FOR FOWLS.—Tests with milk albumen in the place of beef scrap or beef meal showed that the albumen was not as effective as the meat feeds. The price at which it is sold makes it too costly to be profitable as long as beef scrap can be obtained almost anywhere.

MILK FOR FOWLS.—Milk in any form, sweet, sour or as buttermilk, is a very valuable feed for fowls of all kinds, as it takes the place of meat feeds to a considerable extent. Experiments at the West Virginia Experiment Station by Atwood showed that milk was worth about 1

cent a pound when fed to laying hens. Milk fed to laying hens or growing chicks makes better returns than when fed to pigs.

MINERAL MATTER.—The mineral matter or ash in the feed of a laying hen is so important that we want to emphasize the fact that unless feed contains a liberal quantity of mineral matter the hen can not produce the largest possible number of eggs. There is nearly eight times as much mineral matter in the dry substance of an egg as there is in corn or wheat, and no system of feeding with grain can supply a good laying hen with enough mineral matter to manufacture eggs. To supply this deficiency we must feed crushed bone, oyster shell or limestone grit in abundance. One or more of these should always be kept before laying hens and growing chicks.

MOLTING OF FOWLS.—The most careful series of observations covering the molting of fowls at all ages that were ever made were those of Prof. James E. Rice, Miss Clara Nixon, and Clarence E. Rogers at the Cornell University Experiment Station. To Miss Nixon is due the honor of having discovered where the down that covers a chick at birth goes. She discovered that this down is really the tips of the feathers which appear later in the life of the chick. As the chick grows the feather pushes its down tip farther out and the down is worn off while the feather appears in full form a little later. Miss Nixon also discovered that a pullet molts four or more times before reaching the laying period, the feathers dropping out to be replaced by others more in accordance with the size of the chick from time to time.

The so-called Van Dreser method of molting consists in cutting down the rations of fowls at the time the molt would naturally begin until they lose something in

weight. The reduction in the ration is made gradually and really consists in putting them on starvation diet for a week or two. Then the ration is gradually increased until the fowls are on heavy feed again. This seems to hasten the molt and cause the whole flock to molt quickly and at one time. The experiments at Cornell indicate that there is no advantage in this method and possibly some disadvantage, although this was not clearly demonstrated.

In order to determine just how molting proceeds White Leghorns were used and these were colored blue, red, green and various other colors, so that when new feathers came in they could be noticed at once. It was found that the average time required for the full molt was 104 days with three-year-old hens, 101 days with two-year-olds and 82 days with yearlings. It required 42 days for a body feather plucked out to renew itself and somewhat longer for a tail feather.

Hens should be fed a highly nitrogenous ration during the molting period, as the demand for materials from which to supply feather material is very heavy. Wheat, wheat bran, middlings, beef scrap, meatmeal, gluten feed, oats, oilmeal and similar feeds rich in protein should be fed freely.

NEST BOXES.—On page 247 are shown several types of nest-boxes. The nest-box should be easy of access, partially darkened and so arranged that hens feel secluded and hidden while on the nests.

OATS.—This grain comes very nearly being a balanced ration, so far as chemical composition is concerned, but it seems to have too much woody hull to be considered the best grain to feed in its natural condition. Clipped oats make a very valuable grain feed for laying hens.

CRATE FOR SHIPPING DAY-OLD CHICKS. 3 TRAYS, EACH DIVIDED INTO FOUR COMPARTMENTS.

NEST BOX FOR SETTING HENS
MAY BE USED FOR LAYERS

FORCE FEED HOPPER
DOTTED LINE INDICATES SHEET OF TIN FASTENED INSIDE TO FORCE THE FEED TO FRONT

REGULAR SHIPPING CRATE FOR FANCY FOWLS

SHIPPING CRATE MADE FROM A SECOND HAND BOX

DARKENED NEST A-END VIEW. B-REAR VIEW

NEST BOXES. SHOWING DOOR AT BACK HENS ENTER FROM SIDES. NOT SHOWN

Sprouted oats or even oats soaked a few hours are better than the dry grain.

OATS, SPROUTED.—Oats that have been dampened and kept in a warm place until they have started sprouts about an inch long are considered a valuable addition to the ration of either laying hens or growing chicks. The nutritive elements are changed as in the process of digestion when the grain begins to grow and the fresh sprouts take the place of other green feed. The common method of sprouting is to put the oats in a suitable receptacle, such as a box, and dampen them with warm water, leaving them in a warm place for 24 hours. After this they are spread out to a depth of about an inch and kept damp, but not wet until the sprouts are the proper length. Another method used in warm weather is to spread the oat on a platform laid on the ground in a sunny place and cover with about an inch of soil. This is kept damp until the sprouts appear above the surface, when it is taken up and given to the chicks or hens, the roots making it easy to cut out blocks with a hoe or spade.

OVERFAT HENS.—The overfat hen is a myth. A hen never gets too fat to lay if she is given an opportunity to take plenty of exercise. Hens may be confined and fed until they are too fat to be healthy, but it is almost impossible to feed a hen too much if she is compelled to hunt her feed by scratching for it in litter. The best laying hens are fed plenty of grain and beef scrap or green cut bone and green stuff or its substitute, clover or alfalfameal.

OYSTER SHELL.—Oyster shells furnish material for egg shells. Ordinary feeds do not furnish enough lime for this purpose, and hens can not lay eggs without shell material.

PEPPER.—Pepper is frequently fed to laying hens in cold weather under the mistaken notion that it warms the birds. Pepper is stimulating and should never be fed to healthy fowls. It is sometimes useful in sickness in the flock. In case the flock seems afflicted with colds a little red pepper often seems to produce a good effect.

POULTRY AS FOOD.—Poultry long has been regarded as a delicate as well as a nourishing form of animal food, but not until within a few years have any attempts been made to determine exactly the place poultry occupies in the dietary of man as regards its nutritive qualities. The Storrs station published a bulletin on this subject, containing some elaborate tables of the nutritive values of poultry of all kinds, game birds, flesh of domestic animals and a few of the more common vegetable foods. These tables show that more value can be bought in poultry for the same amount of money than in most other animal foods; that eggs at 24 cents a dozen are as cheap as mutton at 20 cents or fowl at the same price. While cheap beef is more economical than high-priced poultry, the housewife who buys poultry at the same price at which she can get good cuts of beef is not wasting money. Farmers can well afford to eat poultry that they have raised on their farms rather than sell the poultry and buy other meats at the average market prices.

POULTRY, BEGINNING IN.—There are two ways in which to start in the poultry business—buying fowls and buying eggs to hatch. The better plan is to buy good fowls from a reliable breeder, but this has the disadvantage of being much more costly than buying eggs. If one is disposed to begin moderately a trio of good fowls will produce enough eggs to give the beginner a good flock within six months. When this is done the

beginner knows exactly what kind of stock his fowls are bred from. From two hens and a cock it is entirely possible to hatch 100 chicks during the season, without beginning too early or continuing too late into the summer. Of these one-half would be cockerels and probably one-half the pullets would not be good enough to breed from, but they would be as good for laying as any. Counting the chicks worth 25 cents each the day they are hatched, which is a fair price for chicks from good stock, the beginner can afford to pay \$25 for a trio of fowls, and this amount should procure a very good trio with which to start.

With \$25 to invest the beginner can buy from 100 to 200 eggs for hatching from reliable breeders. Of these it is safe to count on about two-thirds hatching with the same reductions for cockerels and inferior pullets as in the case of buying fowls. As fowls mature and come into profit-making within six months from the time the eggs are laid, the matter of making a start does not much matter. If either method is chosen the beginner will begin to receive returns before the end of the first year and the rapid increase among fowls makes it possible to build up a large flock within the limits of two seasons, and as the difference between the two methods is not enough to be of first importance the beginner may safely adopt either without fear of going far wrong. If circumstances point to one method as being more convenient than the other the more convenient should be followed.

POULTRY DROPPINGS.—Discussing the fertilizer value of poultry droppings the New Hampshire Experiment Station says: "As is well known when poultry droppings accumulate under the roost and when they are

left in barrels there is a strong odor of ammonia noticeable. The development of such an odor is a sure sign that gaseous ammonia is escaping into the air to be lost for the present. How to prevent such a loss is to prevent the development of the odor. Several chemicals, of more or less fertilizing value in themselves, may be added to the droppings from time to time with good effect, both in stopping waste and in making the air of the henhouse more wholesome. The best materials for this purpose are gypsum or land plaster, acid phosphate and kainit, a cheap potash salt. Each of the chemicals has the power of forming new compounds with the ammonia as fast as it is set free from the original combination. Wood ashes or slaked lime should never be used because neither combines with ammonia but forces it out of its compounds and takes its place. Plaster is apt to form a dry, lumpy mixture when used in large enough quantities to arrest the ammonia, while acid phosphate and kainit effect a moist, sticky mass."

Bulletin 98 of Maine Experiment Station describes an experiment in which sawdust was used in addition to chemicals. By this addition of an absorbent, the kainit and acid phosphate could then be used with excellent results. "Using these results as a basis for calculation the weekly droppings of 25 hens, when scraped from the roosting platforms, should be mixed with about 8 pounds of kainit or acid phosphate and half a peck of sawdust. If one wanted a balanced fertilizer for corn or other hoed crops, a mixture of equal parts of kainit and acid phosphate might be used instead of either alone. Good dry meadow muck would be equally good as sawdust, if not better as an absorbent. In the experiment mentioned more than half the ammonia was lost in hen

manure without chemicals when compared with that which had been mixed with them."

Fresh poultry droppings at present value for fertilizers would be worth about 60 cents per 100 pounds. Figures from different experiment stations would give the product of 25 hens for the winter season of six months as 375 pounds from the roost droppings alone. Poultry droppings are particularly valuable as a top-dressing for grass because of their high content of nitrogen in the form of ammonia compounds, which are nearly as quick in their action as nitrate of soda. A ton of such droppings preserved with chemicals and sawdust would be sufficient for an acre when compared with a chemical formula for top dressing. On the same basis of comparison 100 fowls running at large on an acre should in the summer season of six months have added to its fertility for the equivalent of at least 200 pounds of sulphate of ammonia, 100 pounds of high-grade acid phosphate and 60 pounds of kainit.

POULTRY FEED, LOW COST.—Several persons have made much money selling so-called "secrets" for making poultry feed cheaply, claiming to be able to make it for 8 or 10 cents per bushel. These secrets merely tell how to sprout oats, wheat or barley, causing them to swell and throw out green sprouts until the original quantity is largely increased. No nutritive value is added to the grain by sprouting, but a very palatable feed is produced and probably the process of sprouting changes the starch into a more easily digested feed. The oats are wet and put into a box open enough in the bottom to allow surplus water to drain away. This box is kept in a warm place and warm water is sprinkled over the grain to keep it damp, but not wet. When it sprouts the sprouts are allowed to grow to a length of 2" or more

and the feed is ready for use. Chicks, laying hens and other poultry eat this greedily and it is a very good feed, as it is something in the nature of grain and green feed combined. Another much-lauded cheap feed secret is merely clover hay cut into short lengths and steamed until it is soft, then mixed with cornmeal, wheat middlings and bran. Alfalfa hay is better for this purpose than clover, as it is richer in protein.

POULTRY HOUSE CONSTRUCTION.— When building a poultry house the lowest probable temperature that will be experienced in the locality where the house is to be built should be kept in mind because the comfort of the fowls to be housed is the main consideration. While it is possible to keep out the cold no house, built at a reasonable expense, will keep out the heat. Therefore it is the weather of the coldest months that we must contend with and depend on ventilation to let the heat escape or moderate its effects. Any shed is good enough for the summer months, but where the winter temperature runs low we must try to secure comfort for our birds if we would secure the greatest profits. It is the winter-laying hen that makes the largest profits.

