STATION BULLETIN 262 APRIL, 1930

Electric Brooders

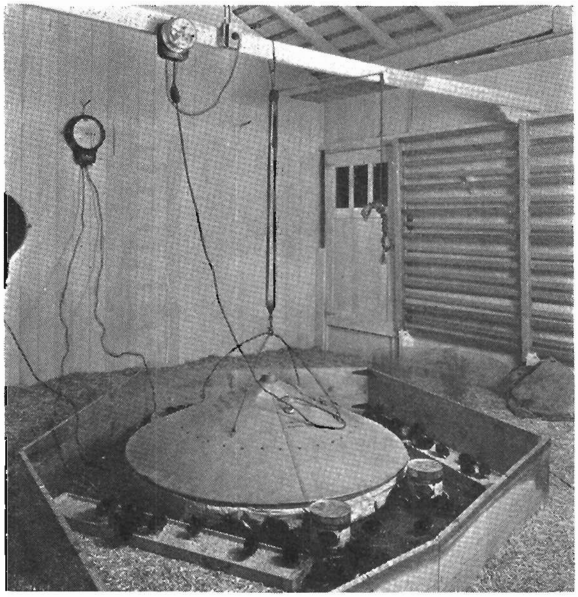

Fig. 1. Chicks receiving their first feed. One-by-twelve boards hinged in pairs make convenient movable fence which prevents floor drafts for the first three to six days.

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

SUMMARY

Electric brooders have been found very satisfactory for brooding chicks and poults.

The cost of heat for brooding chicks was found to be approximately the same when using electric brooders of good construction at the rate of 3c per kw.-hr. as when using a coal stove with briquets at $17.00 per ton.

The labor required in operating electric brooders is much less than for coal-stove brooders.

Well-constructed electric brooders automatically maintain a very uniform brooding temperature.

Electric brooders eliminate a fire hazard that exists when using fuel-burning brooders.

A roosting platform of ½-inch mesh hardware cloth supported by a frame of 1 x 3 lumber on edge is recommended to provide a sanitary roosting place.

Electric brooders should have sufficient heating capacity to maintain a temperature of 100 degrees with no chicks under the hover during the coldest brooding weather.

Electric brooders may be equipped with full automatic heat control or they may have only part of the heating elements equipped with automatic control and the remainder with a hand snap switch control. Full automatic heat control is decidedly superior.

Electric brooders do not require supplemental room heat when the outside temperature is only slightly below freezing. Chicks have been brooded successfully with electric brooders without supplemental room heat with an outside temperature as low as 4 degrees above zero.

Electric brooders should provide under the hover 7 square inches per chick and 12 square inches per poult.

When using electric brooders power interruptions of one to two hours will not injure the chicks if proper management is followed.

There is a large variation in different types and makes of electric brooders, and some are more satisfactory than others.

