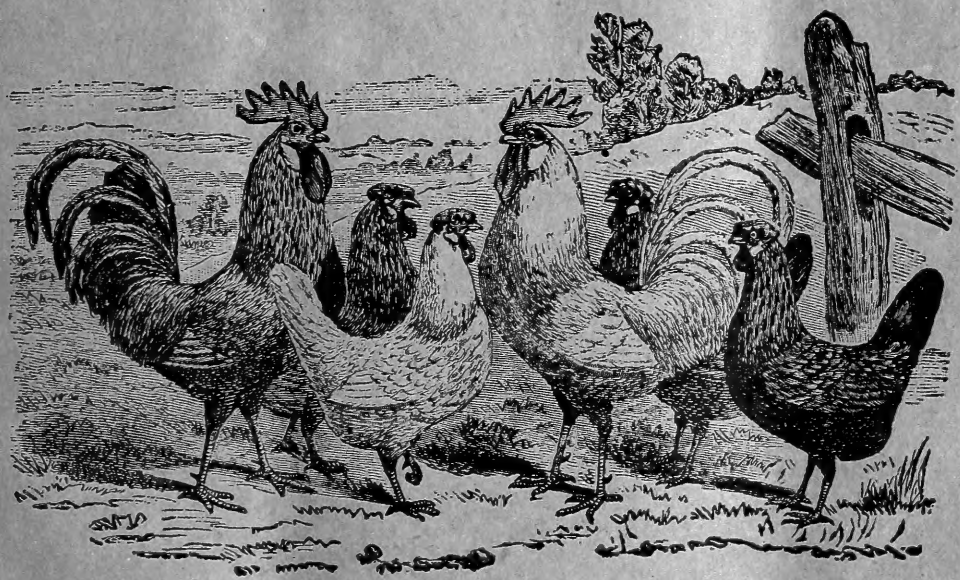
NISSON

on

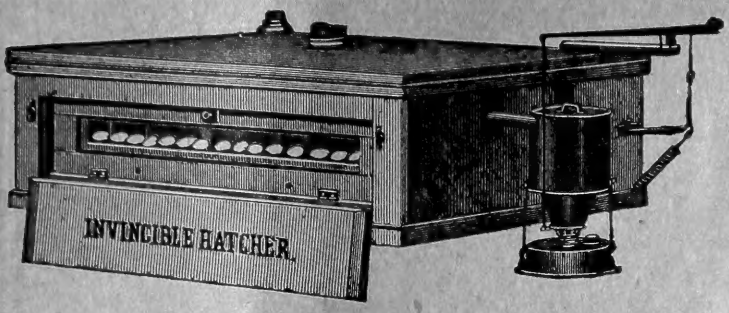
INCUBATION

Especially adapted to the Pacific Coast.



PRICE 25 CENTS.

PRINTED BY CALIFORNIA ORCHARD AND FARM



THE INVINCIBLE HATCHER

We have sold 600 of these machines in six months and have not had one complaint. They are a hot water machine, self regulating. well made and perfectly reliable, the regulator acting perfectly. We furnish everything necessary but the eggs, oil and water, and will promptly refund your money if not exactly as represented. Send for our new catalogue, enclosing 4 cents. 100 eggs, $17; 200 eggs, $20; 300 eggs, $25.

E. A. NOYES, Agent for the Pacific Coast.
West Butte, California.

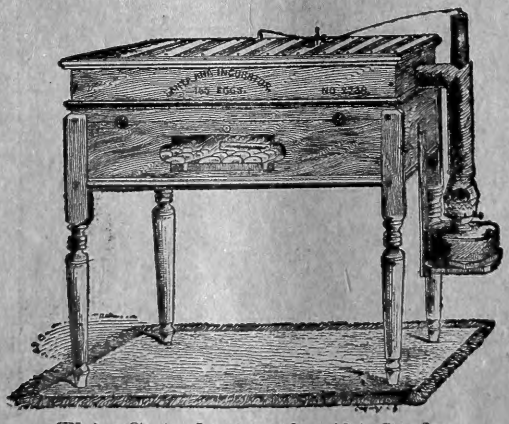
The Sunset Incubator

OF PETALUMA.

THIS old, and in this locality, so favorably known Incubator, is advertised for the first time, now, to the public at large. Its regulation is perfect, distribution of heat equalled by few, surpassed by none, is made of the best materials and by the best of workmen. Prices: 350 Egg Capacity $45: 480 Egg Capacity, $55. For further particulars address,

H. J. HORWEGE, Petaluma, Cal.

SANTA ANA INCUBATOR.



This Cut shows the '94 Style.

THE '95.

COMBINED Hot Air AND Hot Water Incubator

Entirely New Invention.

TRIPLE CASE. DOUBLE DOORS.

Model Copper Heater, Double Regulator.

Our new Catalogue will give full description of this Combined Incubator, Brooders, Poultry and Supplies. Mailed free on application.

Santa Ana Incubator Co.,
SANTA ANA, CALIFORNIA.