In a country as large as this it is manifestly impossible to give any one plan that will apply in every locality. It is thought best to give several plans, allowing those who build after them to modify them to suit the climate in which their fowls must live. In the plans described and illustrated it will be noticed that it is recommended that the rear wall be double and that the roof be ceiled under the rafters as far forward as the front edge of the dropping board, from which the curtain that drops down in front of the dropping board is fixed. If the wall of the house and roof are properly constructed it would be a

waste of material to make this double wall and ceiling in any locality where the temperature never goes below zero, as the fowls will be perfectly comfortable when inclosed in a single wall and a roof with the drop curtain in front in such a temperature. The walls and roof of a poultry house should be absolutely wind-proof. The best way to secure this condition is to use one of the roofing papers, of which many kinds are obtainable in any town. If they are not kept in stock by local hardware or lumber firms any of them can get them with not more than a short delay. The side walls should be made of shiplap or of lumber which fits closely and then covered with one-ply roofing paper. The roof should be sheeted with shiplap or other straight-edged lumber and this covered with three-ply roofing paper. If shingles must be used the roof should be sheeted with cheap flooring and the shingles laid on this. The object is to make the roof and sides perfectly tight, except where the muslin or canvas-covered windows are put in to secure ventilation.

In some localities the entire front of the house may be open most of the year. Such houses are closed in front with poultry netting to keep marauders out and the fowls in when this is desirable. Frames covered with canvas or muslin are made in sections to fit the opening, hinged at the top and swung up and fastened to the roof when not in use. On the next page is shown such a house, used through very severe winters in Chicago to house Rhode Island Reds, with perfect success. The writer gave the plan to a poultryman in Ohio and he wrote, after using it one winter, that his hens were never more healthy and prolific than they were during the time they had been kept in this extreme type of the open-

1, Open-Front Poultry House. 2, An Illinois Poultry House.

front house. The illustration is so plain that the plan need not be discussed in detail. The house was 12'x20' and 7' high in front. The total cost was \$42 and it comfortably housed 50 fowls. Such a house is not recommended for large combed breeds in the colder sections, although it would be a very good house for these breeds in the South or the warmer sections of the West and Southwest.

Poultrymen disagree concerning the best model for poultry houses and probably always will disagree. Some favor the colony house system, setting the single-room houses some distance apart. Others favor the long house of several rooms with an alleyway the entire length. Still others contend that the long house should not be built with an alleyway, as the alley wastes room and allows draughts to sweep from one end of the building to the other without restraint. Some want wire partitions between the rooms; others say a wire partition allows draughts to have free access and that the partitions should be solid, with a door in each one to allow the caretaker to go freely from room to room. The writer prefers the long house with tight partitions and no alleyway, thus making each room a separate apartment. A house built on such a plan is very easily enlarged, as each room is a separate unit, and in the plans this should be kept in mind. The West Virginia house, for example, may have any number of rooms from one up, without in any way interfering with the plan, as each room is merely a separate house closely joined to others. We believe this plan is the better one for another reason, which seems good. A flock of hens which has become thoroughly familiar with its caretaker lays better than one that is not accustomed to the presence of human beings.

In a house built after the West Virginia plan the caretaker is going back and forth among the fowls at every feeding time, and they soon become so familiar with him that they will cluster around him and allow themselves to be picked up and examined without fear, while hens kept in houses so arranged that they are fed from outside their quarters are more or less timid.

Although a detailed estimate is given to show how much material is required for one or two of the houses it is not thought necessary to do this in the case of all of them, as any competent carpenter can make an estimate in a short time. Nothing has been said about the cost of the houses because the price of lumber varies widely in different sections of the country and prices that would obtain in one place might not be applicable to another.

The West Virginia house, plans for which appear on pages 258-261, is 180' long and 16' wide, divided into 9 compartments, each 20'x16', the middle one being used as a feed-room. Each compartment is used to house 75 hens the size of Leghorns. The foundation is of concrete and the floor of cement. The floor was made by filling in and tamping down clay and spreading over this 1" of cement mortar made by using 1 part of Portland cement to 3 parts sand, spread directly on the dirt and leveled by using a straight-edged board. This makes a cheap floor, keeps out rats and dampness and is easily cleaned. The house was constructed of cheap oak boards and the roof is of three-ply roofing. In each room in front are a door and two windows and an opening covered with wire netting, which can be closed when necessary by a cloth curtain. The perches consist of 2"x4" scantling 20' long extending parallel with the north wall, which is double-boarded and the space between the studs

Plate 1.

—Front Elevation—
Curtain-front Laying House.

filled with shavings. Under the perches extend the dropping boards and under this platform the nests are located. Plate 1 shows the front elevation of one room, the door, the two windows and the wire screens in the openings between the windows, covered with wire screens. Plate 2 shows the floor plan, where perches, nest boxes, dust

Plate 3.

box and feed box are located and the location of the grit box and water fountain. The double swing door in the partition is also shown. Plate 3 illustrates two sections in which are shown the section marked C-D above

A GUIDE FOR KEEPERS OF POULTRY

Plate 4.

and section E-F in the same illustration. Section C-D shows the location of the dropping board, perches, nests and how far the ceiling above the perches extends, with the muslin canvas drop curtain swung up to the roof. It also shows the batten door in the partition, which is swung on double hinges and the pen or cage in which broody hens are confined. This broody cage has a slat floor, as indicated in the plan. Just under the broody pen will be noticed a strip with two notches in it. In warm weather the perches are removed and supported in these notches, which places the perches just under the screen windows and gives the hens the benefit of all the air going. Section E-F shows how the water fountain is supported on a platform, the feed box raised from the floor with a platform in front for the hens to stand on when eating, and the canvas-covered frame which is dropped down before the screened openings in the front in cold weather. The runway by which the hens reach the perches is also indicated. Plate 4 is the elevation of the back wall, as viewed from the line A-B shown in it. The dimensions of every part of the house are indicated in the plans.

The Minnesota house, the plans and perspective of which are shown on the next page is simpler than the West Virginia one. It was built by a Minnesota poultryman, who finds it perfectly comfortable in that state where very severe cold weather may be anticipated. This house has no glass windows. The windows are covered with wire netting and inside is a muslin-covered frame hinged at the top which is used in cold weather and swung up and fastened to the roof in warm weather. This house is 12'x40' and is designed for 100 fowls. The sectional view at the bottom of page shows a double rear

PERSPECTIVE

GROUND PLAN

SECTIONAL VIEW

A Minnesota Poultry House.

wall, and the rafters are ceiled as far forward as the dropping board extends, from which point a burlap curtain is dropped down to protect the hens in severe cold weather. The partitions are made of wire netting, except two feet next the floor, and a door swinging either way on spring hinges is placed in each partition. The water pans are on platforms, a hole being cut through the partitions so each pan furnishes water for two rooms. This house was sided with shiplap and the roof was sheathed with fence-flooring and covered with two-ply roofing. The foundation was made of concrete and built up one foot above the surface. This was then filled with gravel and a cement floor laid on top, making a floor that is always dry. The following materials were used:

Cement and gravel for foundation, quantity not given. Dimension stuff—10 pieces 2"x4"x16'—107'; 29 pieces 2"x4"x12'—232'; 12 pieces 2"x4"x14'—112'; 12 pieces 2"x4"x8'—64'; No. 3 fence flooring 696'; No. 1 shiplap 672'; 6 squares two-ply roofing paper; 2 squares one-ply roofing paper; 1 roll red rosin building paper; netting for partitions; muslin for windows. In this plan the dimensions are shown on page 263.

A house for the South or the Pacific Coast is shown on page 265. This house is made with a single wall, the weatherboarding being any common lumber of a cheap grade. At each end is a room 10' square and between these is a room entirely open in front, except that it is covered with wire netting. The enclosed rooms at each end may be arranged as shown in the plans for the Minnesota house (page 263). The open front space between the rooms is divided in the middle by a wire partition, except that two feet next the floor is boarded up to prevent cocks from fighting through the wires. We saw a

Poultry Houses for the South or Pacific Coast.

house of this kind in which the partition was made entirely of wire nailed to 2"x4" studding set so the wire was nailed to the narrow edge. For two feet from the floor netting was nailed on both edges of the studding, making two netting partitions to that height 4" apart. It was impossible for cocks to fight through this double partition, as they could not reach each other. This house is a model used in many places in the colder parts, as fowls can be allowed to run in the open front scratching room when the weather is quite cold. It makes an excellent house for suburban poultry yards and for places where no inclosed yards are used, as the fowls can be shut in the house, taking exercise in the scratching shed. The windows in the rooms are 6' wide and 4' from top to bottom. The burlap curtain is used to drop down before the dropping board, as is the Minnesota house, illustrated on page 263.

On the next page are given diagrams of a plan for a house with an alleyway. The house is 6' high at the plate in front and the peak of the roof is 3' from the north side. The water vessels in this house are let into the partition under the dropping boards, so that they can be filled from the alleyway. Many houses of this style have the nest boxes also under the dropping boards, while some have arrangements for feeding mash in troughs under the dropping boards. The windows are 4'x5' and are made of muslin or have glass in them to suit the fancy of the owner, muslin being preferable. The muslin is stretched on frames hinged at the top so as to swing in. Access to the yards, if there are yards attached, is gained through gates set in the dividing fences next the house. This is a costly house to build, as it takes more lumber and labor to build it than are required for the

PERSPECTIVE

40'

ALLEYWAY

A House With Alleyway on the North Side.

other houses described. It is not nearly so common as it was a few years ago.

The next page shows two houses that can be built very cheaply. The colony house on skids can be moved from place to place about the range and the house with the wire-covered run is adapted to those who keep 15 or 20 fowls in the backyard to furnish eggs for the family. Detailed plans are not necessary. Neither of these houses requires studding, the corner boards being set up and girts nailed to them. The wire run for a few fowls is 30" high, this being high enough to give head room to almost any breed. This run is covered with wire and gives absolute assurance that the fowls will not escape and that strange birds will not meddle with the flock. The writer has kept 15 fowls in a yard like this months at a time, the run being 20' long and 5' wide. Of course every want of the birds was supplied and they kept healthy and laid as well as they would if they had been at liberty.

The piano box house has often been described and many plans for building a poultry house from the lumber in an ordinary piano box have been discussed. The piano box is a cheap source of lumber and on page 269 are given two views of houses built from piano boxes. On page 191 is another plan. It is not necessary to go into detail. The pictures show how they appear after being built. The larger two were built from the lumber of two piano boxes and the smaller from one box. At least two extensive poultry plants are equipped in full with houses made of piano boxes and they are entirely satisfactory.

The foregoing plans are not submitted as the only ones but it is believed that from them a plan may be selected that might be followed in constructing poultry houses,

A GOOD COLONY HOUSE
8x12 FT.
ON SKIDS FOR MOVING
HANDILY

CHEAP HOUSE AND WIRE COVERED RUN
FOR 15 OR 20 FOWLS—HOUSE 8x12 FT.
RUN 8x12 FT. BY 30 IN. HIGH, SUITABLE
FOR A TOWN BACK YARD

Types of Houses That May Be Made From Piano Boxes.

that will cover the necessities of any poultrykeeper in any part of the country. These plans may be modified as to dimensions or interior arrangements to suit the owner. Any attempt to give plans of all the models of poultry houses in use would only mean confusion to the seeker after knowledge.

POULTRY, ORIGIN OF BREEDS OF.—There has been much discussion concerning the origin of our domestic fowls. Scientists are agreed that the original wild fowl from which the domestic races sprang had its home in the far East—India, Ceylon, Java and the islands farther east, perhaps from one, possibly from all these sources. It was long thought that our domestic fowls were descended from *Gallus Bankiva* or jungle fowl of India, but later claims have been made for *G. Stanleyii*, *G. furcatus* and *G. Sonnerati*. As good an authority as Darwin concluded that the Asiatic fowls, such as Brahmas and Cochins, were descended from a different variety of wild fowl, arguing that the feathers on the legs, the smaller pectoral muscles, the short wings and the differences in the structure, could not point to any deliberate effort to make changes in these respects, as they were largely defects which a semi-civilized owner would not value. It has been noted by one writer that the earlier specimens of the Asiatic fowls were tame and quiet, and instead of seeking a secluded place to build nests sought rather open places above the general level of the surrounding land, these traits indicating that these breeds were descended from wild fowl which had lived for ages in an open country where the land was level and subject to overflow, remarking the difference in these respects between the Asiatic fowls and those with clean legs which were descended from the tree-roosting, nest-hiding

jungle fowls of the wooded sections of India or the islands adjacent thereto.