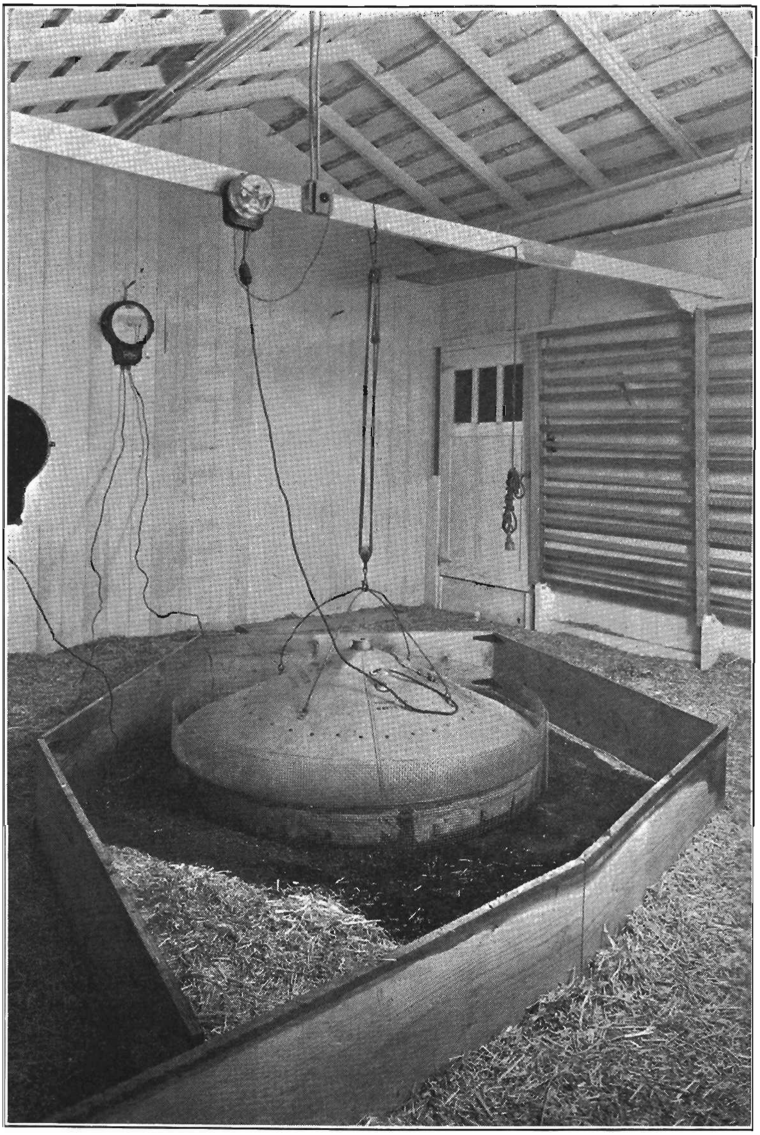

Fig. 2. Electric brooder with 350 chicks under it for the night. Hardware cloth around the hover keeps the chicks under the hover and does not restrict ventilation. This is a good practice for the first three or four nights.

Electric Brooders*

F. E. Price, A. G. Lunn, and
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INTRODUCTION

Artificial brooding of poultry involves the application of heat and ventilation to a compartment or hover to provide for the comfort, health, and growth of the young to be reared. The heat may be supplied by the combustion of some fuel such as wood, coal, briquets, oil or gas or by electricity. The idea of utilizing electricity in brooding has interested many poultrymen as a method of reducing labor costs and maintaining more uniform brooder temperature by the use of automatic controls which are so common to electrical equipment. The initial cost, operating cost, convenience and general performance of electric brooders are factors in which poultrymen who are considering the adoption of this method are interested.

This bulletin presents the results of experimental work with electric brooders at the Oregon Agricultural Experiment Station conducted cooperatively by the departments of Poultry Husbandry and Agricultural Engineering. This study has been made particularly from the poultryman's point of view to determine power requirement, rate of growth, quality of the chick, mortality, and convenience and dependability in operation of various types of electric brooders.

BROODING MANAGEMENT AND DATA OBTAINED

The regular annual college hatch, used in reproducing the pullet flock for the instructional division, was used in the comparative brooder tests. A flock of White Leghorn and Barred Plymouth Rock chicks was divided uniformly among the brooders that were used each year.

The brooder houses were 8 by 10 single-wall colony brooder houses used in previous years for the brooding work. Yards 40 by 100 were provided for each flock.

The feeding and management were those recommended and used by the Poultry Husbandry department as given in Extension Bulletin 386. Cockerels were removed when the sex could be determined. The weights recorded in the latter part of the brooding period, especially for Leghorns, were for pullets only.

At the beginning of each brooder test 100 chicks of each breed were weighed, and 50 of each breed were weighed each week to determine the average gain during the brooding period. The weight of the feed con-

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*The preparation of this bulletin and the experimental work on which it is based have been in cooperation with the Oregon Committee on Electricity in Agriculture. This committee is made up of farmers, business men, and representatives of the State College, Grange, Farmers' Union, public utilities and equipment companies. Its purpose is "to determine and disseminate facts regarding the use of electricity for profit and convenience on Oregon farms."—James T. Jardine, Director, Agricultural Experiment Station; Chairman, Oregon Committee on Electricity in Agriculture.

sumed each week was recorded. Mortality, fuel or power consumption, outside maximum and minimum temperatures, as well as room and brooder temperatures, were recorded daily. The advantages and disadvantages of operation for the different brooders were observed and recorded.

All conditions of management, quality of chicks, feeding equipment and care were as nearly equal for all brooders as it was possible to obtain. Table I gives the range in maximum and minimum outside temperature for the brooding periods.

All brooders were operated without supplementary room heat.

TABLE I. OUTSIDE TEMPERATURES FOR BROODING PERIOD APRIL 1 TO MAY 15

Corvallis, Oregon.

	1926		1927	
	Maximum	Minimum	Maximum	Minimum
1st week	62°-76°	34°-44°	56°-64°	31°-43°
2d week	68°-80°	40°-53°	56°-74°	30°-37°
3d week	64°-84°	38°-53°	54°-72°	30°-43°
4th week	66°-82°	42°-48°	61°-80°	37°-52°
5th week	67°-93°	42°-55°	60°-72°	36°-43°
6th week	56°-82°	38°-46°	58°-73°	40°-50°

DESCRIPTION OF BROODERS STUDIED

Five different electric brooders, one coal burning and one kerosene burning brooder, were used in this experiment. Table II gives the specifications of these electric brooders and others that have been used in a limited way which are to be referred to as brooder numbers 1 to 9 inclusive.