NISSON

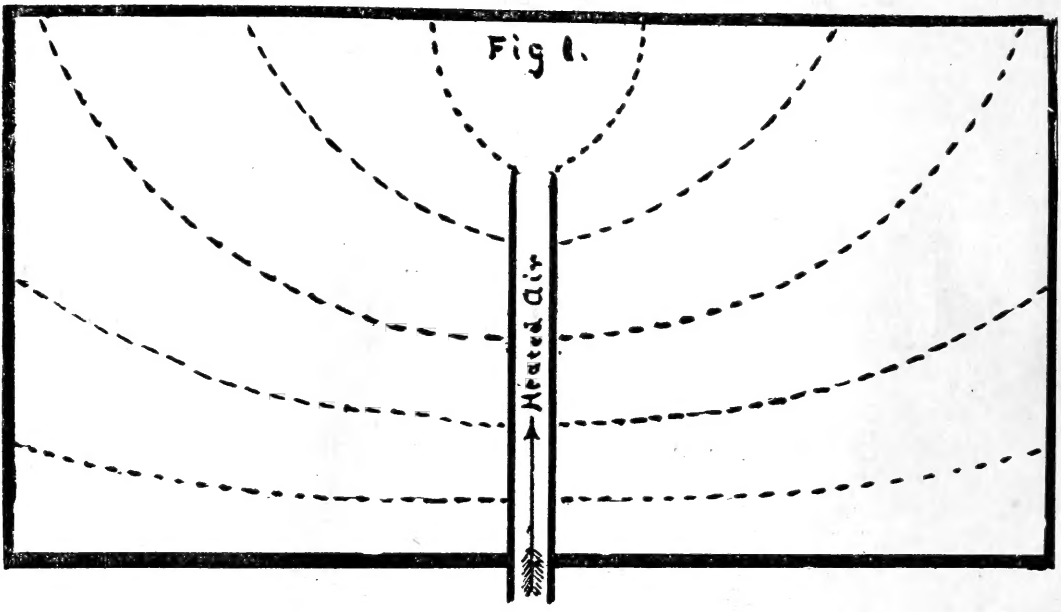
on

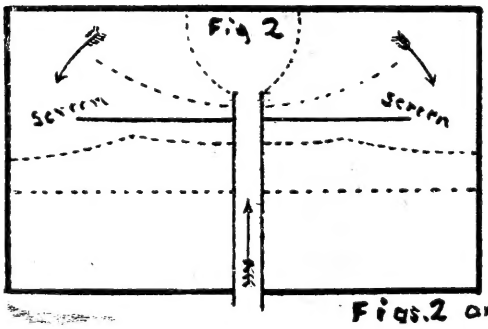
INCUBATION

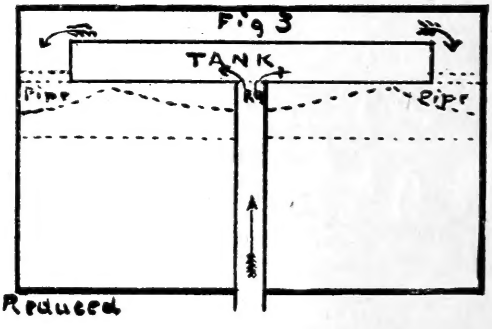
Especially adapted to the Pacific Coast.

PUBLISHED BY C. NISSON, PETALUMA, CAL.

1894.







Figs. 2 and 3 Reduced

AIR CIRCULATION IN INCUBATORS.

Page 11.

HATCHING BY HENS.

WHAT KIND OF HENS TO USE.

Nearly all market poultry men, who make the poultry business a specialty, use incubators, invariably so if they keep very large flocks of hens or raise broilers or ducklings for market. Some poultry men who keep less than one thousand hens and seldom more than five hundred, and raise young chicks merely with a view of keeping up their flocks, still use hens for hatching.

Where eggs for market is the principal product taken into consideration, some breed or breeds of the Mediterranean class, and usually Leghorns, are kept. But as they are very poor sitters and mothers, if hens are to be used for hatching all the young chicks, it is absolutely necessary to keep some other breeds or crosses for this purpose.

All the breeds of the Asiatic class make good sitters and excellent mothers, are quiet and gentle, but being rather heavy, they are too apt to break eggs in the nest if sitting on the thin-shelled eggs of any of the Mediterranean breeds.

All of the American class, the Plymouth Rocks and Wyandottes, being also quiet and gentle of disposition and less heavy, are better for hatching purposes than the Asiatics. The old American Dominick is especially a good breed for this purpose, and seems in all localities to be much less inclined to disease than the newer breeds. Perhaps, however, the Black-Breasted Red Game and some of the other games, either pure or crossed on some other breed, even on non-sitters, make the most satisfactory hen for hatching and rearing purposes if rightly managed, which simply means to make them get used to being handled.

HOW TO SET A HEN.

One often hears people say that hens stealing their nest away always do better, hatch their eggs better, bring out a larger hatch and raise their chicks better, than hens having been given a nest with eggs from other hens. People who say so are either not close observers, or they do not know how to set a hen, or they have not got the right kind of a hen. Besides having the right kind of hens for sitting purposes, one must also have the right kind of quarters and nests for the hens. In all cases the nest should be, or appear to the hen to be, secluded. If a box is used for nest, it should never be so deep that the hen must jump in order to get off or on it, nor so shallow that the eggs can be pushed out of it.

Where hundreds of chicks are raised annually, it is necessary to have special arrangements. They need not be elaborate or costly. If the hatching is done after the heaviest storms of the season are over, the hens can be set outside in a suitable coop, something like the engraving. At the end of a common hen-coop, a box is placed for the hen to set in. This box should be made so it can be closed up. The hen is closed in for about twenty-four hours after she is set. The coop should also be covered with boards or sacks at the end nearest the nest. In the coop is placed food and drink and after the hen brings out her brood the nest may be taken away, the opening in the

coop closed up, and the coop gently moved into fresh ground. The hen with her brood should occupy this coop for two to three weeks. In the nest should of course be put suitable litter, a little coarse straw in the bottom and a softer material on top. It is well to put a little sulphur on the top of the litter, then put the eggs in. If the hen has fleas, also put in some insect powder. This is usually all that is necessary. Late in the season the box can be dispensed with if the coop is in a well sheltered and dry place. Simply scoop out a hole in one corner, and make a nest there, cover the coop well so that rain will not get into the nest.

Always make a point to set several hens at a time so as to put two or more broods together. A hen can take care of sixteen to forty chicks. I have often had them care for the latter number when weather was not too cold and rough, and it always appeared to me that the hens with large broods always did the best. Where there are so many chicks she is compelled to hover oftener, and the chicks have always a chance to get under her. With only a few chicks she is more apt to be careless.

The earlier hens can be set the better usually, still as it takes more time comparatively, to care for a few broods than for many, it is sometimes not well to be in too much of a hurry. Where many hundreds of chicks are to be raised it is quite a task, and it is necessary to husband one's energies so they will last to the end. It will not do to rest or become careless until the task is finished.

While the common A-shaped lath coop will, in most cases, answer all purposes, both while the hen is hatching and rearing her brood, even if placed outside in a dry and sheltered situation, it may sometimes be better to have covered houses and fenced-in runs made specially for the purpose. As the construction of such yards and sheds depends so much upon varying circumstances, it will hardly be of much benefit to describe any particular system. Anyone who intends to make a business of chicken-raising must possess ingenuity enough to adapt himself to circumstances. It may be said, however, that elaborate and costly contrivances are not necessarily the best. On the contrary, plain coops and houses that can easily be cleaned and, if possible, moved about, are the best.

In speaking of early-raised chicks it means, here on this coast, winter-raised chicks. If hatched after the middle of March they are not considered early, and in most localities in California chicks hatched late in April or later seldom do well. In many places, however, it is quite easy and also profitable to hatch in August and succeeding months. If the broods hatched then can be placed on the edge of a corn-patch or cabbage, bean or other green-crop patch they often do remarkably well. The mellow soil, green food and many insects always abounding in such places is much in their favor; besides, the hens having passed the busiest part of the laying season will stay with their broods longer. They often begin moulting while going with their broods, and being well cared for will be apt to get so well over this period as to begin laying before winter weather sets in, and keep on laying all winter.

Why chicks hatched in August, September and October should do better than May and June hatched chicks is not easily explained, but it is a fact, and as it is so easy to get broody hens at that time of the year, when even non-sitters condescend to hatch and raise their chicks pretty well, it is rather

fortunate and should be taken advantage of where hens are used for hatching. There is only one drawback to fall hatching; that is lice. It is usually the worst time of the year with lice, and it is no use to try to raise lice and chicks at the same time.

SHE MUST BE FREE FROM LICE.