These speculations do not lead to anything. We know that the wild jungle fowl of today (*G. Bankiva*), resembles the Black-Breasted Red game fowl of our poultryyards in color and shape and in the crow of the cock and the cackling of the hen. We know also that these wild fowls will cross with tame ones and produce fertile progeny, and that Asiatic fowls and other breeds intermix without the least difficulty. To be sure several races of wild pheasant interbreed to such an extent that purebred birds are now hard to find, but the fact remains that the authentic history of the domestic fowl, so far as it has been possible to trace it, takes us back to India, the Sanskrit language and the "institutes" or "codes" of Manu, 1,000 years before the beginning of our era.

From that time we have a tolerably connected history and a logical theory as to their introduction into the western world, as represented by the European countries. So long as man ran wild, was a nomad traveling to and fro, he sought food and raiment among the wild things that grew or bred in the countries through which he passed or in the territory about which he wandered. Later life became more complicated. Communal life had its origin and tribes became fixed in villages or confined to certain restricted territory. It now became necessary to till the soil and secure domestic animals in order that the food supply might be constant and dependable. It is doubtful whether this motive impelled the ancient tribesman to tame the wild fowl of the woods and mountains. He was fond of war and so was the jungle fowl. With less frequent forays to soothe his turbulent spirit he captured and subdued the wild cock of the jungle and made

him the instrument of his pleasure by watching him fight, an amusement that is in high favor today in our semi-civilized possessions in the Far East. One writer says many wild jungle cocks are captured by taking tame ones to their haunts and getting them in a fight with their wild kind.

The story of the distribution of the domestic fowl is the story of how history was made. Two theories have been formulated to account for the presence of domestic fowls in the more civilized parts of the world, as early at least as the beginning of our era. One is that when the Aryans swarmed out of India and began their long journey to the West to become the empire-builders of the world, they brought with them domestic fowls as well as other domesticated animals. If they did, the fowls were the only living things that survived, as there is no evidence that any of the domestic animals we now have descended in a direct line from the farther eastern countries of the ancient world.

Another seemingly and more reasonable theory is that when Cyrus made his great foray into India more than 500 years before Christ he brought back to Persia fowls such as the inhabitants of India kept in domestication. Two centuries later Alexander overran Persia and from his invasion fowls came to Greece. These the Grecians called "Persian" fowls, this being strong proof that this theory of the distribution of domestic poultry is a better one than the first.

In the period reaching back to 500 or 600 years before the beginning of the Christian era, literature has frequent references to domestic fowls, and they were figured on monuments and tombs. Zoroaster, who lived more than 500 years before Christ, and founded a religion named

after him, gave the cock a high place as the herald of the dawn and the guardian of light and the sun. On the tombs of the Harpies in Lycia, now in the British museum, is a figure of a god to whom a cock is being offered as a sacrifice. This would indicate that domestic fowls were known in the West before the Persians became world-conquerors under Cyrus the Great. On the other hand, it seems impossible that the Lycians were acquainted with the domestic fowl and that the Grecians were not, yet that they were not is evidenced by the fact that Homer does not mention them, nor is there any mention of them by his contemporaries or followers. Surely if the domestic cock had been known in those days, when clocks were unknown, his regularity in greeting the coming of morn would have appealed to the poetic souls of the nature-loving Greeks and he would have had mention if not much praise.

The earliest authentic mention of domestic fowls in western literature is found in the writings of Aristophanes, who died about 400 years before the beginning of our era. Nowhere in the Old Testament is there any reference to domestic fowls but there are mentions in the New Testament where reference is made to the hen that gathers her brood under her wings and in the crowing of the cock the night before the crucifixion. It is probable, therefore, that during the time between the writing of the last book of the Old Testament and the advent of Christ we may place the introduction of fowls into the countries of western Asia and probably eastern Europe.

While domestic fowls were slowly making their way westward there is no doubt that they were known in China centuries before western nations were acquainted

with them. Mention is made of domestic fowl in a Chinese encyclopedia, reputed to have been written at least 1,400 years before the Christian era.

Summing up all the evidence Brown thinks that domestic fowls may have reached us in two ways: Through Asia by way of China, Siberia, Russia, and thence into Europe from the north, or from India to Persia and thence to Greece and the more western nations of Europe. That they had even penetrated Britain at an early date is proved by Caesar, who tells of the fighting cocks of the Britons at the time he overran and subdued that island. When the original breeds broke into the numerous varieties of modern fowls we do not know nor is it probable that we ever shall know. How it happened that the Chinese began to breed fowls with feathers on their legs and toes or how the original ancestors of the Polish fowls were secured, is lost in the mysteries of prehistoric days.

It is probable that there were good reasons why some of the pheasants with plumage of brilliant hues were not chosen rather than the sober-hued jungle cock, but what these reasons were have been forgotten. Brown in his "Races of Domestic Poultry" enumerates and describes 67 distinct breeds or races of fowls, many of these being further sub-divided into several varieties. Surely the poultry breeder of today should be at no loss to secure a variety exactly to his liking. Yet the making of varieties goes on, and even new races are being built up from interbreeding two or more of established breeds. Of the making of new varieties there seems to be no end.

PROTECTION FOR POULTRY YARDS.—The best protection for poultryyards is a thickly-set row of evergreen trees, set on two sides so as to shield them from the prevailing cold winds. In this country these usually

come from the north and west, but in limited areas they come from other points of the compass.

PROTECTING CHICKS FROM OLDER ONES.—

Frequently it is desirable to allow young and old fowls to run together. This creates trouble, as the young chicks require more frequent feeding than the older ones. To avoid this trouble a "creep" is used, similar to an arrangement used by shepherds to feed lambs and keep away older sheep. A creep is made by making a pen about 6' square and covered with wire netting. This pen should be made on a framework so it can be easily moved. Feed for the chicks is scattered in the pen far enough from the edge so the older fowls cannot reach it from the outside. Then the pen is raised on blocks just high enough to allow the chicks to pass under but prevent the older fowls from getting inside. As the chicks grow the creep is raised enough to easily admit them. This saves watching the chicks while they are eating and allows them to get feed at any time, or to escape from the persecutions of the older fowls. It is not recommended that chicks and older fowls should run together, but sometimes this is necessary and then the creep comes in very good play.

PROTECTED TROUGH.—The protected trough is designed to prevent fowls from wasting ground feed when fed dry. It is simply a trough protected by upright slats, roofed over. The fowls can eat from between the slats but are prevented from throwing the feed on the ground. They may be made of any size suitable for any breed of fowls. For mature fowls the slats are usually 2" wide and spaced the same distance apart. Very often a V-shaped trough is made and the slats nailed across the top. This form of protected troughs is not as satis-

factory as the one illustrated, as the fowls often walk along the top and foul the feed with their droppings.

PURE BREEDS.—The fact that those who make a business of keeping poultry for market purposes invariably keep pure-bred fowls should be sufficient answer to the question, Does it pay to keep pure-bred poultry? On general principles a pure-bred flock will be more profitable than one that is of mixed blood because the uniformity of breeding makes it easier to feed the flock as a unit and get the best results. In a mongrel flock there may be some birds of the meat breeds, some of the egg breeds and nondescripts of all kinds, large and small. Uniformity always attracts attention in the market and uniform lots bring the best prices. However, no one should buy chickens or other fowls merely because they are pure-breds, for some pure-breds are no better as layers than mongrels.

QUILL FEATHERS.—The large feathers in the wings and tails of turkeys and the quill feathers in geese find a ready sale in city markets. These feathers are used for making brushes, toothpicks and in the case of white wing feathers large numbers are used in making ornamental quills or artificial wings for women's hats. They should be thoroughly dried and tied in bundles before being sent to market. Commission merchants in large cities will dispose of them.

QUININE.—Quinine as a tonic is often useful in doctoring sick fowls. It is especially useful in treating colds that do not yield readily to treatment. It should be given in capsules holding one grain, and the doses should be about 12 hours apart in ordinary cases. More than three or four doses should not be given.

QUICK FATTENING.—To fatten fowls quickly, according to the American method, shut them in small numbers in a place that can be darkened so as to maintain just light enough for the hens to see to walk about, except when they are eating. Feed a mixture of ground oats, cornmeal, cracked wheat and wheat middlings, scalded and made into a dough with hot water. Feed as often during the day as they will eat the feed clean. Give them all the water they will drink and keep grit where they can get it. Do not feed green stuff of any kind. Boiled potatoes, rice, cornbread, cracked corn or whole wheat, may be fed for variety. By this method fowls can be made very fat and plump in from 10 to 14 days. They should be disposed of as soon as fully fitted for the table, as they will lose their appetites if fed too long, after which they will lose weight rather than increase it.

QUICK-FATTENING METHOD.—A method of fattening quickly, which appears to work as well as the cramming method used in Europe, is to shut the fowls in a small run where they cannot take much exercise and feed them all they will eat of a mixture of cornmeal, buckwheat flour and milk, mixing these just so the mixture will drop from a wooden spoon but not run. Feed all the fowls will eat and remove the feed troughs as soon as they have eaten. Give them plenty of water, charcoal and grit. Feed in this manner for 10 days or two weeks before they are to be sent to market and market at once. If fed in this way for more than two or three days after they have become fitted for market they lose appetite and weight. Some fowls will fatten in 10 days while others will not become thoroughly fitted for two weeks. Fowls fattened in this way are deliciously tender and palatable. Chicks fed in this way are

known as milk-fed chicks and bring the highest prices in city markets. Some feeders add a little tallow to this ration during the latter half of the feeding period. The tallow should be raw beef suet chopped into small pieces and should be fed sparingly. If milk is not available in mixing this mash water may be substituted, but it is not as good.

RATIONS, BALANCED.—A ration is the whole quantity of feed supplied in one day. This should be borne in mind because it is rather common to call a ration the feed supplied for one meal. A balanced ration is a ration so compounded of a variety of feeds that it meets all the requirements of a fowl in the way of nutrients, so as to promote symmetrical growth, maintain health and vigor and, in the case of laying hens, supply sufficient nutrients to enable them to produce eggs to the utmost limit of their capacity.

While no ration will make a good layer of a hen that is naturally a poor layer, it is quite possible to feed a ration so badly compounded that it will be impossible for a good layer to which it is fed to produce eggs to the limit of her capacity. When we use the term "feeding for eggs" we mean feeding a ration that will supply all the nutrients needed by a hen to produce eggs to the extent of her limit, be she a good layer or a poor one. In considering the balanced ration it is perhaps best to inquire into the essential elements of such a ration before going into the composition of it and the manner of computing it. In this connection we quote Prof. James E. Rice of the New York College of Agriculture:

"Fowls do not always use the nutrients in the same proportions. For instance, it is to be expected that if fowls are kept in very cold quarters, or if they are com-

pelled to take vigorous exercise, they will use up more of the fuel nutrients than they would otherwise. So too hens in active laying will require a larger quantity of protein than hens not laying in order to secrete the white of the egg, which is a form of protein called albumen. The same principle will apply to the ration for growing stock. To a certain extent fowls are able to adjust themselves to rations deficient in carbohydrates. This is a wise provision of nature. It enables a fowl to survive under misuse. The good feeder, however, will not take advantage of this quality to feed improper feeds because the ultimate result will be loss of production and impaired digestion. For example, if a narrow feed (one very rich in protein) be fed, the kidneys and liver are unduly taxed in an effort to work off the excessive quantity of nitrogen. There being a deficiency of carbohydrate feed the animal burns up protein, a more expensive fuel than carbohydrate feed. It would be like burning mahogany instead of maple because mahogany happens to be in the house.