Brooder No. 1 shown in Figure 3 was one of the first electric brooders used in the tests. The hover is rectangular in shape with a 2-inch wood flat top with an under lining of beaverboard and a top covering of rubberized

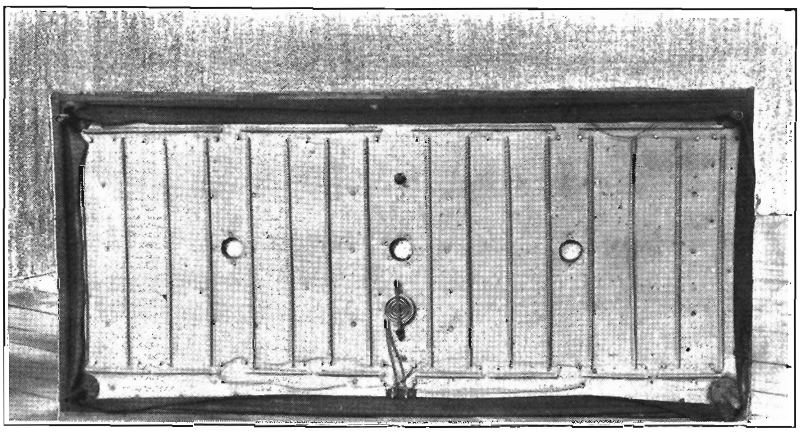

Fig. 3. Brooder No. 1 tipped to show under side of hover and heating coils, ventilation openings, and thermostat.

roofing. The heating unit is wired in four circuits, which are of the non-glow type. One curtain is used around the outside of the hover. Three openings 2¼ inches in diameter are provided in the top of the hover as ventilators.

Brooder No. 2 was a home-made machine developed and used extensively by F. E. Lamb of Canby, Oregon (see Figure 4). The brooder was 28 inches wide and 95 inches long with a gabled roof having a slope of 1 to 3.3. The hover was built of flooring and the top was lined with galvanized iron leaving a 1¼-inch space which was filled with planer shavings. Three holes 2 inches in diameter were provided at the top near the ridge for ventilation. A curtain was used around the outer edge of the hover.

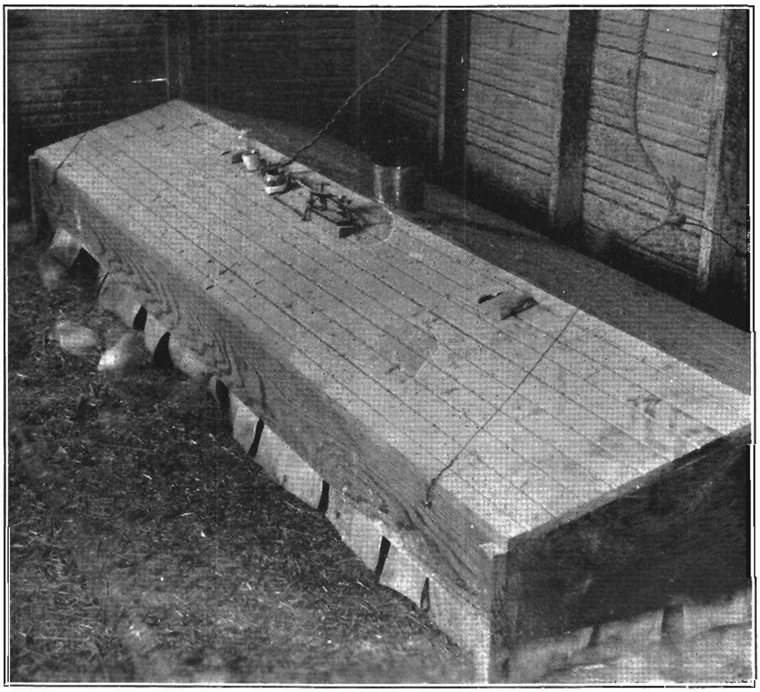

Fig. 4. Brooder No. 2. Home-made—wood exterior, planer-shaving insulation, metal ceiling.

Brooder No. 3 was conical in shape, constructed of galvanized iron with a 1-inch wood ceiling forming an air space in the top as shown in Figure 5. It has an outer rim and curtain and an inner circular section with a second curtain. The inner circle is about two-thirds the diameter of the entire brooder. The heating coils, which are of the non-glow type, are fastened to the ceiling of the brooder by cleats just inside the inner circle. All of the heating elements are controlled by a thermostatic switch.

Ventilation is provided through a 3-inch tube or flue which can be adjusted at the top and extends down through the center of the hover to about the level of the top of the curtain.

There is a door in the outside metal hover. A double glass window in the wood ceiling of the brooder permits the operator to look down into the central zone under the brooder and observe the way the chicks are brooding, inspect the thermometer or remove it, adjust the thermostat or turn on or off the attraction light or brooder light, which is under the hover, as may be desired without any loss of heat or disturbance to the chicks. These are worth-while features.

The brooder is suspended with a rope and pulley and held in place by a counter weight, which provides a convenient arrangement for raising the hover for inspection and cleaning under the hover.