If it is necessary at all times to keep hens free from lice it is doubly so while she is used for hatching purposes. A hen should be clean when she begins hatching. The most common of these parasites is the hen-mite, often called the red mite on account of its color when full of blood. Unlike a louse it stays on the fowl only while feeding, and leaves them when satisfied, to hide under the perches or in the cracks of the house. These mites multiply so fast and, on account of their staying on the poultry only a short time, and that mostly at night, the hens are utterly at their mercy as their dusting themselves during the daytime can do them no good. The poultryman must therefore do the work for the hen. Fortunately it is comparatively easy to destroy them. The remedies are so many, and most of them quite efficient, that the choice of the various remedies is of less importance than the thoroughness with which they are applied. Coal-oil will kill all it comes in contact with but, on account of its volatile nature, must be used often. Crude petroleum has more staying qualities and, if the perches and walls inside the house are well painted with it, it will destroy the mites pretty thoroughly, as those not reached directly can not get out of their hiding-places without getting into it. Coal-tar is similar to crude petroleum but hardens quicker and is, therefore, not quite so good. Crude carbolic acid, mixed with water, a good-sized teaspoonful to one gallon of water, or half a teacup to an ordinary four-gallon bucket, if sprayed with a good force-pump having a good nozzle, and driven well into all cracks is a good and quick remedy. The same may be said of water alone heated to as near boiling-point as can be used. When either of the two latter remedies are used the perches should be painted with crude petroleum, or grease melted and mixed with coal-oil in such a proportion that it is like thick paint when cold. These remedies, except the coal-oil alone, if well done will clean houses thoroughly and need not be done more than three times a year. If nothing but coal-oil is used the houses must be gone over monthly, at least.

The long, dirty-white body louse is the next in importance. It would, indeed, be far more annoying than the red mite if it was not for the fact that hens are able to clean themselves pretty thoroughly of this parasite if they are, at all times, liberally supplied with dusting places, and are fed well and kept in good health. Ordinarily, nothing else is required except where poultry is in any way crowded, in which case a regular warfare may have to be inaugurated against this pest. When a hen is to be used for hatching she must be examined and rid of them before being put upon the nest. Dusting with buhach if done well, is a pretty sure remedy. Sulphur simply dusted into the feathers does not seem to be quite as efficient. The fumes of sulphur kills most of the various kinds of lice but the heat of the hen is not sufficient to produce fumes except when hatching. For this reason a small handful of sulphur on top of litter in the nest, as recommended before, is at least a good preventive and, as far as my experience goes, a cure.

Only one more of these skin parasites need be mentioned, because it can not be destroyed by any of the above remedies. This is usually known as the head-louse; it is, however, not a louse, but a tick. The best remedy is, undoubtedly, a little oil or lard applied to the head, where they are mostly found.

Fleas are sometimes, also, very annoying. Buhach kills them but it may have to be repeated two or three times during incubation.

It may seem a good many preliminaries to go through with before setting a hen but it should be remembered that all these hen-enemies do not necessarily exist. In fact, the successful poultryman has his hens clean, usually, or nearly so, and with only a little extra precaution during the hatching season, will have his broods come off clean.

While hatching, the hen should be as little disturbed as possible and the attendant, whenever around feeding or looking after her should move about quietly and slowly. The eggs used for hatching should, of course, be from good, healthy and strong stock and as fresh as possible. If eggs have to be kept for any length of time, say from one to four weeks, they should remain in a cool and even temperature, from about 40 to 55°

RAISING CHICKS BY HENS.

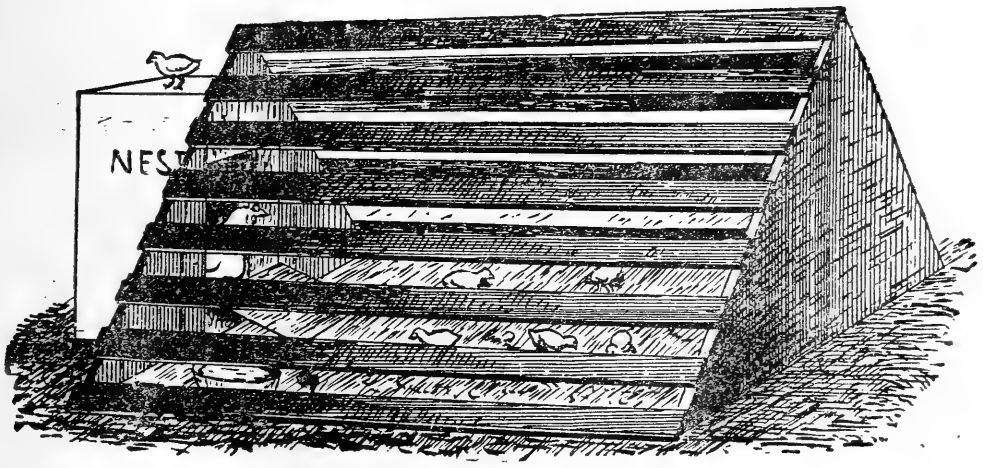
It is comparatively easy to raise chicks by hens if there are no lice to begin with, the hen has ordinary motherly instinct, it is the right season and no extraordinary circumstances interfere. A hen stealing her nest away often succeeds in raising nearly all her chicks without any assistance, so if the hen is favored in the way of providing food for herself and young ones, and protected from her natural enemies, she should certainly be able to raise at least 80 per cent. of her chicks, and can do it easy enough with proper management.

She should be given as favorable a location as possible, it should be rather open but sheltered from raw winds; under large trees or in orchards, unless the trees are small, are not good locations. If an orchard has to be used, the brood should be put at the edge, the most sunny and sheltered side being preferred. If the location is too open and exposed some shelter should be furnished, always remembering that it is near the ground the shelter is needed.

The coop in which the hen is confined ought not to be too small, one end and part of one side next to this end should be tight enough so the hen can be sheltered from rain and strong wind, and also if need be have shade. A fair sized A coop is 4x3½ base, height 2½ feet. The length of time in which a hen with a brood should be confined to her coop will depend upon circumstances and the hen, it will vary from one to three weeks, but need very seldom exceed two weeks. The coop should be daily moved a little on fresh ground so as to avoid filthiness. After a hen has occupied a coop constantly for about a week, and especially if it is the same coop and in the same locality where she hatched her brood, she will return to this coop at night if let out in the daytime. If this is also the place where the young ones are to remain, a hen house might be put up there when the chicks are about four weeks old. The hen will soon take to this house, and the young ones will go to roost with her when six or eight weeks old and perhaps sooner. The perches should be removed if the hen goes to roost before it is desirable.

About feeding the broods it will be necessary to say a little on the food question, not because it is in any way difficult to feed properly, but many people have a notion that it is the most important part of chicken raising and the most difficult to do right. Impractical and fussy writers are mainly responsible for this timidity. As a matter of fact chicks as well as hens are exceedingly easy to please. The most important thing about feeding is to feed liberally (not wastefully), not to feed forever only one thing; not even the best of chicken feed, wheat, if fed quite exclusively is good for best results. Some variety of food should always be given, and in proportion to the chance the chicks have of supplying themselves with a change of food around their runs. Nearly all kinds of table scraps form a very acceptable variety, indeed, no sensible observing person who takes pleasure in feeding young chicks (and who do not) need be afraid to feed wrong. It is only those who trust to these impractical writers rather than their own good common sense, who are apt to make mistakes. Given plenty of food, of water, of grit, and comfortable clean quarters, with a watchful, careful attendant and success is pretty certain.