“Fowls are not able to adjust themselves to rations deficient in protein. In their effort to do so they consume more carbohydrate feed than can properly be digested and assimilated. The first result of this excess is to produce fatness; in extreme cases it ultimately ends in starvation because the fowl cannot eat enough feed to obtain a sufficient quantity of protein to satisfy its needs. In other words, although protein (growth nutrient) may take the place to some extent of carbohydrates (fuel nutrients), no amount of carbohydrates can be substituted for protein in a ration for fowls. The fowl can burn up protein if necessary. Therefore we should make the ration suit the fowl, and not ask the fowl to adapt itself

to the ration. The condition of the fowls is always the best guide in making rations. If they are getting too fat cut out feed rich in carbohydrates and put in feeds rich in protein, in their place, feed less liberally, and induce the fowls to take exercise."

Here Prof. Rice gives the key to an important fact in poultry breeding. It is the fat, lazy hen that does not lay. A hen rarely becomes too fat to lay well if she is given an opportunity to take abundant exercise. Keep the hens fat, but keep them in good hard condition by keeping them at work. The good farmer likes to keep his horses fat but he knows a stall-fed fat horse is not worth nearly so much for work as one that has been made fat while at regular work. Continuing Prof. Rice says:

"Some of the essential points of a good ration are: It should be composed of feeds every one of which the fowls like. It should contain a sufficient quantity of digestible nutrients to supply the needs of growth and large production. It should contain enough bulk to enable the digestible nutrients to act quickly upon it. It should not contain an excess of indigestible fiber, which must be thrown off by the system, thus causing waste of energy. A certain portion of the ration should be of whole grain in order to provide muscular activity for the digestive organs. This is made necessary in grinding grain. Under certain conditions a quantity of the ration should be of ground grain. This is for the purpose of providing quickly available nutrients to supply the immediate demands of rapid growth or heavy, continuous egg yield. It must provide a good variety of feeds in which are included grain, green feed, meat and mineral matter in proper proportions. The feeds in the ration must not

have an injurious effect upon the color or flavor of the product. The age of the fowl, the breed, the kind of product which it is desired to produce, must be taken into consideration; as to whether the feed is intended to grow bone and muscle or to produce eggs or to fatten. It pays to give such points close attention.

"The ration must provide the two classes of feed nutrients, the protein and carbohydrates, in such proportions that they will supply the daily need of the fowl's system. It must also provide sufficient digestible protein to supply the waste of tissue with new growth, and to produce eggs. It must provide sufficient carbohydrates to furnish heat, energy and to lay by a little surplus fuel in the form of fat. It is not how much a fowl eats, but how much it can digest, that determines the value of feed. Various classes of animals differ in their capacity to digest the same kinds of feeds. Feeds also vary in their digestibility when used by the same animal. Unfortunately, the proportions of each poultry feed which fowls can digest ordinarily have not as yet been determined. Therefore we are obliged to accept standards of digestibility which are used in formulating rations for other animals as the result of many experiments."

The principles laid down by Prof. Rice contain everything that it is necessary we should keep in mind when formulating a ration for fowls. As he remarks, we have no such authoritative feeding tables as have feeders of other classes of stock. Investigators have never made the careful experiments with poultry that Wolff and others have with horses, cattle, sheep and swine. The best and about the only work of this kind that has been done in this country was by Wheeler at the New York station. He found that about 500 pounds live weight of

hens, that is about 100 hens weighing 5 pounds each, would require per day :

Dry matter.....	27.5 pounds
Ash.....	1.5 pounds
Protein.....	3. pounds
Carbohydrates.....	18.75 pounds
Fat.....	1.75 pounds

This has a nutritive ratio of 1:4.6.

As carbohydrates and fat have the same duties to perform in nutrition it is customary to add them together in formulating rations. In the foregoing formula the fat content is 1.75. This multiplied by 2.25 gives 3.9375. For convenience we call this 3.94. This expresses the fat in terms of carbohydrates. Adding this to the carbohydrate content of the ration (18.75) we have 22.69 as the carbohydrate content of the ration.

In order to save time and make it plain an invariable rule is followed in describing the nutritive value of a ration. This is to consider the protein content as representing unity, making it easy to determine the nutritive ratio of any ration and to see at a glance whether it is balanced as it should be. To get this ratio we divide the carbohydrate content by the protein content. In this case we have 22.94 as representing carbohydrates and 5 as representing protein. Dividing the carbohydrates content (22.94) by the protein content (5) we have 4.59, so we say the nutritive ratio is one of protein to 4.59 of carbohydrates. In practice we write it thus: 1:4.59, or still further to simplify the matter we call the 59 hundredths six-tenths and write the nutritive ratio thus: 1:4.6. It is customary to ignore small fractions in computing feed values in this way.

When formulating rations for fowls it is customary to accept a ration that is anywhere from 1:4.5 to 1:5.5 as

SAMPLE RATIONS FOR FOWLS. FORMULATED BY PROF. J. E. RICE.

	Dry matter.	Ash.	Protein.	Carbohy- drates.	Nutri- tive ratio.
10 pounds wheat middlings.....	8.80	.380	1.28	6.07	1:4.7
18 pounds corn meal.....	16.02	.27	1.422	13.752	1:9.7
10 pounds oats, ground.....	8.9	.3	.92	5.68	1:6.2
15 pounds potatoes, boiled.....	3.15	.15	.135	2.475	1:18.3
1 pound meat scrap.....	.893	.041	.662	.331	1:0.5
10 pounds skimmilk.....	.94	.094	.29	.59	1:2
Total, 64 pounds.....	38.703	4.231	4.709	28.898	1:6.1

The above ration is deficient in protein, but would make a very good ration to feed to fowls which were being fitted for market.

	Dry matter.	Ash.	Protein.	Carbohy- drates.	Nutri- tive ratio.
10 pounds wheat.....	9	.180	1.02	7.3	1:7.2
10 pounds corn.....	8.9	.15	.79	7.64	1:9.7
5 pounds oats.....	4.45	.15	.46	2.84	1:6.2
4 pounds wheat bran.....	3.52	.232	.488	1.812	1:3.8
4 pounds oats, ground.....	3.56	.12	.368	2.272	1:6.2
2 pounds wheat middlings.....	1.76	.076	.256	1.214	1:4.7
2 pounds meat scraps.....	1.786	.082	1.324	.662	1:0.5
10 pounds mangels, raw.....	1.30	.11	.11	1.04	1:5.1
5 pounds turnips, boiled.....	.475	.04	.05	.3825	1:7.7
10 pounds skimmilk.....	.094	.07	.29	.59	1:2
Total, 72 pounds.....	35.691	1.210	5.156	25.7525	1:5

The above ration has a nutritive ratio of 1:5. It is a little too rich in carbohydrates, but would make an excellent ration for hens to keep them in laying condition in winter. Keep in mind the fact that in cold weather more carbohydrates are needed than in warm weather. The Esquimaux lives on seal blubber because he must have an abundance of carbohydrates (fuel, etc.), to maintain animal heat in his arctic climate. So with a hen; she must have more fuel in winter than in summer.

being near enough for all practical purposes. Unfortunately there is no rule by which a ration may be figured out and we are obliged to go by the "rule of thumb" and work out the rations we feed by trial. When grain and ground feed are given in a formula for a ration it is not because they are to be fed together, but because they are a part of the feed for the day. The grain may be fed at one time in the day and the ground feed at another. The formulas on page 283 are given as examples. They were worked out by trying various quantities of the several feeds until a ration suitable for the purpose for which it was needed was found.

It will be noticed in the ration last given that it contains raw mangels and boiled turnips. If both of these are not easily procured either might be used in the place of the other without materially affecting the value of the ration, although the mangels are better than the turnips, as they have a nutritive ratio of 1:5.1, while turnips have a ratio of 1:7.7. In case of either of these feeds it is the bulk we are after rather than nutritive value. Both the rations contain skimmilk. This is not always procurable, and where this is the case a little more meat scrap may be added to the ration and water substituted in mixing the ration. Notice that wheat middlings are almost exactly a balanced ration. This is one of the most valuable of feeds for growing chicks or laying hens. It will also be noticed that wheat bran is rich in protein. One of the most successful poultrymen keeps a protected trough of wheat bran where his chicks and laying hens could have access to it.

When describing rations we say they are "balanced," "wide" or "narrow." The meaning of a balanced ration has been explained. A ration is called narrow when it

contains an excess of protein and wide when it contains an excess of carbohydrates. If we accept the ratio 1:4.6 as a balanced one for hens, a ration containing more than 4.6 of carbohydrates to 1 of protein would be called a wide ration, and one containing less than this quantity would be called a narrow one. A thorough understanding of this subject gives the poultrykeeper a chance to feed to produce the desired results at the least expenditure for feedstuffs.

In the tables given under the head of "Feed" the fats have been reduced to terms of carbohydrates and added in to save trouble in computing the value of several feeds.

RATS IN POULTRY HOUSES.—Rats may be kept out of a poultry house by sinking wire netting all around it to the depth of a foot. Dig a ditch around the poultry house and line the inside bank with wire netting, 1" mesh, 1' wide and replace the earth. When the house stands off the ground the wire should be wide enough to reach from the lower edge of the wall to the depth of 1' below the surface. If an earthen floor is used the use of a stone, brick or cement foundation sunk into the ground 1' will prevent rats from getting in.

REGULARITY.—Fowls should always be fed at regular times. If this is done they will soon learn to know when feeding time comes and will not worry until after that time passes. Above all feed fowls so as to keep them in good condition. Many a poultryman has thrown away the profits of his flock of laying hens by letting something prevent his feeding them properly for a few days. On Sundays and holidays fowls should be fed the same as on other days and as regularly. A flock of laying hens fed by a hit-or-miss system will never produce at its best.

ROUP, CURE FOR.—The following treatment for roup when it has extensively infected the flock is recommended by the New York Experiment Station: A solution is made of one teaspoonful of permanganate of potash, dissolved in one pint of water. All the cheesy matter is picked off with a toothpick and the spots painted with iodine. Then the heads of the sick fowls are dipped in the solution. This treatment to be repeated daily until a cure is effected.

ROUP.—Roup is a very contagious disease of poultry caused by a specific germ. Some authorities speak of roup, diphtheria and catarrh in fowls, but Prof. Philip B. Hadley of the Biological Division of the Rhode Island Experiment Station classes all the symptoms usually ascribed to these three diseases as different forms of the same disease. Stripped of its technical form his description of roup includes a discharge from the nostrils, the eyes, the slit in the top of the mouth, the throat and windpipe, the disease extending even to the intestines and blind gut. If allowed to go unchecked the majority of cases terminate fatally from a combination of the poisonous action of the microbes which cause the disease, from choking or from a wasting away of the flesh owing to internal complications. The specific germ that causes the disease has not been definitely isolated, but it appears to be closely related to the germ that causes white diarrhoea in chicks and blackhead in turkeys—not the same germ probably but a nearly related one.

Roup often appears in isolated localities where it could hardly have come through infection, and it seems quite probable that the germ causing it is everywhere present ready to take advantage of favorable conditions to multiply and become the cause of an epidemic. It would seem

that it always originates in a cold, when it appears in a healthy flock that has not been subject to contagion. There is very good reason to believe that the disease is not infectious, as the writer has known it to rage in one yard while the fowls in another near by showed no symptoms. The following from "The Breeder's Gazette" agrees very closely with present knowledge of the disease and gives a course of treatment which has been found as efficacious as any tried:

"The very best way to treat a bad case of roup is to kill the patient and burn the body. Then try to save the remainder by using some thorough system of disinfection that any druggist will recommend. Roup starts from carelessness, possibly through ignorance or lack of knowledge. No one would deliberately expose his fowls in a way to ruin their health, but many do not know that a little crack in the wall of the poultry house or some other exposure to unequal temperature may start a cold with disastrous consequences. Colds are shown by a watery discharge from the nostrils and a gathering of a frothy substance in the corners of the eyes. Sometimes hens will rattle in their throats when they breathe or they will sneeze, especially after going to roost. Usually common kerosene will cure a simple cold, if taken when it first shows. Put the oil in a sewing machine oil can and squirt it into the nostrils and the slit in the top of the mouth. If the cold seems severe give the patient a one-half grain capsule of quinine once a day for two or three days.