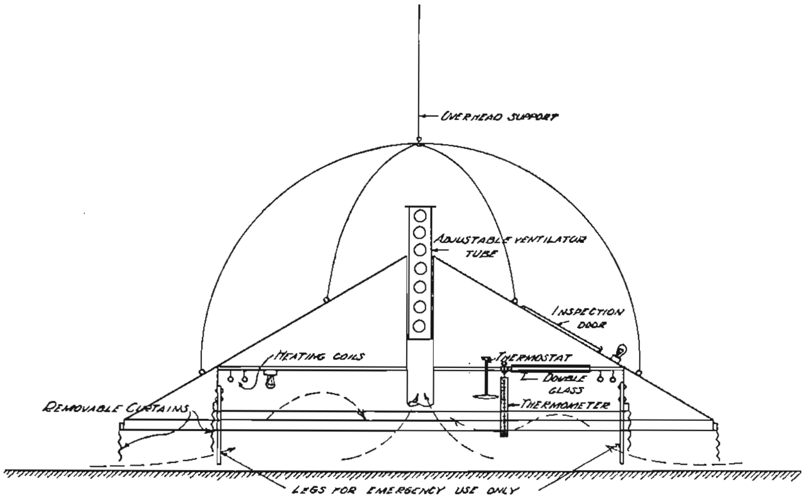

Fig. 5. Brooder No. 3.

Brooder No. 4 was entirely different from any of the other brooders. This brooder was of the underheat type, which consists of a large flat box-type compartment with a special floor under which the heat is applied. The chicks brood on this special floor instead of on the floor of the brooder house. Sand is used on the floor of the brooder. The ventilation system is indicated in Figure 6.

Brooder No. 5 was developed by Geo. W. Kable, formerly agricultural engineer for the Experiment Station. This brooder consists of two separate units—the electric heating device and the hover. Any hover can be used. The heating device is a small hot-air type furnace, 22 inches long and 8 inches in diameter, and extending 18 inches below the floor of the brooder room. Fresh air can be taken in from under the brooder-house floor. See Figure 7.

Brooder No. 6 was not used at the Experiment Station in 1926 or 1927 but was used by a leading poultryman near by as a special test. The consturction of this brooder is shown in Figure 8.

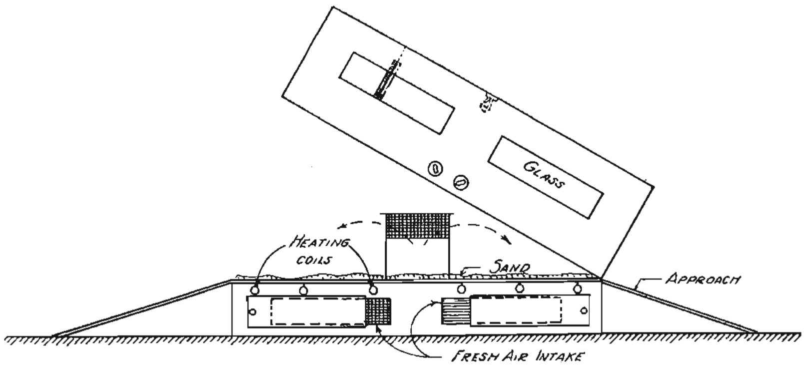

Fig. 6. Brooder No. 4.

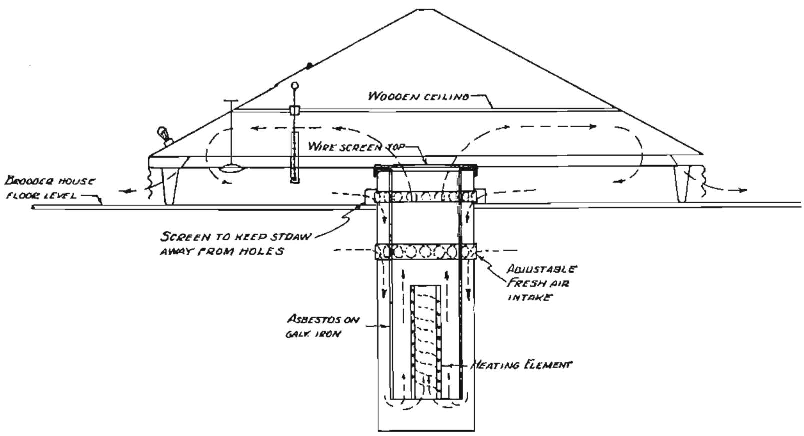

Fig. 7. Brooder No. 5.

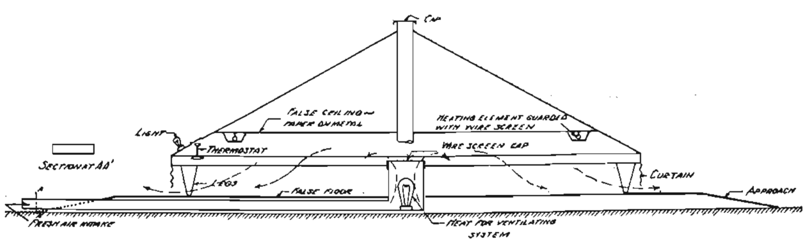

Fig. 8. Brooder No. 6.