This finishes the chapter on natural hatching and rearing. While perhaps the practical, experienced poultry raiser has not been benefited by reading it, I hope it has been sufficiently plain to beginners and others who have not made a specialty of poultry raising heretofore to be of service. The natural process of hatching will not likely ever be entirely abolished, indeed if systematically and carefully managed a great many chicks can be raised with comparatively little work and loss.



ARTIFICIAL INCUBATION.

Artificial incubation is now practiced to a very great extent by market poultry men as well as others not making a specialty of poultry farming. This is owing to the comparative perfect hatching machines made at the present day. It would not be truthful to call the incubator of to-day absolutely perfect, all the statements of incubator manufacturers to the contrary, notwithstanding, no incubator can hatch as well as a good hen, it will neither hatch as strong chicks nor as large a percentage. It may be said, and quite truthfully, that a good incubator properly managed will give better results than the average hen, but a good hen, free from lice and given a good chance in every way, will do considerably better. The exact reason why this is so we do not know, at least I have not heard of or seen anybody make even a good suggestion toward an explanation, indeed, most writers on this subject that I have had a chance to read, do not even seem to acknowledge the fact at all, but seem to believe that incubators can do better than any hen; this is certainly not so.

It seems to be in starting the life in the egg that incubators fail the most and perhaps it is only the beginning which is defective in artificial hatching. Not only do many eggs, which upon being opened seem to be perfectly fertilized fail to come to life, but many also die within a week, usually within three days after life started. After this and until the eighteenth day very few die, perhaps no more than would die under a hen, but between the eighteenth and twenty-first day quite a large percentage, seldom less than 10 per cent. die. This later mortality may be partly, perhaps entirely due to the defective beginning, the embryo chick not having got a sufficiently strong start to enable it to stand the strain in getting out of the shell. There may be other reasons I do not know, neither do I know why the artificial start should be so inferior to the natural start, however the two starts differ very materially. In the incubator the eggs are heated up simply by exposing the eggs to hot air. As air is not a good conductor of heat it takes a long time for the eggs to become blood warm, about twelve hours. Under a hen the eggs are in direct contact with its body (as is well known the hen plucks all her feathers under her body out before she begins incubation), her skin being a good conductor of heat the eggs very quickly and very thoroughly become heated up to blood heat. We all know how quickly a cold hand absorbs heat from a hot forehead, or a cold foot from a warm one when in direct contact with each other. It is therefore quite a certainty that eggs under a hen become warm in at least the tenth part of the time it takes eggs in an incubator to acquire the same temperature.

But whether this is the reason that incubator eggs do not start as well as eggs under hens, I cannot say possibly, but it appears to me to be not unreasonable to suppose it has at least much to do with it. This supposition is somewhat strengthened by experiments I made several years ago in heating up my incubators very thoroughly so that the sand in the trays became quite warm before I put in the eggs. Eggs started under hens and finished

in an incubator nearly always come out stronger and better than those started in the incubator. Not long since I found a nest a hen had stolen and left, the eggs were quite cold and I put them in the incubator; every egg brought forth a chick and every chick came out clean and dry and strong.

I have frequently started eggs under hens to refill the incubators with after testing, and these eggs have always hatched the best. Some market poultrymen make it a practice to start all their eggs under hens whenever it is practicable for them to do so, and only finish them in the incubator in order to have them come out free from lice, using brooders for rearing the chicks.

All these facts tend to show pretty conclusively that the artificial beginning is faulty. The reason why I cannot say positively, that it is only, or at least mainly the beginning of artificial hatching which is faulty, is that I have not had a chance to fully demonstrate that eggs started in incubators and finished under hens come out materially better than if finished in the incubator. We have in this, as in everything, much to learn; in order to come to true conclusions we must experiment very carefully and patiently. The most important thing is to locate the fault, remedies are comparatively easy to apply when the trouble is conclusively proved. It was my first plan to make more exhaustive experiments before writing these articles, but upon second consideration, and judging from past experience, I felt certain that even if I solved this one point two other points would be ready for investi gation, so I will content myself and hope my readers will be content with stating as my present opinion, that the slowness of heating the egg to blood heat the first time is one of the main drawbacks to artificial incubation, and every time after, when eggs cool down much, this same drawback is acting in continually less degrees as we near the close of the hatch. I do not wish it to be understood to be a dead certainty, and especially would I not wish it to be understood that the cooling off of eggs should not take place at all. But this will be considered further on. We will now consider

THE INCUBATOR AS WE FIND IT.

We have what is called hot water and hot air incubators. There is not so much difference in the action of these two kinds as many people seem to think. The egg chamber in either is of course filled with hot air. The pipes or tanks, which in one kind contains hot water and the other hot air are, and must be, perfectly air tight; their function is to heat the air in the egg chamber. Whether they contain water, air, oil or any other medium is of no particular importance, so long as they furnish the necessary heat and distribute the same evenly to all parts over the egg trays. That the air in a hot-water incubator should be more moist than in a hot-air incubator, is of course not so, at least no good argument has been brought forward to prove it. But even if it is so, it would be of no particular advantage, as moisture can be applied in quantities to suit in any kind of incubator, and too much moisture is just as bad as too little of it. A certain amount of heat must be applied and the simplest and cheapest way of furnishing it is the best other things being equal. It is of utmost importance to have the heat so evenly distributed that the heat is at least nearly the same in all parts of the egg chamber on the level of the eggs. In nearly all square incubators it is somewhat difficult to get the corners as warm as the other parts. Even if the

temperature is at first nearly even, toward the close of the hatch the difference will be larger, owing to the fact that the chicks in the eggs then furnish some heat, and consequently the heat will be higher in the center than on the outside, and especially the corners. The reason for this is plain enough and need not be enlarged upon.

In selecting an incubator this should therefore be duly considered, although slight variation can be easily overcome by changing the position of the eggs in the trays when turning the eggs. Perhaps in this connection I might mention that it is not quite safe to judge the temperature of the egg chamber by the degrees registered by the thermometer lying on eggs that have been in the incubator ten days or over, it must then be taken into consideration that the heat of the eggs after that day may vary and influence the thermometor accordingly. For this reason the evenness of the temperature in the egg chamber can best be ascertained during the first week of the hatch. Another important thing to consider is the ventilation, or it is perhaps better to call it,

THE CIRCULATION OF AIR IN INCUBATORS.

During the first period of the modern incubator making, the manufacturers argued that eggs containing a living breathing being must necessarily need fresh air, and like all breathing life must throw off carbonic acid, and carbonic acid being fatal had to be got rid of. It was argued that this gas being heavy, incubators should have plenty ventilation below the eggs. Indeed, some incubators were made with no solid bottom to them at all. When it was found that less ventilated incubators hatched better, some makers went to the other extreme and made away with ventilation altogether, claiming that it was all nonsense about the carbonic acid, that eggs neeeded no fresh air, and a few knowing genii even going so far as to claim that the air-space in eggs was filled with pure oxygen, sufficient to furnish all the fresh air a chick needed and that as a matter of course heat only was needed.