"Another good cure is peroxide of hydrogen, reduced one-half with water. Drop a few drops of this in the eyes, nostrils and the slit in the roof of the mouth. Keep this in a glass bottle and use a glass syringe when admin-

istering it or simply drop it out of the bottle. To prevent colds and keep roup at bay, put enough permanganate of potash in the drinking water to give it a slight reddish color. This permanganate of potash dissolved in water until the water is a deep claret color and used as a wash for the head and mouth is a very good cure for mild cases of roup.

"When a cold degenerates into any of the diseases known as roup it is time for the owner of the sick fowl to take immediate action. Roup has several phases and is known by several local names. It is called 'swelled face,' 'pip,' 'canker' or 'catarrh.' Some authorities call the kind that appears as a swelling on one or both sides of the face, 'catarrhal roup,' and the kind that develops a tough yellowish membrane in the throat and mouth as 'diphtheretic roup.' Either kind may easily be known by the foul odor known to poultrymen as the 'roup smell' which once met is always recognized. When it reaches this stage it has become contagious. The pus clogs up nostrils or throat, according to the form of the disease, interfering with the breathing of the patient. The fowl coughs and sneezes to throw the obstruction out, wipes its beak on its feathers and the diseased and germ laden matter is scattered about the feed boxes, the poultry house and on other birds only to be swallowed and produce disease.

"Radical measures must be adopted to effect a cure. If the face is swelled near the eye or one or both sides, watch the swelling and when it becomes soft in the center open it freely with a sharp knife, cutting from the upper to the lower side. Cut deep enough so the enclosed pus will drain out, then wash the wound with a mixture of peroxide of hydrogen and water, half and half. Drop

the mixture into the wound and continue until it ceases to foam. The foaming shows that diseased tissue is being burned out although the operation is almost absolutely painless. After this, anoint the wound with a good carbolic salve. Put some of the mixture in the mouth so as to wash out or kill the germs, and keep the patient in a warm, dry room for a day or two. If the disease shows the 'canker' spots of diphtheria take a sharp splinter of soft wood, such as a match whittled to a flat, sharp point, and gently lift the 'canker' or false membrane and thus loosen and remove it. Then wash thoroughly with the mixture of peroxide of hydrogen and water, or better, put the mixture in a glass tumbler or fruit jar and dip the head of the patient in it deep enough to cover the whole head, allowing the patient to strangle slightly, so as to force the mixture into the throat, nostrils and every part of the mouth. Keep the patient under observation and if the raw spots where the membrane was removed do not begin to heal at once repeat the operation. Keep the sick fowls by themselves in a warm, light room. Feed them on warm mash. If the fowl will not eat force the feed into its crop. Stale bread soaked in milk and squeezed dry enough to make into little balls makes a good feed for sick fowls.

"Roup can be prevented. Cold and roup come from keeping fowls in badly ventilated houses; keeping too many in one room; and allowing dampness in the poultry house; and allowing the droppings to accumulate in the house. Hens will endure cold without injury but a very small hole in the side of the house may allow a draft from a high wind to strike a hen and start her on the way to a case of roup. They may run out of doors in very cold, windy weather without injury if they

have a dry, windproof house to go into when they begin to feel cold. They will dabble around in mud and slush all day and escape trouble if they have a house which is free from dampness to retire to at night."

SALT.—Salt is as necessary to fowls as it is to human beings. It aids digestion and makes the blood richer. Two ounces a day to 100 hens is enough. Fowls sometimes eat salt and die because they have been deprived of it and eat too much when they get a chance to help themselves.

SCALY LEG.—This is the work of a very minute insect which burrows under the scale on the legs of fowls and lives there. Its excretions are of a lime-like consistency and if the insects are allowed to remain at work these excretions form unsightly masses and destroy the scales as well as the symmetry of the shanks. This trouble is very easily combated. Simply grease the shanks of the fowls with lard, rubbing it in so as to get it lodged under the scale. This kills the insect, softens the lime-like growths and stops further progress, but the shanks never recover their natural condition. If the legs of fowls are greased lightly occasionally this disease will not attack them. It rarely makes its appearance where poultry houses are kept clean and properly whitewashed. Asiatic fowls are more liable to scaly leg than the breeds with clean legs.

SEPARATING THE SEXES.—It is best to keep the sexes apart except during the hatching season. This gives the poultryman infertile eggs, which will keep fresh and sweet in hot weather for weeks, while a fertilized egg will spoil in a few days, when the temperature is high. It also has been shown by careful experiments that unmated hens will produce more eggs than hens which have

males in the same yards with them. In the Australian laying competitions 186 eggs were laid in a year by 600 hens, this record being the average for the whole number. An average of 241 eggs each was made by six of these hens kept in one pen.

SHIPPING CRATES.—On page 247 are given illustrations of the crates used in shipping breeding fowls to distant points. Where the fowls are to be more than 24 hours on the road a cup of water should be fastened in one corner at a convenient distance from the bottom for the fowls to drink from, and so placed that the express messenger can easily put water in it. The shipping crate for young chicks (page 247) shows how the separate trays are fastened together and how each tray is divided into four sections in order to prevent too much jostling of the chicks. The trays should be lined with some soft material and each covered with burlap.

SHRINKAGE OF DRESSING FOWLS.—Fowls lose from 8 to 11 per cent in dressing without removing the intestines. When the intestines are removed the shrinkage runs from 25 to 30 per cent. These figures are the result of numerous tests. When fowls are well fattened and have been deprived of feed for at least 12 hours before being killed, as all fowls should be, the shrinkage will not exceed the smaller percentages named given. The foreman of a large packing house has estimated the shrinkage from dressing at about 10 per cent, but the fowls he referred to were fattened perfectly and left without feed for 24 hours before being killed. The shrinkage from other classes of poultry does not vary widely from the figures given.

SIX HUNDRED HENS.—One of the most instructive experiments on a large scale ever carried out was con-

ducted by Prof. Horace Atwood at the West Virginia station in 1907. To determine the profits of keeping a large flock he took 600 White Leghorn pullets averaging 5 months old, weighing an average of 2.53 pounds when the experiment began, and carried them through a year, keeping careful account of all expenses connected with the keeping of the flock. These 600 hens laid during the year 67,769 eggs or 5,647 dozen and 5 eggs, averaging 113 each. The eggs were sold in the market at from 20 to 40 cents a dozen and brought \$1,458.87, an average of a fraction more than 24 cents a dozen the year through, an average price easy to reach when hens are kept so as to lay well in winter when eggs are high in price. The house they were kept in is described and a plan given in another place. That the hens were well kept is shown by the record for December and January, in which months they laid 3,372 and 4,645 eggs respectively. The quantity and cost of feed for the year follows:

	Pounds.	Cost.
Cornmeal.....	3.441	\$42.88
Wheat bran.....	5.434	71.74
Wheat middlings.....	2.932	39.82
Oilmeal.....	950	18.72
Wheat.....	10.509	152.21
Corn.....	8.952	103.81
Beef scrap.....	3.463	57.70
Green cut bone.....	178	1.33
Eusilage.....	1.536	3.75
Rye.....	1.120	16.80
Ground oats.....	337	5.73
Oyster shell.....	1.510	8.30
Mica crystal grit.....	1.400	7.70
	Gals.	
Skimmilk.....	205	4.10
		<u>\$534.59</u>

These hens consumed more than 36,000 pounds of grain, beef scrap and cut bone, an average of 60 pounds

each at a cost of about 89 cents each, which may be taken as the average feed cost of keeping a hen where prices range as they did at this time. During the year 54 hens died, and these were charged to expenditures at \$8 per dozen, the price fixed for the other fowls. At the end of the year 25 per cent was charged for depreciation and \$66 charged to the interest account. When the balance was struck at the end of the year the account stood as follows:

EXPENDITURES.	
For feed.....	\$534.59
For labor	120.00
For fowls which died.....	36.00
For depreciation in the value of fowls due to age	100.00
For interest on investment.....	66.00
For profit on 600 hens	602.28
	<u>\$1,428.87</u>
INCOME.	
For eggs.	\$1,458.87

This shows a profit of a little more than \$1 per hen, which is net profit instead of the profit above feed cost, as is frequently the case in published accounts of the profits of poultrykeeping.

It will be noticed that \$120 was charged to labor. This would indicate that one man was kept busy about one-third of the time in caring for these fowls. It seems safe to say that one man could easily care for 1,000 hens and under similar conditions could make \$1,200 per year.

HENS, COST OF KEEPING.—Prof. Atwood estimates that it costs 25 cents per pound a year to keep the average hen at the prices prevailing in 1909. He bases his estimate on the cost of keeping a large flock at the West Virginia Experiment Station. It has been asserted that it costs twice as much to keep a Light Brahma as it does a Leghorn. We would say that we think the differ-

ence is probably not quite as great as this, as the Leghorn hen would require proportionally more feed to supply material for the larger number of eggs she would produce, although Prof. Thompson of Australia has asserted that the larger breeds consume "a great deal more" feed than the Leghorns. In our own yards we once weighed the feed for a pen of Leghorns and a pen of Brahmas and found that the Leghorns consumed but three-fifths as much feed as the Brahmas.

SKIMMILK FOR CHICKS.—At the Indiana Experiment Station W. B. Anderson tested the value of skimmilk in feeding young chickens. He selected two lots that received the same treatment except that Lot 2 was given all the skimmilk the chicks would eat, in addition to the grain ration. The test was continued eight weeks. Lot 1 consumed 180 pounds of grain and the average weekly gain per chick was 2.62 ounces. Lot 2 consumed 217 pounds of grain and 90 pounds skimmilk and the average weekly gain per chick was 4.46 ounces. The milk was very profitable as it improved the digestion of the chicks as well as making the ration more efficient, resulting in more rapid growth. The experiment was repeated with practically identical results. If a 10-pound baby would make the same proportionate gain it would weight 260 pounds when three months old. This shows that the digestive organs of a chick work at high pressure.

SKIMMILK FOR LAYING HENS.—At the West Virginia Station Prof. Atwood made a very thorough test of the value of skimmilk in feeding laying hens. The milk was allowed to sour before being fed and then was used to moisten the mash of the flock to which it was fed. Two flocks were used in the experiment. One was given a mash moistened with the sour skimmilk and the other

a mash moistened with water. In all other respects the fowls were treated alike and the birds themselves were as near alike as possible. In two trials 802 quarts of skimmilk were fed, resulting in an increase in the egg production of 702 eggs. These eggs sold at from 20 to 25 cents per dozen. At these figures the value of the skimmilk for hens was from $1\frac{1}{2}$ to 2 cents per quart. In reporting this experiment Prof. Atwood remarks that thick sour milk seems to have greater value for hens than sweet milk and that more experimental work is needed to clear up this matter. Very recently an eminent European physician announced that he has discovered a preparation of milk, which is fermented, that promotes health in human beings, and it has long been understood that the koumyss of the Tartar tribes (which is fermented milk) is a very wholesome drink. It seems to be well established that the lactic acid in sour milk improves digestion, and is beneficial in assisting the organs of elimination in throwing off the waste matters of the system. No doubt something of this kind is brought about when sour skimmilk is fed to hens. At any rate, Prof. Atwood has demonstrated that skimmilk is more valuable when fed to hens than for any other purpose to which it usually is put.