Brooder No. 7 was received at the Experiment Station in April, 1929. It was used in one regular brooding in 1929 and in a special test in January, 1930. The construction and ventilation system of this brooder are shown in Figure 9.

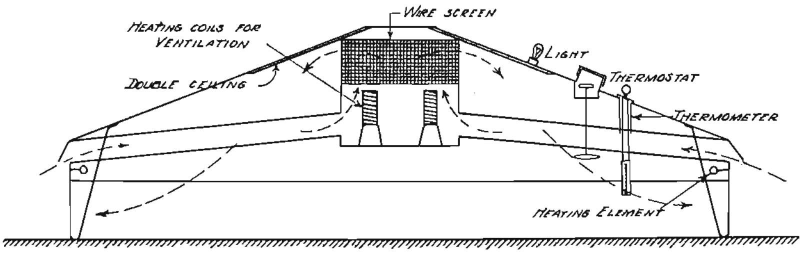

Fig. 9. Brooder No. 7.

Brooder No. 8 was the only one using the red heat or glowing heating elements. The four heating elements are about 30 inches from the floor and the heat is directed to the floor by a special reflector. See Figure 10. This brooder was used for one brood in 1929 but not under experimental conditions.

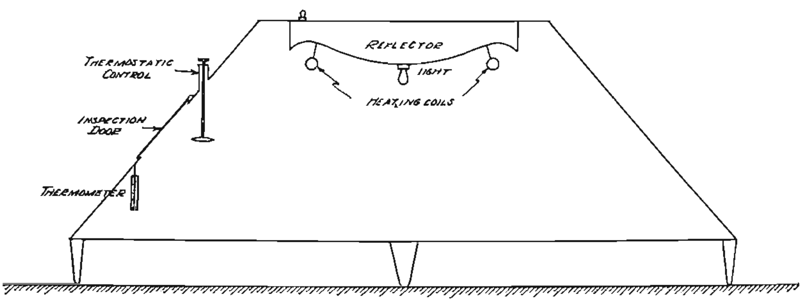

Fig. 10. Brooder No. 8.

Brooder No. 9 will be used for the first time at the Experiment Station in 1930. It is quite similar to brooder No. 2 used in the 1926 tests except that it is all metal with 2 inches sawdust for insulation. With this amount of insulation it should be low in power consumption. Laboratory tests have been made with this brooder which show that it has very uniform heat distribution under the hover. See Figure 11.

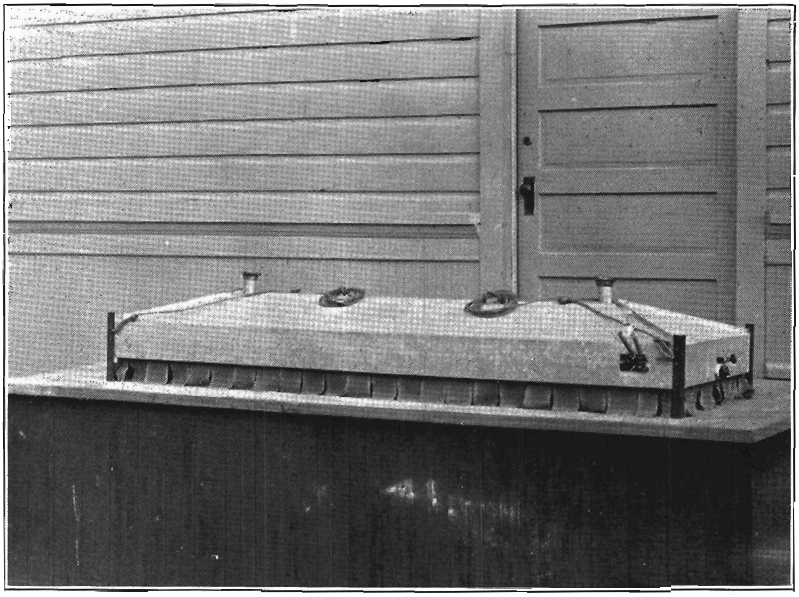

Fig. 11. Brooder No. 9.

RESULTS OF BROODER EXPERIMENT

In 1926, five electric brooders, two of the No. 1, two No. 2, and one No. 3, and a coal-stove brooder were included in the experiment. The coal-stove brooder was one of the type that had been used at the Experiment Station for several years with very satisfactory results.

The tabular summary of the results of this brooding season is given in Table III.

In the 1927 brooding season, the two No. 1 brooders and the two No. 2 home-made brooders were not used, but brooder No. 4, of the underheat type, and an oil brooder were added to the test. The oil-burning wickless brooder had a hover without a curtain. The oil flow was controlled by a float. This was one of the newer types of small oil brooders of the 500-chick size. Brooder No. 3 was used again in 1927.

The brooders were all used without supplemental room heat. Since most of the electric brooders heat the room only slightly the question is often asked whether this is not an objection. From observations throughout this test it was found that the chicks soon learned to return to the brooder to get warm and appeared more lively with electric brooders than when the entire room was kept warm as with a stove or fuel type of brooder.