We are apt to go from one extreme to another and to jump at conclusions. As a matter of fact the incubator makers of the first period were by far the nearest correct, as far as theory went, and only overdid the fresh air business to such an extent that cold drafts were created, causing uneveness of temperature. Their incubators were in other respects not as near perfect as those of to-day, but if those who claimed that no fresh air is needed could have made their incubators as air-tight as they supposed they did, they would have made a complete failure of it.

There must be a circulation of air in incubators, and there must be fresh air. The idea that the air space in eggs should contain pure oxygen is absurd in the extreme. The air space, which is first formed by the contraction of the contents upon cooling, increases in size as evaporation takes place. This alone proves that the shell of the egg is porous, and that some circulation of air must take place. Pure air is just as essential to young life as to more mature beings and this should never be lost sight of.

What is quite necessary, then, in any kind of incubator, is a constant supply of pure air without causing strong draught, which is sure to again cause uneven temperature,

Air is light and very easily put in motion, in fact pretty difficult to keep quiet. If kept as near quiet as possible the temperature will be proportion-

ately even at the same level, the upper air being the warmest and the lower the coldest. It is, however, impossible to keep air immovable where a constant supply of new air is introduced. In hot-air incubators heat is usually supplied from one point, except in very large ones. At the point where this heated air is introduced there is a disturbance. The eggs must be placed far enough below this point so as to be in a layer of air not directly affected by it. The larger this supply of air must be and the more it is confined to one point the further the eggs must be below it. As, however, it is somewhat difficult to force heat downward, it will require more heat to keep up the temperature in a high egg-chamber than in a low one; therefore, to make extreme height unnecessary the heat is either first conveyed to a tank or drum, thus extending the point of disturbance over a large area and in a horizontal direction, or a screen is interposed between the egg-trays and this heat supply; or the egg-trays must be placed in a more or less slanting position in order to receive the same degree of heat.

The accompanying drawings show this more plainly than words. In fig. 1 the heated air radiates from one point. The dotted lines show what would likely be the lines of equal temperature. The egg-trays would have to be quite a long distance below the point where the heated air is introduced before a nearly level line could be found, and an absolutely level line could rarely be reached. Either a screen or a tank properly placed will overcome this effectually. In hot water incubators the heat is introduced more evenly all over than in hot air incubators.

In hot-water incubators the water, whether circulating through pipes or tanks, has about the same temperature all over, hence it is somewhat easier to get the even temperature in hot water incubators than in hot air incubators. The evenness of the temperature does not however depend alone upon how the heated air is supplied.

Incubators are not made air tight, there must be openings for the air, as it expands, to escape, if not the temperature could not rise; there would be no circulation. It is therefore necessary to have openings for air to escape, even if a constant stream of hot air is not continually introduced. Circulation is necessary. The very reason why corners in square incubators are so difficult to get as warm as the rest of the incubator is just because of the imperfect circulation there. These openings are of course of much importance, and their size and location should be carefully studied. They must always be below the egg trays, preferably in the bottom, and the bottom should not be too close to the egg trays.

If these openings or holes were just of a size only necessary to furnish the needed escape of air, the best places for them in square incubators would be in the corners, for the reason that the air would then be forced toward the corners, causing the circulation of the heated air into these corners.

But as the volume of air which is forced downward varies greatly, they must be of a size in order to be large enough at all times, that at times, and in fact most the time, the current will be the other way if, as of course is always the case, the temperature of the incubator room is lower than that of the egg chamber and cold air will enter. As the corners, of all places, are where we don't want a cold draft, it is really a mistake to make the holes in the corners, in spite of the fact that a great many incubators have the holes just there. The proper place for the escape hole is just under the warmest

spot of the egg trays, which is usually in the center, or toward the back end in incubators were the doors are in one end only.

In nearly all square incubators it will be of advantage to cut off about three inches of the outside corners of the egg trays. Where wire or other kind of open bottomed trays are used, the opening in the bottom influences the eggs directly over them much more than in solid bottomed trays, and precautions must be taken accordingly.

I have dwelt somewhat at length on circulation of air as it is important for operators to pay particular attention to the circulation of air in the incubators they use. Much of the failure is just caused by faulty circulation of air, and no incubator can act alike in all kinds of climates and situations. Pure air and even temperature must both be had. Pure air with uneven temperature will not do, neither will even temperature with impure air.

The way doors are placed in incubators also affects the temperature, and the frequent opening of doors has a disturbing influence. In large incubators, having a width of three feet or over, it is best to have doors on the two opposite sides. If on one side only uneven circulation and temperature is apt to be caused, not only because the doors open on but one side, thus causing a more frequent and rapid cooling of the eggs there, but also because even if the doors are opened as little as possible, they never fit so exactly, especially in old incubators, but that air will enter more or less freely, and so this side in a manner monopolizes the circulation, while the air in the back part is apt to become stagnant. In this way both an uneven temperature and unequal purity of air may be the result.

Round or octagonal shaped incubators are not used now as much as formerly, because, I suppose, they are more expensive to make. So it will not be necessary to discuss them separately to any extent as the advantages they may possess over square ones will perhaps not counterbalance their extra cost. Their main advantage in shape being the absence of square corners and thus an even temperature can be more easily obtained. If we suppose Fig. 1 and 2 to be round incubators it will be seen that by making the trays slant toward the center in Fig. 1 we can have the eggs in a layer of air of even temperature, and by interposing a screen as in Fig. 2 of the right size and distance from the trays we need not even have the slanting position.

An incubator shonld not be condemned hastily because the temperature is not perfectly even. If the variation is so great as to cause loss the reason why should be found. It should be ascertained whether the fault is in the incubator or outside the incubator. If the fault is in the incubator and can not be remedied, then lose no time in throwing it away as it will prove an expensive tool at any price.

REGULATING THE TEMPERATURE.

The importance of regulating the temperature is pretty well recognized, in fact it is if anything a little over estimated, and many failures supposed to be due to imperfect regulation, is quite often caused by something else. Still the regulator should be a good one and be able to keep the temperature below safe degrees. An unreliable regulator is certainly worse than none.

There are a great many kinds of regulators, some of which are patented. They all act upon the principle of expansion by heat and such bodies as air,

water, ether, quicksilver, etc., expanding freely are employed in one kind of regulators while in another the thermostatic principle, or unequal expansion of two different metals, or similar bodies, is used. Thus, for instance, if a strip of iron and one of zinc be fastened together firmly at the ends and loosely in the middle, the one end be fastened to something firm and the other end left free, then the free end will sway to and fro as the temperature varies, because heat expands the one metal, zinc, more than the other, iron. Zinc being of the metals the one expanding most by heat, and iron the least. these two metals would naturally be used if metals are used. Guttapercha, expands however nearly five times as much as zinc, and therefore a bar of it with a strip of iron would be preferable.