SORGHUM SEED.—The seed of sorghum cane is esteemed as a feed for poultry. In many sections it is freely grown for the purpose of making syrup for table use. The seed is produced freely and is usually allowed to waste in the field where it was made. If it were saved and fed to poultry it would go a long way towards paying the expense of growing the crop.

STANDARD OF PERFECTION.—The "Standard of Perfection" is a book published by the American Poultry

Association which describes with great minuteness the shape and color of every variety of poultry recognized in this country. It assumes the prerogative of passing on the eligibility of all new breeds for a place among recognized breeds. The standard is the copyright property of the association and its revenue is derived from its sale. The standard is revised every five years, at which time new breeds, or newly-introduced breeds from foreign countries, are examined and their eligibility passed upon.

STANDARD WEIGHT OF EGGS.—Custom has made the standard weight of eggs 2 ounces each. Iowa has a law making this the legal weight, but no other state has legislated on the subject.

STANDARD WEIGHTS OF BREEDS.—The American Standard of Perfection requires that most of the breeds of fowls mentioned in it shall reach a certain weight. This varies considerably in the different breeds and even in the varieties of the several breeds. We give the weights required for matured specimens, the weights of cockerels and pullets being usually about one pound lighter than cocks and hens in the respective varieties. The weights follow in pounds and fractions: Plymouth Rocks, all varieties, and Javas, cock $9\frac{1}{2}$ and $7\frac{1}{2}$; Wyandottes and Rhode Island Reds, cock $8\frac{1}{2}$ and hen $6\frac{1}{2}$; Buckeyes, cock 9 and hen 6; Dominiques, cock 8 and hen 6; Light Brahmas, cock 12 and hen $9\frac{1}{2}$; Dark Brahmas and all varieties of Cochins, cock 11 and hen $8\frac{1}{2}$; Langshans, cock 10 and hen 7. Leghorns, no weight requirement; Black Minorcas, cock 9 and hen $7\frac{1}{2}$; White and Rose Comb Black Minorcas, cock 8 and hen $6\frac{1}{2}$; Black Spanish, cock 8 and hen $6\frac{1}{2}$; Andalusians, cock 6 and hen 5; Anconas, no weight requirement; White Dorkings, cock $7\frac{1}{2}$ and hen 6; Silver Gray Dorkings, cock 8 and

hen $6\frac{1}{2}$; Colored Dorkings, cock 9 and hen 7; Red Caps, cock $7\frac{1}{2}$ and hen 6; Orpington, all varieties, cock 10 and hen 8; Polish, no weight requirements; Hamburgs, no weight requirements; Houdans, cock 7 and hen 6; Crevecoeurs, cock 8 and hen 7; La Fleche, cock $8\frac{1}{2}$ and hen $7\frac{1}{2}$; Standard Games, no weight requirement; Cornish and White Cornish, cock 9 and hen $6\frac{1}{2}$; Black Sumatras, no weight requirements; Black Breasted Red Malays, cock 9 and hen 7. Bantams are valued according to their smallness and are disqualified if they weigh a few ounces more than the standard weight. Bantam weights follow: All Game Bantams, cock 22 and hen 20 ounces; all Sebright, Rose Comb, Booted White, Polish and Japanese bantams, cock 26 and hen 22 ounces; Brahma and Cochin bantams, all varieties, cock 30 and hen 26 ounces; Silkies, Sultans and Frizzlies, no weight requirement.

The standard weights of turkeys are in pounds: Bronze, male 36 and female 25; Narragansetts, male 30 and female 18; Slate and Black, male 27 and female 18; White, male 26 and female 16.

The standard weight of ducks, in pounds: Pekins, Cayugas and Blue Swedish, drake 8 and duck 7; Aylesburys and Rouens, drake 9 and duck 8; Crested White, drake 7 and duck 6; Muscovys, both varieties, drake 10 and duck 7; Indian Runner, drake $4\frac{1}{2}$ and duck 4.

The weights prescribed for geese follow: Toulouse, Embden and African, gander 20 and goose 18; Chinese, both varieties, and Wild or Canadian, gander 12 and goose 10; Egyptian, gander 10 and goose 8 pounds.

SQUAB BROILERS.—Recently there has grown up a demand in the large cities for what is known as "squab broilers," chicks four weeks old weighing half a pound each. It has been found by an extensive producer of

squab broilers in New Jersey that White Leghorns make the most desirable of this size. At the time they are to be sold they are plump and compact in body and deliciously tender and palatable. These little broilers sell in New York at a price which nets the breeder from \$1.25 a pair, for the earliest ones in the spring, down to 70 cents per pair for the last ones sold. The business is growing and extending to the cities farther west. Squab broilers are fed largely on a mash mixed with milk, which gives their flesh a peculiarly delicious flavor, and caterers who have a high-class patronage take them quickly when offered.

TAPEWORMS, DESTROYING.—In Europe considerable loss is experienced in poultry through the ravages of tapeworms. In this country this form of parasitic affliction has been comparatively rare until quite lately when several outbreaks have been reported. The Maryland station reports that almost invariably these worms were expelled and the fowl cured by administering a stiff purgative dose of Epsom salts following this with two teaspoonfuls of turpentine introduced into the crop through a rubber tube. (See Epsom Salts, Purgative Dose.)

Fowls afflicted with tapeworms become very much emaciated and the droppings usually contain considerable quantities of yellow mucus. In such droppings may be found the segments of the tapeworms that have passed from the intestines. During the last stages the birds become dull and listless. At first the appetite of the bird is in no way disturbed but when the disease reaches the stage of listlessness the appetite fails and the victims show a tendency to huddle. Most cases in Maryland exhibited a marked diarrhoea. On several occasions the birds

suffering from the disease appeared weak and epileptic. Death usually came suddenly with convulsions.

Birds suffering from tapeworm should be isolated and their droppings destroyed or treated with a disinfectant. There seems to be no certain method of diagnosing this disease except the finding of segments of the worms in the droppings.

TESTING EGGS OUT OF INCUBATORS.—It is necessary to test eggs out of an incubator in order to prevent the contamination of good ones from the bacteria that begin to infest eggs with dead germs in them. If these bacteria do not entirely destroy the life of the good eggs they frequently weaken the germs to such a degree that the chicks hatched from such exposed eggs come out weak and incapable of growing into a vigorous maturity.

TESTING EGGS FOR FRESHNESS.—Dr. Wiley of the Department of Agriculture says if one cup of salt be dissolved in 10 cups of water and a perfectly fresh egg put into the solution it will sink. After a day or two the egg will not sink so far and it continues to lie higher in the water until an egg two weeks old lies well up on the surface.

TRAPNESTS.—Trapnests show which hen lays the egg. They are the only things that show without mistake just which hens lay enough to make a profit and which ones do not pay for the feed they eat. If any poultryman will use a trapnest a year he will learn some astonishing things about his hens. He may find he has hens that lay 200 or more eggs in a year and others, seemingly just as good, that lay only a few eggs in a year. By selecting the best layers and selecting their best daughters, always breeding from a male that is from a

good layer, it will be possible to improve the laying qualities of our flocks until from an average of 64 eggs in a year flocks may be built up which will lay from 150 to 200 eggs in a year. Not every one has time to take care of trapnests, but every one might select a few hens and test them by trapnesting and from these hatch chickens for the improvement of the flock. It does not require much time to attend to a flock that is being trapnested. The writer has seen the trapnests in which 400 hens were laying gone over in 30 minutes and about four visits a day are enough. Where a dozen or two hens are being trapnested the time required would be only a few minutes four or five times a day and in the end it would pay to take this trouble.

TRAPNESTS, HOW TO MAKE.—The trapnest here described was invented by Prof. James Dryden of the Oregon station several years ago, and it has been used by him in his experiments and by several other experiment stations with perfect success. It can be made by any one who can use a saw and drive a nail. It can be made out of one board 1"x10"x12', as shown by the opposite diagram. There is no patent on the Dryden trapnest, and Prof. Dryden has publicly announced that anyone is at liberty to make and use it. The description may not seem plain on casual reading but if the directions are followed, a step at a time, it will be found that the building of the trapnest is involved in no difficulties whatever. The following is the material used:

1 board 1"x12"x10'; 6 screw eyes No. 210, bright; 2 pieces round iron 3/16"x12"; 2 pieces rawhide 9"x12"

With a square lay off the board, as shown in the diagram. The shaded places are waste pieces of the board. The solid black lines show where the board is to be cut.

Fig. 2

Fig. 1

Fig. 3

Detail of Construction of the Dryden Trapnest.

When cutting the sides apart it will be necessary to cut only as far as X, then split the boards apart and saw the required angle. After sawing the pieces the nest is ready to put together.

1. Nail the sides to the bottom so the ends will be even.
2. Stand the nest on end and nail on the back. This will square sides.
3. Stand the nest on its back and nail in the front piece.
4. Nail on the front brace, which should be set into the sides at lines indicated by A and B.
5. To the end of the bottom board nail the nest end front.
6. The two front pieces are nailed on either side of the door to the sides and the front brace.
7. Put in the piece ($10\frac{1}{2}'' \times 3\frac{3}{4}''$) on which the door is balanced; nail it in between the sides so that the inner side will be flush with the outer side of the front pieces. In this piece put a screw eye 4" from each side, the outer edge of the screw eye being flush with the inside of the piece.
8. Turn the nest on its side and bore the holes in the sides through which the $\frac{3}{16}''$ iron is to pass. The holes are 1" from the bottom and $1\frac{1}{4}''$ from the nest front.
9. On the bottom of the trip-board put in a screw eye $\frac{7}{8}''$ from the end and 1" from each side. At the other end of the trip-board bore two $\frac{3}{8}''$ holes 1" from the end and 3" from each side.
10. On the bottom and at each side of the door put in a screw eye $1\frac{1}{2}''$ from the end and $\frac{3}{4}''$ from the sides. On the upper side tack the two rawhide strips, using a small staple or nail for each. The strips are tacked on so the ends of the strap will be 2" from the end and $\frac{1}{2}''$ from the side of the door.
11. Place the door in front of the trip-board, the screw eyes down; push the rawhide strips through the holes in the trip-board; turn the board over and draw the strips up tight; then bend the door back over the trip-board until there

is a full $\frac{3}{4}$ " between the boards when laid flat; the strap should then be tacked to the lower side of the trip-board (see 2 in illustration). 12. Put the trip-board and door in place. This should be done by pushing the iron rods through the side of the box and the screw eyes in the trip-board and through the screw eyes and in the front piece and the door. Care should be taken in putting the screw eyes in the proper place or the door will not balance.

The nests may be built singly or in groups, or they may be put under the dropping boards where dropping boards are used. When so placed they do not need a top. In any case it will be an advantage to have the nests made separate and installed in a frame so each nest can be pulled out when a hen is to be released. Occasionally a hen is slow about coming out and pulling the nest out makes it easier to handle her. These nests are intended for indoor use and must be sheltered if used outside the house. The dimensions of the door as given are calculated for hens of medium size. If larger hens are kept the door should be made slightly wider. The door should not be large enough to admit two hens at one time; therefore the size of the door should be calculated for the size of the hens kept.

TURKEYS, COMMERCIAL.—For a history and descriptions see "Breeds of Fowls." Turkeys are not the kind of poultry for the man with a limited range. They have never given up the tendency of their wild ancestry to wander far from home and they will not brook confinement even for a few days, except when very young, and then they do better if they have their liberty during the warmer hours of the day. Under domestication the turkey seems to have lost some of its vitality,

as young turkeys are rather delicate and require good care to bring them up to the age where they are safe. After a young turkey has begun to show the characteristic red caruncles that cover the neck of the mature bird it is as hardy as anything in nature, enduring with perfect impunity any stress of weather.