The data on fuel or power cost, mortality and weight of chicks for 1927 are given in Table IV.

TABLE II. ELECTRIC BROODER SPECIFICATIONS

Brooder number	Size	Chick capacity (Mfgrs'. rating)	Space per chick	Type of heating elements	Ventilation	110 Volts Power required by heating elements: Thermostat control	Continuous or snap switch	Total	Curtain
	in.		*sq. in.*			*watts*	*watts*	*watts*	
1	32 x 70	500	4.48	Black heat overhead	In at side, out holes in top	740 (old type) 580 (new type)	0 0	740 (old type) 580 (new type)	Yes
2	28 x 95	500	5.37	Black heat overhead	In at side, out holes in top	840	0	840	Yes
3	56 diam.	350	7.03	Black heat overhead	In at sides, out center flue	480	0	480	Yes
4	36 x 92	500	6.6	Black heat under brooder floor	Two intakes in floor, out at sides	400	325 185	910	Yes
5	40 x 61	350	7.00	Glow heat in cylinder under floor of house	Air recirculates, fresh air in at bottom center, out at sides	650	0	650	Yes
6	54 diam.	500	4.54	Black heat overhead	In through fresh air tube to center, out at sides	1300	0	1300	Yes
7	47 diam.	350	5.16	Glow heat—in *top and center* Black heat at outer edge	In through tubes from sides, out at sides	500	700	1200	No
8	62 diam.	500	6.0	Glow heat—at top and center	Special convection currents air in and out at sides	550	550	1100	No
9	30 x 96	500	5.76	Black heat overhead	In at sides, out through flues in top	560	180	560	Yes

Chick mortality. The chick-mortality records show that the coal stove had the lowest mortality in 1926; in 1927 No. 3 electric brooder had the lowest mortality.

The two home-made electric brooders No. 2-A and No. 2-B that were used in 1926 performed quite well as to chick mortality, as they ranked second and third. Brooder No. 3 ranked fourth in 1926 and first in 1927. Brooder No. 5 placed second in 1927.

The rather high mortality in brooder No. 1 in 1926 was probably due to operating the brooder as recommended by the manufacturer. While the directions specified the usual brooding temperature, the thermometer was suspended so as to be considerably above the chicks, with the result that the temperature near the chicks was much colder than that recorded by the thermometer, thus causing the chicks to become chilled. This might not be a serious objection if the operating temperature had been determined by watching the chicks instead of the thermometer. Poultrymen who would follow the manufacturer's instructions would experience difficulty. In order to check on this the brooders were operated in the official tests according to manufacturers' instructions.

Weight of chicks. The performance of the brooders as indicated by the weight of the chicks is also shown in the Brooder Rating Index, Table V, as well as in the tabular summaries. Brooder No. 3 ranked first in 1926 and 1927. The coal stove ranked fourth in 1926. Brooder No. 5 rated second in weight of chicks in 1927.

TABLE III. BROODER EXPERIMENT

1926

Brooder number	*Average weight of chicks at 6 weeks: Rocks	Leghorns	Total feed cost 6 weeks	Percent mortality for 6 weeks	Fuel† or power cost: Total	Per chick	Number of chicks at start
	oz.	oz.		%			
No. 1-A	9.16	7.84	$12.45	15.0	$6.76	.017c	400
No. 1-B	9.08	8.20	13.44	13.7	5.51	.014	400
No. 2-A	8.72	7.06	14.11	8.5	5.55	.014	400
No. 2-B	8.46	7.03	13.43	10.5	3.85	.010	400
No. 3	9.38	8.16	11.79	12.5	3.15	.008	400
Coal stove	8.56	8.20	13.86	5.4	5.26	.013	400

*Weight of pullets only.
†Electricity at 3c per kw.-hr. Briquets at $17.00 per ton.

TABLE IV. BROODER EXPERIMENT

1927

Brooder number	*Average weight of chicks at 8 weeks: Rocks	Leghorns	Total feed cost 8 weeks	Percent mortality for 8 weeks	Fuel† or power cost: Total	Per chick	Number of chicks at start
	oz.	oz.		%			
No. 3	16.76	16.04	$20.15	6.5	6.44	.018c	350
No. 4	12.36	14.60	23.73	15.0	8.08	.016	500
No. 5	17.56	15.04	21.50	10.5	7.26	.021	350
Oil brooder	16.60	15.68	18.24	13.7	10.80	.031	350

*Weight of pullets only.
†Electricity at 3c per kw.-hr. Kerosene at 18c per gallon.