Of the liquids that may be used for expanding a regulator, sulphuric ether expands the most, sulphuret of carbon, alcohol, linseed oil, water, quicksilver, next in the order named. Of more importance than the respective expansive power of these liquids is the material used for enveloping them. These must be made of the most flexible material consistent with the necessary strength, as the resistant power of the envelope is apt to prevent the gradual expansion of the fluids and cause the expansion to be spasmodic, and of course a regulator expanding in a jerky manner is very unsatisfactory. The envelopes must also be of a material that can withstand the chemical actions of the fluids used. Where a perfectly airtight vessel is not necessary to envelop the fluids used, as water or non-evaporating oils, a float in an open vessel may be used.

The function of a regulator is to work a delicately hung lever, the lever to open a valve in the egg chamber or heating pipes, or simply cause the flame of the lamp to decrease or increase by working a double wick tube, or it may be used to connect or sever an electric current, the valves being worked by electricity instead of a lever. The latter method is used now far less than formerly because it requires the extra work of keeping a battery in working order. If a battery should happen to be out of order the regulator is quite useless, and as it is apt to get out of order without warning or at least unexpectedly, especially to amateurs, it can not be considered a good method. It is true it works with absolute accuracy when in proper working order, but there is no necessity of keeping the temperature always at one point.

It will be unnecessary to go into a more detailed description of the various regulators which may be used in incubators or brooders, as all leading incubators have reliable regulators, and where, in home made incubators one is wanted, it is cheaper to buy from some manufacturer of incubators or dealer in poultry supplies than to try to make one. But it is well to be somewhat familiar with the construction and workings of whatever regulator one uses.

MOISTURE IN INCUBATORS.

Besides pure air of the right temperature it is also of importance to guard against air becoming too dry. The moisture which exists in the atmosphere under ordinary circumstances may be considered the right amount for the successful hatching of eggs under hens. Since the temperature of the eggs under hens rarely ever exceeds 103 degrees it may be reasonably supposed that if the heat of the eggs in an incubator does not exceed the same temper-

ature then no moisture should be added to the air in the incubator, unless it is unduly ventilated. It is true that eggs closely covered by a hen may not evaporate as much as eggs in an incubator, where there is always more or less circulation of air passing over them; still, unless the incubator is in a very open, dry room, or the incubator more ventilated than is necessary, no extra moisture need be added. It is somewhat difficult to keep the heat down to 103 deg. in incubators during the last half of the hatch and it is, therefore, necessary to see that the air does not become too dry then. As many operators prefer to run the incubator at 104 deg. with more frequent cooling of the eggs than at 103 deg. with less cooling, more moisture must then be applied. To condense it into a rule: The higher the temperature the more moisture must be supplied, because more evaporation takes place. There are exceptions to this rule, but to go into detailed explanations would take unnecessary space. Most persons are aware when the atmosphere is abnormally dry or humid and will take precautions accordingly. Besides, the evaporation that must take place, to make a successful hatch, is not confined to such a narrow limit that we need be afraid of erring much if we are observant.

THE BEST WAY TO APPLY MOISTURE.

Is perhaps, in hot-air incubators, evaporating pans under the egg trays, sufficiently far below the trays so as not to be exposed to greater heat than between 80 and 90 deg., but the construction of the incubator must be considered in this connection. There is, however, little danger of too much moisture from water exposed to only 80 deg. Where sand is used in egg trays it may be moistened, whenever it is desired to add to the humidity of the air, and it is a very good way. If lamps in hot-air incubators are so constructed as to hold water on the top of the oil-tank, then that will both make the lamp safer and add sufficient moisture to the incubator for the first week or two, if not run above 103 deg. In hot-water incubators, water cups or wet sponges for the last week is usually all that is required if any moisture is required at all before eggs begin to chip. But the cups should be in the trays or on the same level. It is not good practice to put the cups on the hot pipes or tanks.

Finally, I will say that too much moisture is usually applied by beginners. According to my observation whenever chicks become glued to the shell after pipping it is a sign that too much moisture has been given or the temperature has been too low. If the atmosphere has been too dry chicks will be apt to die in the shell before pipping, but of course, that is not the only cause for dying in the shell before pipping. Impure air, weak stock, too much heat or generally poor management of the incubator may bring about the same results.

THE EFFECTS OF IMPROPER MOISTURE.

If the proper amount of evaporation has taken place, all the fluids surrounding the chick and not absorbed by it, has been reduced to the appearance of a colorless mucuous membrane or lining, which does not stick to the chick at all, but from which it emerges clean and free. If from insufficient evaporation a proper reduction and thickening of this matter has not taken place it is too soft and plentiful to hold together, it does not separate freely from the chick, and when the chick chips the shell, allowing air to come in contact with it, being of a very glutinous nature, it dries and glues the chick

to the shell so it can not move, and it perishes if not helped out. When helped out successfully, the chick will still be covered with this sticky matter, which dries quickly and plasters the down onto the body, a condition so well known to all who have hatched chicks by incubators.

When this state of affairs exists it is best to keep the air in the incubator pretty well saturated with moisture, and kept shut as much as possible. This prevents, to some extent, a too rapid drying, thus giving the chick a chance to get out of the shell before being dried on to it. At the same time it is just such hatches which need fresh air, as the air becomes very offensive during the process of incubation.

A better plan is, therefore, if it can be done, to keep the room wherein the incubator is, warm and damp. The incubator can then be opened more freely and chicks helped out as soon as it is seen they can not get out without help. Too low a temperature throughout the hatch also prevents sufficient evaporation and the result is similar.

If the eggs, during incubation, have been exposed to too much heat and dry air, this mucuous lining becomes too dry, so the chick can not move around freely and at last not at all, when it can not chip, usually dying in the shell just ready to chip it.

TURNING AND COOLING THE EGS.

As a rule, turning the eggs twice a day is recommended, not that such frequent turning, in itself, seems necessary or likely is, but in turning the eggs one has the opportunity to change the position of the eggs, which is of advantage if there is any difference in the temperature of the egg chamber. How little turning will suffice I am not able to say, because I have never neglected the turning so much that any harm seemed to have come from it. I make a practice of heating the incubator well before putting in the eggs, and then turn them about twelve hours after, or sooner if the temperature has reached 100 degrees or over. In turning them then, and indeed during the first week, I make it a point not to let the eggs cool down more than I can possibly help.

My reason for turning the eggs so soon is, that there is considerable difference in the degree of heat between the under and upper side of the eggs, as most incubators supply heat only from above. It, therefore, appears to me that frequent turning, if of benefit, is especially so in the beginning of the hatch. The difference of heat between the upper and under side grows less, gradually. As the chick develops, the necessity for turning diminishes in proportion.

During the first week I cool the eggs as little as possible, because, as said at the beginning of this treatise on artificial incubation, the slowness with which eggs get heated up when placed in the incubator, and every time they are cooled off, is the greatest fault of the incubator. For this reason I take care not to cool the eggs much at first. During the latter part of the hatch I make it a point to cool the eggs down to 75 or 80 deg., at least every other day, and my reason for this is, that the cooling and reheating of the eggs is in itself a necessity, in order to assist the embryo in getting fresh air. In cooling the eggs the contents naturally contract, and, by so doing, air is forced into the airspace from without. In reheating the eggs air is again forced out. By this process a fresh air circulation is forced to take place.