The Bronze turkey is the favorite in this country, although considerable numbers of white turkeys are bred. The Narragansett turkey was at one time a general favorite in some parts of the East, but it is now hard to find pure specimens, as the variety was crossed with the Bronze to improve its vitality and the stronger variety dominated to such an extent that the Narragansett in its purity it is hard to find. Bronze turkeys attain great weights but it has not been thought best to breed from the largest males, rather choosing the largest hens and a male slightly below the heaviest weight attained. Rather small-boned and plump turkeys are favorites in the market and make weight as economically as large ones. Turkeys do not attain full size until two or three years old and two-year-old birds make better breeders than yearlings. One male is sufficient for 10 or 12 females, as one copulation fertilizes all the eggs in one laying or clutch and sometimes all laid in one season.

Turkey hens should be given entire liberty and allowed to seek their nests at their own will. If barrels partially covered with brush are placed on their sides in fence corners and places somewhat hidden, hen turkeys will usually accept them as nests. A thick coat of straw should be put in the barrel for the hen to arrange as a nest. The eggs should be gathered regularly and handled carefully, keeping them in a dry cool place and turning them every day. Turkeys may be hatched in incubators,

1, Bourbon Red Tom. 2, Black Tom. 3, White Tom. 4 and 5, Young and Mature Bronze Toms.

but a common hen is better. The hen turkey will lay about three clutches in a season. A good layer will lay about 30 eggs in a season and she should be kept laying by breaking her up when she goes broody. Merely destroying her nest will cause her to give up the notion of sitting and put her to laying again.

The hen turkey is a rather good mother. If she is allowed to sit she must be set where she laid her eggs. The eggs hatch in four weeks. Young turkeys should be left in the nest from 36 to 48 hours after they hatch, without being disturbed in any way. If the hen is shut up on her nest she will usually sit quietly without worrying, her whole attention being engrossed in the young birds. When the young are taken from the nest they should be put in a dry coop, in front of which is a grassy run. This need not be large, a run 4' wide and 10' long being ample. This should be made of wide boards set on edge or of wire netting with a mesh small enough to confine the young birds, as they must be protected closely for the first few days. The run and coop should be moved every day or two.

Curds made by scalding clabbered milk, squeezed as dry as possible, make a good feed for turkeys at first. This is mixed with onion tops, chopped fine and a little black pepper is added. Others feed bread soaked in sweet milk and squeezed dry. Still others mix hard-boiled eggs and stale bread into a crumbly mass and feed it with good results. This system of feeding should be continued for about two weeks. The run should be moved every day or two, as young turkeys require plenty of green feed. The brood coop should have a board floor and the mother should be confined to it. Use insect powder freely, as lice seem to like young turkeys

and they usually grow a large crop of them from the beginning.

The young birds should be supplied with water, charcoal and grit from the first. After two weeks begin to feed other feed. Table scraps and cracked corn, continuing to feed curds, if they are convenient, as they are very nutritious and easily digested. By the time they are six weeks old they may be fed grain only and allowed considerable liberty through the day. They should be fed every evening, no matter how good a range they have, as this will accustom them to coming home to sleep. If they are allowed to sleep one night away from home they will not come back to the house again, but wander here and there and sleep on any convenient fence when night comes.

In the western states where turkeys have free range they require but very little feed until time to fit them for market. Then they should be given all they will eat of sound old corn. If new corn is fed to them in large quantities it sometimes gives them diarrhoea and prevents them from putting on weight. Turkeys are usually sold alive and dressed by the buyer. Where they are dressed at home they are killed and dressed the same as chickens and the directions given under the head of "Marketing Poultry."

The deadly disease known as blackhead has of late years destroyed so many turkeys in the eastern states and has appeared in so many localities in that part of the Middle West east of the Mississippi River, that the breeding of them should be undertaken with considerable caution. Care should be taken to buy only healthy breeding stock. It is better to begin by purchasing eggs, as these rarely carry any infection with them, although it is

thought that they are sometimes infected before they are laid.

The diseases of turkeys apart from blackhead are the same as those that afflict chickens and are treated in the same way. They are quite subject to colds and roup when exposed to these diseases, but if kept away from sources of infection rarely contract them originally. In the South and Far West turkey breeding is very profitable, as there are wide ranges on which they can find their own feed and grow to full size at small cost.

The best time to market turkeys is just before Thanksgiving, but there seems to be a tendency to make the turkey a Christmas bird also and late-hatched ones may be held over with good prospects of meeting a ready sale.

Breeding turkeys for fancy purposes as a specialty is not usually a profitable venture, but when they are kept in connection with other poultry a good many can be sold at good prices. The demand is not large, but it is quite constant and a great many poultry breeders who make a specialty of breeding for the fancy trade find turkeys as a side line a branch of fancy poultry business worth taking up.

For show purposes the largest and most brilliantly-colored specimens should be selected and they should be made fat enough for market, as poultry judges are partial to a well-rounded, plump and hard-fleshed specimen in the showroom.

TURKEYS, SUMMARY OF BREEDING.—Never let the young turkey get wet; the slightest dampness is usually fatal. Feed nothing the first 24 hours after they are hatched. Before putting them in the coop see that they are perfectly clean and free from lice, and dust them with insect powder. Be sure the hen is free from lice and

White Turkeys and a Flock-Header.

dust her too. Look out for mites and large lice on the heads, necks and vents. Grease heads, necks and vents with lard. Avoid kerosene. Use only a little lard, but work it well into the down. If the down sticks together after lard is applied too much has been used. Nine-tenths of the young turkeys that die, die from lice. Remember this. Filth will make short work of young turkeys. Feed on clean surfaces. Give water only in such manner that they cannot get wet above the beaks.

The first week feed a mixture of eggs beaten and mixed with ground oats or rolled oats, salted to taste, and cooked as bread, then crumbled for them with milk or curds so they can drink all they want to. Feed every two hours, early and late. Give a little raw meat every day; also chopped onions or other tender green feed. After the first week keep wheat and ground bone in boxes before them all the time but feed three times a day on a mixture of cornmeal and wheat middlings, cooked, to which green feed has been added. Mashed potatoes, cooked turnips and cold rice are always in order. Too much hard-boiled egg will cause bowel disease. Remove coops to fresh ground often to avoid disease. Ground bone, fine gravel, ground shells and a dust bath must be provided. They must be carefully attended until they become well feathered. Finely-cut ground bones from the butchers, with meat adhering, are excellent for them. Give them liberty on dry, warm days. A high roost in an open shed, open to the south, is best for grown turkeys. A single mating of male and female fertilizes all the eggs laid in a season, hence one gobbler will suffice for 12 or more hens.

Two-year-old gobblers with pullets or yearling gobblers with old hens make a good mating. Turkeys may

be hatched in an incubator and raised in a brooder until three months old, but only in lots of 25, as they require constant attention. Capons make excellent nurses for young turkeys. It is not advisable to mate a 40-pound gobbler with common hens, as injury is likely to result. A medium-sized gobbler is preferable. Young gobblers may be distinguished from the females by being heavier, more masculine appearing about the head, heavier caruncles and a development of "tassels" on the breast. A little experience is required at first. Adult turkeys can not be kept in confinement, as they will pine away. By feeding in the barnyard a little night and morning they will not stray away very far, but can not be prevented from roaming. The hen prefers to make her own nest. Gobblers and hens of the same age may be mated but it is better to have different ages.

USEFUL INFORMATION ABOUT EGGS.—Within a few years the poultry industry has become fourth or fifth in rank among our rural industries, and promises soon to become of yet greater importance. In view of the very large preventable losses in every stage of the progress of eggs from the producer to the consumer, it becomes important to give the subject of the production and handling eggs serious thought, that these losses may be avoided. For this reason it seems advisable to give in this connection some information about eggs that will add to their value and thus increase the net revenue derived from them by the producer and those who handle them on their way to the ultimate consumer. It is impossible to give more than a guess at the aggregate value of the eggs produced in this country. While the average farmer can closely approximate the number of bushels of wheat, corn or other farm crops he produces within a

year, he is rarely able to give an intelligent estimate of the number of eggs produced on his farm. Secretary of Agriculture Wilson has estimated that the value of the eggs and poultry produced in this country in a year is about that of wheat or hay, roughly \$625,000,000, and these figures are thought to be well within the facts by those who keep in touch with the poultry business.

Secretary Coburn of the Kansas State Board of Agriculture is probably able to give as close a guess at the egg production of his state as any one in a similar position in any other state and he gives the figures for Kansas for five years as follows:

1903	\$6,498,856
1904	7,551,871
1905	8,541,153
1906	9,085,896
1907	10,300,082

This shows an increase in five years of \$3,801,226 or more than 50 per cent. If other states have made similar increases, and there is reason to think they have, the figures given by Secretary Wilson are exceedingly conservative. In spite of this rapid increase in production the supply has not kept pace with the demand, as is shown by the constant rise in prices. The farm price of eggs in 1899 was 11.15 cents per dozen, as averaged in the United States; in 1903 it was 12.37 cents; in 1904, 17.2 cents; in 1905, 18.7 cents; in 1906, 17 cents; in 1907, the last year for which statistics are available, it was 18.2 cents. The units of production are so small that we fail to realize the enormous aggregate value of poultry products.

The most important source of revenue in the poultry industry is the production of eggs. It has been estimated

by several statisticians, working separately, and using different methods, that the revenue derived from eggs is about two-thirds of the total amount received from the poultry industry. In New England in the East and in the states commonly called the Coast States in the West, those in the Rocky Mountain and Pacific Coast sections of the country, eggs are uniformly high in price. In the southern states eggs are almost uniformly low in price, as compared with other sections. Heretofore it has been accepted as a foregone conclusion that eggs would be high from Nov. 1 to about the latter part of February. It is common for farmers to look forward to Easter Sunday as the time after which there will be a sharp decline. It seems that the rule may be abrogated in the future, as during 1909 instead of declining eggs actually rose in price during April and May. The cost of producing a dozen eggs has not definitely been determined. Some Canadian estimates indicate that about 6 cents a dozen would be the proper figure. Experienced poultrymen in this country estimate that the cost is from 10 to 12 cents a dozen. A few years ago the experiment station at Cornell University undertook to settle this question through the co-operation of a number of poultrykeepers. The reports varied so widely in the matter of feed-cost that they were not of much value, especially as some of them were admittedly more in the nature of guesses than carefully kept records.

In the Australian laying competition, beginning April 1, 1908, and ending March 31, 1909, 300 hens in their first laying year, divided into flocks of 6, were fed at a cost of \$568.62, counting the pound Sterling at \$4.86 American money. These hens laid 4,506 dozen eggs, almost exactly 180 each, the feed cost per dozen being about 12.6

cents per dozen. The feed was bran, middlings, corn, wheat, meat (mostly bullocks' livers), green feed (chopped alfalfa), shells and less than \$5 worth of sundry feeds. Prices for the feedstuffs used did not vary widely from prices for the same things in this country. Incidentally it may be stated that these eggs were sold in the open market at an average price of almost exactly 31 cents, American money.

The best results ever obtained in America from carefully conducted experiments were those of Graham at the Ontario Agricultural College. Two pens, one each of Barred Plymouth Rocks and Andalusians, each pen containing 12 hens and one cock, were confined in yards from April 22 to Aug. 22, a period of four months, and the feed consumed by them was carefully weighed and the cost computed. For the four months the feed-cost of Plymouth Rock eggs was $6\frac{1}{3}$ cents and the feed-cost of eggs from Andalusians was $5\frac{4}{10}$ cents per dozen. This is a remarkably good showing, but the test was made during the period of highest laying and at the time in the year when feed is likely to be cheapest and the smallest quantity required. If the same hens have been kept through the year the eggs would probably have averaged 10 or 12 cents per dozen for the year.

The price of eggs in the final market depends altogether on the quality, and tracing back through every change of ownership every buyer has discounted the price he could afford to give for eggs in perfect condition enough to protect himself from every probable—one might almost say every possible—loss that he may experience through any lack of quality. To command the highest price eggs must be perfectly clean, weigh 2 ounces each and be perfectly fresh. Every deficiency in

any of these will reduce the price, and producers are the only ones who feel the effect of any reduction in price from any of the causes.