TABLE V. BROODER RATING INDEX

	First	Second	Third	Fourth	Fifth
		Fuel-cost rating			
1926	No. 3	No. 2-B	Coal stove	No. 1-B	No. 1-A
1927	No. 4	No. 3	No. 5	Oil brooder	
		Mortality rating			
1926	Coal stove	No. 2-A	No. 2-B	No. 3	No. 1-B
1927	No. 3	No. 5	Oil brooder	No. 4	
		Weight of chicks			
1926	No. 3	No. 1-A	No. 1-A	Coal stove	No. 2-A
1927	No. 3	No. 5	Oil brooder	No. 4	

COMMON OBJECTIONS TO ELECTRIC BROODERS

The most common objections to electric brooders are: first, interruptions in the electric power service, which usually occur to some extent in any locality, due particularly to storms; second, the lack of heat for the brooding room or cold room brooding; third, the condensation of moisture, commonly called sweating, under the brooder; and fourth, cost of electricity as compared to fuel-burning brooders.

Electric power interruptions. Power interruption did not cause any difficulties in the three brooding seasons at the Experiment Station. There were no power interruptions in 1926 or 1927. In 1928 the power was off on April 2 for 2 hours, which was the second day of brooding, and on April 4 for 25 minutes.

When the power was off for 2 hours, brooder No. 3 dropped from 98 to 85 degrees at first when no changes were made, but when the opening in the ventilating flue was reduced and the hover lowered, the temperature under the brooder was raised to 93 degrees. Brooder No. 4, which was the under-heat type, dropped only 4 degrees and brooder No. 5 dropped 7 degrees. The brooders were in separate colony-type houses with no supplemental heat, and there was a severe wind and rain storm at the time of the power interruption. The brooder houses were quite old and not of tight construction. Additional data on power interruptions are given on pages 22-23.

Electric brooders that have metal hovers without insulation not only require more current to operate but cool more quickly when power interruptions occur.

A "power-off" alarm should be attached to the power circuit in order to warn the operator in case of power interruptions, particularly at night. If a 100-percent safety-first provision is desired, a low-temperature alarm could also be provided, although the "power-off" alarm is probably sufficient.

Combination alarms which serve as a burglar, fire or "power-off" alarm and which could also be used as a low-temperature alarm with slight modification can be secured from some of the brooder manufacturers.

Unheated brooder room. During the daytime, when the chicks spend most of their time out from under the brooder feeding and scratching, the temperature under the brooder should be kept high enough to warm the chicks quickly so that they can get back to their feed and exercise. By following this method the cold brooder room was found to be very satisfactory at the Experiment Station, where during the colder part of the brooding period outside temperatures varied from 30 to 35 degrees, the minimum temperatures in the normal brooding season in Western Oregon as shown in Table I. For brooding in colder weather, see pages 21-22.

The practice of reducing the brooder temperature during the daytime in order to conserve on cost of electricity is a great mistake. The brooder ventilation may be reduced by the operator during the daytime since there is only a small percentage of the chicks under the brooder at one time. This will reduce the power consumption without lowering the brooder temperature since less of the warmed air is permitted to escape from the brooder.

Wet litter under the brooder. Adequate heat and ventilation are necessary to keep the litter dry under electric brooder. A great deal of moisture is given off by the chicks through respiration and from droppings. This moisture must be carried from the brooder by adequate ventilation, otherwise the air under the hover becomes saturated with moisture, which is condensed into drops of water at the colder points. Adequate heat under the hover is necessary to prevent damp litter, particularly since the ventilating system of electric brooders is dependent upon the difference in the room temperature and the brooder temperature. As the chicks grow older and there is a desire to lower the temperature near the chicks, it is advisable to raise the hover when using brooders of the overhead-heat type that do not have some special device to force ventilation.

Any first-rate electric brooder will keep the litter under the hover dry during the first week or ten days. After this time it may become a problem to the extent that the litter under the hover will require changing 2 or 3 times a week. Electric brooders will not keep the litter dry 6 to 10 inches beyond the edge of the hover and this is where the chicks begin to roost when they are 2 to 4 weeks old. A much better system after the first week or two is to make a frame of 1 x 3 boards placed on edge and cover it with ½-inch mesh hardware cloth and place it under the hover. It should be large enough to extend out one foot on all sides of the hover. Droppings will pass through this ½-inch mesh, thus providing a sanitary and dry roosting platform. See Figure 14.

Cost of heat. The data obtained in the brooder tests at the Experiment Station (page 13) show that well-constructed electric brooders operated at as low or lower heat cost than the coal stove. The power rate was 3 cents per kilowatt-hour and the briquet cost was $17.00 per ton.

ADVANTAGES OF ELECTRIC BROODERS

The first and most important advantage of electric brooders is the convenience and saving in labor over fuel-burning brooders; second, electric brooders are more accurate in maintaining the brooding temperature that is desired than the fuel-burning brooders, particularly during warm weather; and third, they almost entirely eliminate any danger of fire. Since the brooder room receives practically no heat the chicks become accustomed to the cool room from the beginning. This tends to cause more rapid feathering of the chicks.