With the temperature always at the same degree, it is quite likely that altogether too little circulation of air takes place in the egg, and the most prolific cause of dying in the shell is from lack of pure air.

If we could heat the eggs after each cooling as quickly as a hen does, and without exposing them to excessively hot air, I would recommend a daily cooling from, say, the fifth day. This we can not do with any incubator, as made at present, and for that reason we must be satisfied with less cooling. Each operator must try to find the correct middle way. I can only point out the dangers of the extremes, and have given my "middle way" as suits my location and incubator.

Since we can not assist the chick in getting as much fresh air as it ought to have by the frequent cooling, as pointed out, and which it gets under hens it will be seen that my recommendation to have the air in the egg chamber always as fresh as possible, consistent with even heat and no strong currents, is based upon my belief that no good opportunity for supplying the embryo with fresh air must be neglected.

ABOUT THE EGGS USED FOR INCUBATORS.

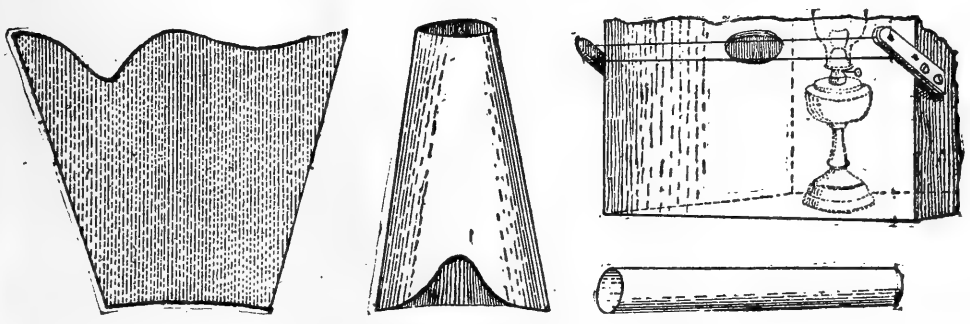
Taking for granted that we are not, in all details, able to do as well with artificial as natural incubation it follows that we must try to have the conditions we are able to control in as perfect a state as possible. Important as the proper regulation of heat and moisture and judicious cooling are, the most important thing after all is that of the eggs used.

With first-class eggs good results with indifferent management of the incubator is far more certain than the very best management of the very best incubator with indifferent eggs. To have eggs in the best possible condition it is necessary to have good, healthy, robust stock, well and generously fed and with a proper proportion of males. If the stock is confined in yards it is important to feed a varied diet. Green food and meat, as well as grain should be fed and a chance for necessary exercise, if the yards are very small, must not be overlooked any more than the other requirements necessary for vigorous health, With unrestricted run fowls will keep in proper condition with far less attention and it is to be recommended wherever practicable. The proper proportion of males to females depends somewhat on breed. In the Mediterranean class less roosters are needed than in most other classes, and in all it is thought necessary to have more males when confined than with free range, the males being less vigorous in confinement. With all Leghorns, Minorcas or other breeds of the Mediterranean class one male to fifteen hens is sufficient, if in open range and the males not too young nor too old. In this class the males are, as a rule, in their best condition when one and two years old. After that the males are not always so reliable, especially where there has been much chance of fighting, to which the males of these breeds are much given, and which seems to sap their strength.

The eggs from hens after the second year though much decreased in number are still as good as ever for hatching. Eggs from immature pullets are not to be recommended. It may be said that the fresher the eggs the better, still, if kept in a cool and even temperature of about 40 to 50 degrees, eggs will keep in good condition for hatching quite a long time. They must not be kept at a temperature as low as 35 degrees, and the more it is above 45 the shorter will be the time they retain their vitality.

TESTING THE EGGS.

It is quite impossible to say whether an egg is fertile or not until it has been in the incubator for at least two full days, On the third day in bright light one can tell pretty well, if the shells are white. In dark shelled eggs one can not see the veins in all eggs before the fourth or fifth day. The best light for testing is sun light. If one has a sunny window where the sun can shine on the egg as it is held to the tester, it is an easy thing to distinguish a living egg from a dead one. If the room can be nearly darkened and the sun shines on a window, by covering the window with a blanket or curtain, in which is made a hole the size of an egg, the test can be made by simply holding the egg against the hole. If the eggs must be tested by lamplight a simple tester is made by nailing four boards, six or eight inches wide, together like a tube, making it long enough so the tube is twelve inches above where the flame of the lamp, which is placed inside, will be, and just opposite the flame cut an oval hole the size of an egg. Stretch two thin wires in front of the hole the lower one one-half inch and the upper one one and a half inch from the tube, in such a manner that they serve as a support for the egg, while being held before the hole. If a mirror is placed back of the flame so much more light will be thrown toward the hole. The simplest daylight tester is made by simply rolling some stiff paper or pliable cardboard into a tube eight or ten inches long and a little smaller in diameter than an egg. But, as only one eye can be used with such a tester, some will prefer one by which both eyes can be used. By cutting a piece of leather or pliable pasteboard the proper shape in the manner shown, so that it will fit the face when folded and exclude the light, a very convenient tester is made.



SEVERAL KINDS OF EGG TESTERS.

All eggs in which no veins are visible on the fifth day are good and can be removed. Many of the eggs removed will be nearly clear, showing only a faint cioud, which does not move about freely. Such eggs were not fertile or had lost their vitality before being put in. They can be used for culinary purposes as they are not altered in any way. If, however, there is any blood formed or the cloud (or yolk) looks dark or is floating about freely, the egg is unfit for kitchen use. It had been fertile, life had started in it and died. It takes some practice to be able to tell the difference when testing such eggs, but with a good light it can very well be done and good eggs be saved. On the tenth to fifteenth day the eggs should be tested again so as to get all dead eggs removed from the incubator.

ABOUT THERMOMETERS.

Thermometers should be reliable; if it is not known that they are correct it is an easy matter to find out, by simply standing them together with one known to be correct in a vessel with water, so the bulbs are all on a level, then slowly heat the water and watch them well when the 103 deg. is reached. Let the water go some degrees higher, again noting the difference, if any, of the thermometers. A thermometer not registering correctly is only dangerous when it is supposed to be correct. If the fault is known the operator allows for the variation, which is always the same. Thermometers should be placed on the eggs, the bulbs touching them. During the latter half of the hatch it should be seen to that the thermometer does not rest on dead eggs. It is always preferable to have more than one thermometer in the incubator

THE HEAT OF THE INCUBATOR.

Whether to make the heat of the eggs be 103 deg. with less cooling or 104 with more cooling, is best determined by the operator, some prefering the one way and others the other. It may be said that during the last week it need cause no alarm if the thermometer runs up to 105 or 106 deg. for a while. It should not remain too long so, and when noticed it is well to take the eggs out for a cooling.

That cooling of the eggs is necessary I have shown, and also why we can not cool as much as we ought to.