Eggs very readily spoil during warm weather or when kept in damp, ill-smelling places, such as cellars or storage rooms. Because of this readiness to spoil the term "fresh eggs" has come to mean a good one. The condition of an egg does not depend altogether on its age. An egg 48 hours old would be considered fresh if it had been kept under proper conditions, but an egg which has laid in the south side of a damp straw stack for the same length of time in warm weather would not be fit to eat, and, therefore, would not be classed as a fresh egg. However, eggs of this sort are often marketed.

The first thing an egg-buyer looks at is the size and condition as to cleanliness. Then he examines the egg to determine its condition as to the freshness of its contents. This is done by holding the egg between the eye and a light, known as "candling." In the cities candling eggs is a distinct and lucrative profession and candlers become remarkably proficient in judging eggs in this way. Usually an incandescent electric light is put in a tube or box in which there is only a single round opening, rather smaller than an egg. The candler picks up three eggs in each hand, taps them gently together to discover if any of them have broken shells, and then rapidly revolves each egg between his eyes and the light, judging their condition by their appearance.

In candling eggs they are separated into several qualities. Those with cracked shells are called "checks." Those in which the shell is broken and pushed in are called "dents," and "leakers" are those broken enough so the contents can run out. All such eggs, if the contents

are fresh, are sold to bakers and other people who can make use of them.

Eggs in which decay has begun are known as "spots" and "rots." The spots are those in which the bacterial growth has just begun and shows by a dark spot when the egg is candled. Rots are those which are entirely opaque as viewed by the candler. Eggs which have been held too long may be in fairly good condition, but by evaporation may lose a part of their contents. These are called "shrunk" eggs and when the contents have become watery they are known as "frothy" eggs.

Dirty eggs may be simply stained by contact with wet straw or other nesting material or they may be fouled by chicken droppings. All these departures from perfection are counted against them when they change hands and every time such a change is made. It is estimated that 17 per cent of all the eggs produced are lost through some of these disqualifying defects. This loss has been estimated as follows:

Dirties	2	per cent
Breakage	2	per cent
Chick development.....	5	per cent
Shrunk or held eggs.	5	per cent
Rotten eggs.....	2½	per cent
Moldy or bad flavors	0½	per cent
	<hr/>	
	17	per cent

Besides the loss thus figured there is a less tangible but very considerable one due to the loss by curtailed consumption. People do not like bad eggs and if such are served they are inclined to order something else next time. This cuts down the demand and reduces the price. Any city egg-dealer realizes how quickly the demand adapts itself to the quality of the product. While this loss cannot be estimated it is a very real one. Some

idea of the difference between the amount realized for eggs as they are commonly handled and the valuation placed on really high-grade goods may be obtained by a comparison of the average price of eggs in New York as they are commonly handled and strictly high-grade ones, as shown in the subjoined table.

MONTHS.	Average price (per dozen) of all eggs received in New York.	Wholesale price (per dozen) for strictly fresh eggs.
January	25.8c.	42c.
February	24.5c.	40c.
March.....	19.3c.	32c.
April	16.9c.	30c.
May.	16.6c.	31c.
June	15.5c.	32c.
July	15.6c.	35c.
August.....	17.7c.	38c.
September.....	20.7c.	40c.
October.....	21.4c.	42c.
November.....	26.0c.	45c.
December.....	27.7c.	42c.

These figures were obtained by the Bureau of Animal Industry from a firm doing an extensive business in eggs in New York City.

While on occasion deleterious bacteria may be found in eggs as soon as they are laid, the chance of their presence then is so remote that it amounts practically to nothing. It is quite possible for bacteria to penetrate to the inside of the shell of an egg if it is not properly cared for. In its natural state the shell of an egg is lined with a tough membrane made up of innumerable fibers crossing each other in every direction. As long as the egg is kept dry no bacteria can penetrate this membrane, but if the egg

is allowed to lie in a wet nest or become wet bacteria may enter without resistance. For this reason eggs should be kept dry from the time they are gathered until they are consumed.

Of the loss of 17 per cent in the value of eggs from the time they are produced until they are consumed but 2 per cent is caused by breakage and all the other causes are preventable by using proper care in handling and forwarding them to market. This loss the producer bears and every one who produces eggs to sell should use his best effort to avoid any of these causes mentioned. If each one would do his part the whole body of producers would feel the benefit in the increased prices which would be obtained and the production of eggs would become much more profitable than it ever before has been. It is the careless producer who brings about this great loss for which every one suffers the penalty.

UTILITY CLASSIFICATION.—Sometimes the several breeds of poultry are classified according to their advantages as utility fowls. The utility poultryman is not usually greatly interested in fancy points, although the time seems to be coming when utility and fancy will be represented in many cases by the same fowls. Fancy poultry breeders are taking great pains in breeding laying strains and utility breeders are taking more interest in fancy points. With a view to classifying the breeds according to their dominant characteristics we may separate them into four general classes: 1. Egg breeds; 2. Meat Breeds; 3. General-Purpose breeds; 4. Fancy breeds, sometimes called Beauty breeds.

The distinctively egg breeds are rather small in size, active, ranging far afield when given their liberty, early to mature and needing good houses in cold weather, more

than the larger breeds. Among these breeds are the Leghorns, Minorcas, Andalusians, Spanish and Hamburgs.

Meat breeds are large in body, not notably active, domestic, easily confined and given to taking on weight when liberally fed. Among these breeds would be classed Brahmas, Cochins, Langshans and Orpingtons.

General-purpose breeds are those which are fairly good layers, fairly active, good sitters and mothers and of medium size. The really good general-purpose breeds are the Plymouth Rocks, the Wyandottes and the Rhode Island Reds.

Fancy breeds are those which are not highly esteemed for either eggs or meat. Among these may be classed the Polish fowls, the Bantams, Sultans and Silkies.

It should be understood that this classification is not very exact. Some of the breeds might well be included in two classifications or put into the general-purpose class. Houdans, for instance, are good layers and good table fowls. The Langshan is one of the big meat breeds yet some notable records as layers have been made by Langshans. Minorcas are as heavy as Plymouth Rocks, yet they are most excellent layers. There are even cases where the diminutive Bantam takes its place as a utility fowl. However, the classification given is in a general way about correct.

WATERGLASS, USING.—Waterglass in tins will keep good for years, but when diluted with water is only good for twelve months. Barrels, earthenware vessels, galvanized iron buckets and cement tanks are suitable for egg storing. Eggs have merely to be dropped in the solution, and allowed to rest in any position. Egg vessels may be stored anywhere in any temperature, above freezing, in outhouse, cellar, back room, upstairs or

any other spare place, but a moderately cool place is best. Eggs a week old will preserve well, but do not come out as fresh as those preserved the day they are laid. Eggs may be taken out of the solution at any time in the year and others put in at any time.

Eggs will keep sweet and fresh for a month or more after being taken out of the solution. All water for diluting the waterglass should be boiled, as this kills any germs that may be in it and prevents thickening of the liquid. The vessel need only be half filled as the eggs will cause it to rise as they are put in, and the cover is to keep dust out. Waterglass is harmless to both hands and clothes and is non-poisonous. The waterglass acts only on the shell of the egg, making it air and water tight. Eggs preserved in waterglass which are to be sold should be rinsed in warm water and wiped dry. They will then be clean and fresh.

WHITE DIARRHOEA.—This disease has caused the loss of chickens by the thousand in this country during the last few years. It seems to be spreading to every community where chickens are raised in large numbers, and even to the farms. The disease is characterized by whitish evacuations from the bowels, which frequently adhere to the down around the vent in such a way as to stop the passages from the bowels. The chicks afflicted with this disease become lethargic, stand around with their eyes closed, occasionally peeping in a mournful way, refuse to eat and die. The Rhode Island station, the Connecticut station and several of the other stations have investigated this disease without further result than determining that it is caused by bacteria. The latest investigations to be given to the public were those of Prof. F. C. Stoneburn of the Connecticut station and Prof.

L. F. Rettger of the Sheffield Scientific School. The common name of this disease, white diarrhoea, is given from the whitish color of the evacuations from the bowels. Other names are "sleepy sickness" and "bowel complaint." Stoneburn and Rettger call it "Bacillary White Diarrhoea," and the distinctive bacterium which causes the disease they have named *Bacterium pullorium*.

Not all chicks contract the disease, nor is it always fatal, but chicks that are attacked and recover usually remain stunted and grow slowly. It usually attacks chicks when a few days old and those that reach the age of two months without being attacked seem safe from it. The investigations of Stoneburn and Rettger indicate that infection may be derived from the hen that lays the eggs, as many examinations disclosed *Bacterium pullorium* in the ovaries of hens and in the yolks of eggs. The bacteria may also be derived from the litter in the nest, from the soil and even from the hands of the attendant.

The only remedy suggested so far is thorough cleanliness, disinfecting the eggs before they are put under the hen or into the incubator and disinfecting the incubator and brooder used.

WHITEWASH FOR POULTRY HOUSES.—Poultry houses should be frequently whitewashed in order to kill disease germs and insects which may find lodgment in the cracks in the walls. The following directions for making the so-called "government" whitewash will produce a wash which will adhere to walls and last for a long time, inside or outside:

Half a bushel of unslaked lime slaked in warm water. Cover during the process to keep in the steam. Strain the liquid through a fine sieve or strainer. Add a peck of salt, previously dissolved in warm water, 3 pounds of

rice which has been ground and boiled to a thin paste, a half a pound of Spanish whiting and a pound of glue which has previously been dissolved over a slow fire, and add 5 gallons of hot water to the mixture. Stir well, cover up to keep out dirt and let stand for five days. It should be put on hot. One pint of the mixture will cover a square yard if properly applied. Small brushes are best. There is nothing that compares with this for outside or inside work, and it retains its brilliancy for years. Coloring may be put into it to make it any shade, Spanish brown, yellow or clay color. For inside work in poultry houses add two pints of carbolic acid which makes it a fine disinfectant.

WORMS, INTESTINAL.—The only certain way of telling whether fowls are infested with worms is finding the worms in the droppings. Where the worms are numerous they may cause death with symptoms so closely resembling other diseases that correct diagnosis is impossible. The following drugs will be found efficacious in destroying intestinal worms:

1. Isolate infested birds and destroy or disinfect their droppings while being treated.
2. Put 1 to 2 drams of copper sulphate in each gallon of drinking water for one week; or
3. Powdered pomegranate root bark (for tapeworms), followed by 2 or 3 teaspoonfuls of castor oil; or
4. Oil of turpentine, 1 to 2 teaspoonfuls, followed in five or six hours with castor oil.
5. Powdered santonin in 5 to 8-grain doses is especially good for round worms.
6. Chopped up pumpkin seeds for tapeworms.

For worms in the air passages (gape worms among other kinds) use any of the following:

1. Turpentine introduced into the windpipe by using a stripped feather; or
2. Steaming with creolin and tur-

pentine in hot water; or 3. Feeding garlic in feed. These remedies are given in the order of their popularity.

YOLKS, COLOR INFLUENCED BY FEED.—Prof. Atwood showed that when wheat, oats, or white corn were fed alone or in combination, with beef scraps to balance the rations that the yolks of eggs were very light, entirely too light for the fancy trade, but when yellow corn was fed the yolks were very rich in color. It is thought that green feed, especially green grass or other green stuff, clover or alfalfameal, tend to make the yolks of eggs rich yellow in color. It would seem that any feed which makes butter yellow when fed to a cow would make the yolks of hens fed on the same kind of feed yellow.

ZENOLEUM.—Zenoleum, creolin, naphthol are all disinfectants and germicides, the base of which is the phenols, all having the phenol (carbolic acid) odor. They are recommended as disinfectants and germicides and a weak solution of them is used to disinfect incubators, their use seeming to improve the hatch and to be of some advantage in making the chicks healthier and more resistant of white diarrhoea.