It should be remembered, that it is the eggs and not the incubator we desire to cool. The incubator should lose as little of its heat as possible, not only for economic reasons, but because the eggs should be reheated as quickly as possible without exposing them to a very hot blast. In reheating the eggs, the temperature of the egg chamber should not be excessively high, even if it is desirable to reheat quickly, but when for some reason, (as when the eggs have become quite cold from some accident), it becomes necessary to have a high temperature in the egg chamber, the air should be made as humid as possible. In heating the eggs the first time a moist atmosphere is far better also, as it tempers the bad effect of too high a temperature, which one is apt to have. A correspondent of mine makes it a practice to wet the sand in his trays with hot, nearly boiling, water when filling his incubator. He always has good tests and hatches. As this agrees with my observations that eggs placed on moist sand give better tests than on dry sand, I experimented also with sand made nearly wet with hot water and found the tests better than where the sand had been moistened with water not heated.

In speaking of better tests I mean that I got less of what careless observers call infertile eggs, which proved that less germs were destroyed when the air was thoroughly saturated with moisture, even though the air of the incubator was very hot, in fact very few germs were destroyed, and the eggs which were clear were nearly all really infertile. Unless moisture is added, it is better to have less heat, not more than 108 deg., even if the eggs heat up slower.

I will now briefly recapitulate the main points about incubation. In natural incubation the principal points are: good hens, freedom from lice and proper quarters, for the sitting hen. In artificial incubation a well regulated

incubator, an attendant fully understanding the effects of temperature, especially in so far as to know, that as a rule the higher the temperature the more moisture must be supplied, that the air must always be supplied with sufficient moisture to prevent a too rapid evaporation from the egg, and at the same time not be so saturated with moisture as to prevent the necessary evaporation; to also take in consideration, that when eggs are being heated, either when first put in or after a severe cooling, the air, in order to bring the eggs up to the proper heat in a reasonable time, is considerably above the degree indicated by the thermometer, and moisture to be used accordingly.

And finally I will add that in my judgment it is far better for the operator to get used to rely upon his own judgment than to depend upon hydrometers to regulate the moisture.

SINGLE COMB BROWN LEGHORNS.

SEND FOR CATALOGUE!!

341½ MAIN ST. STOCKTON, CAL.

THE STOCKTON INCUBATOR has the latest improvements, the most perfect self-regulator. It is impossible to overheat the eggs. A perfect distribution of heat, moisture and ventilation. No experience required to run it as now constructed, and they are giving universal satisfaction.

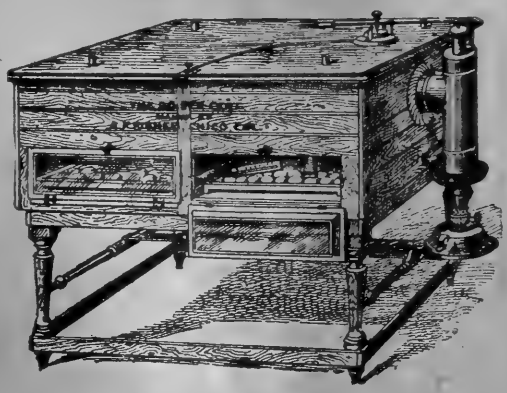
PRICE LIST.

120 Egg Capacity...	$20 00		480 Egg Capacity...	$ 45 00	
180 " " ...	25 00		600 " " ...	50 00	
240 " " ...	30 00		1000 " " ...	70 00	
360 " " ...	40 00		2000 " " ...	120 00	

STOCKTON INCUBATOR COMPANY,

341½ Main Street, STOCKTON, CAL,

The 90 Per Cent INCUBATOR



The Best is the Cheapest.

Send for our 50-page

ILLUSTRATED CATALOGUE

Before Purchasing.

GEO. H. CROLEY,

417 SACRAMENTO STREET, S. F.

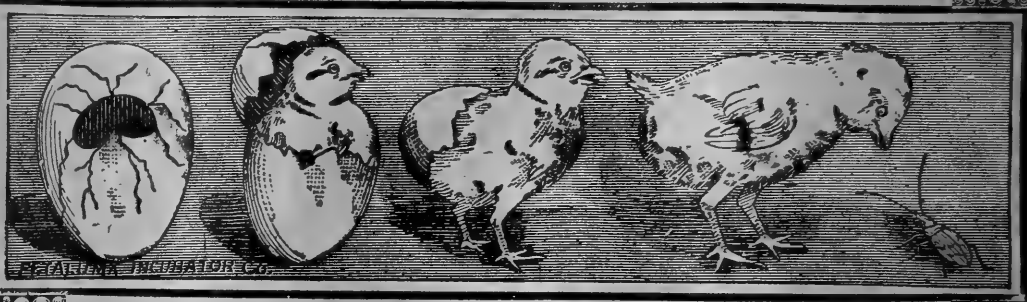
Jubilee Hatcher—New Model.

500-Egg Machine.

Do you want an Incubator? If so, why not get the best? The late improvements on the **JUBILEE** makes it head the list. It has new features not to be found in any other machine. The **New Model** is a perfect self-regulating **Hot Water** machine, with copper boilers and an entirely new system of operation. The chicks can be removed from the machine without opening the egg-chamber. It will pay you to investigate before you buy. Manufactured by

A. W. BESSEY, Orange, California.

PROGRESSION



The Petaluma Incubators and Brooders have long been the leading and popular machines. In accordance with the spirit of progress maintained for the past fourteen years we have again made improvements which are recognized as superior to anything heretofore put upon the market.

We are the Pioneer makers of Incubators and Brooders and have sold more than all others combined on the Pacific Coast. Added improvements although increasing the cost of manufacturing has not prevented us from reducing our prices so that the Petaluma Incubators and Brooders are the cheapest machines now sold, quality of material used, workmanship and efficiency being considered. It is true there are machines advertised at prices a little lower than ours. Do not confound the Petaluma with the poorly constructed and inferior material machines.

Heaters. The interior of our heaters are made of copper, and other parts of the best galvanized iron, so that a machine properly cared for will last a lifetime.

The Petaluma has been awarded more premiums in competition than any other Incubator, and has not only been exhibited at many of the State and District Fairs but at the great World's Fair, Chicago; the California Midwinter Exposition, San Francisco and at the Antwerp (Belgium) Exposition, besides at the London Aquarium, London, England; the Zoological Gardens, Amsterdam, Holland, and many other places of prominence; and has more gold and silver medals, a greater number of enconiums from the Press of the World; and the largest percentages in hatching to its credit.

The Petaluma is the cheapest (if the best is the cheapest). Uses the least oil. Consumes the least time in taking care of it. The most perfect in regulation of temperature. Can be left alone the longest with safety. Has nothing to get out of order. Eggs turned instantly. Lightest in weight, hence lowest freight charge. Hatches the largest percentage of good, strong, vigorous chicks. Is the easiest to manage and the best machine for beginners as well as those of long experience.

Our illustrated Catalogue gives full information regarding our Incubators and Brooders, and large line of Poultry Supplies, mailed free.

PETALUMA INCUBATOR CO.
Petaluma, California.