SUGGESTIONS FOR OPERATORS OF ELECTRIC BROODERS

An electric brooder should be carefully inspected sufficiently in advance of the brooding season to give time to obtain and install any needed repair parts. The thermostat and heating coils must be in good condition to assure satisfactory operation of the brooder. The contact points of the thermostat are the most common source of trouble. They should be smooth and should contact over the entire face. If the points are in a very pitted condition a new set should be installed rather than to invite trouble during the brooding season. By keeping an extra complete thermostat on hand quick repair is assured. All electrical insulation should be inspected and repaired if not in good condition.

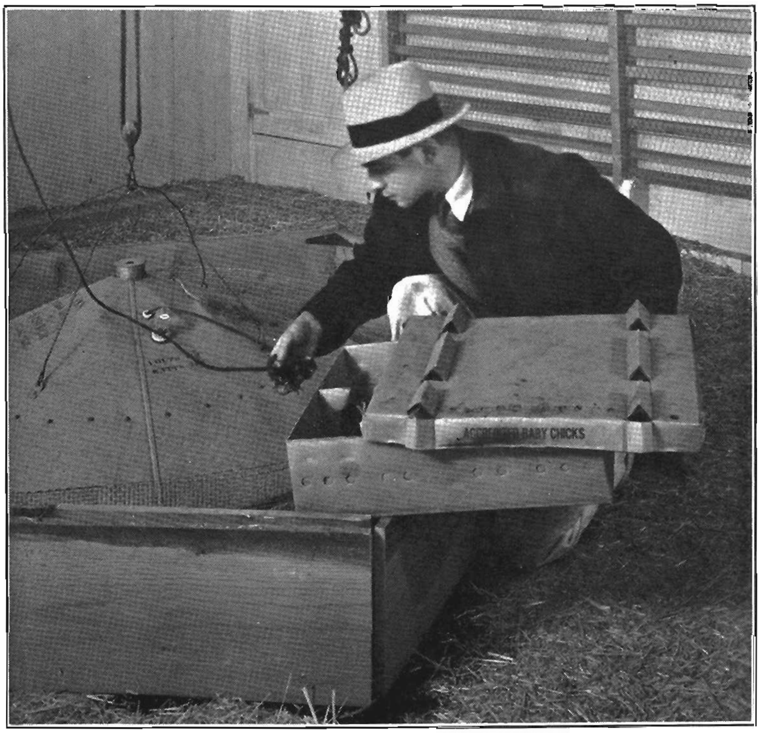

Fig. 12. Receiving the chicks and putting them under the electric brooder at 98° to 100° F.

Electric brooders if well constructed require very few repairs, but even so a thorough inspection should be made each spring to avoid interruptions during brooding. They should be set in operation a few days before the chicks are to be placed with the brooder to be sure a temperature of 98 to 100 degrees can be maintained 2½ inches above the floor.

Handling the chicks. Chicks should be confined under the brooder the first few nights. This can best be done by placing a strip of ½-inch mesh hardware cloth about a foot wide around the hover and pulling it close to the hover. See Figure 12. One-by-twelve boards hinged in pairs make a good secondary fence for electric brooders to confine the chicks near the hover during the first 3 to 6 days and prevent possible floor drafts. See Figure 2.

Electric brooders that have full automatic heat control offer no danger of overheating the chicks when they are confined under the hover. If the brooder has one or more heating elements that are not controlled by the thermostat the thermometer and chicks should be watched for about half an hour to be certain the heat supply is properly set.

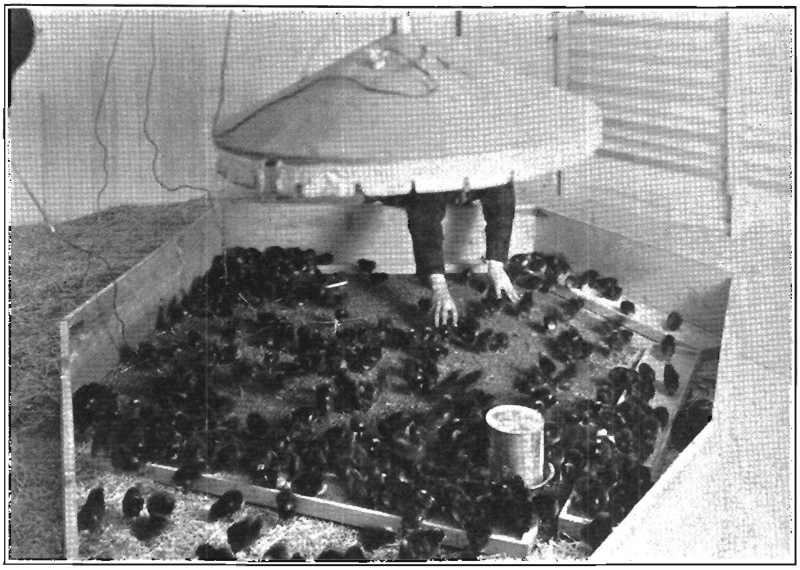

Fig. 13. A counter weight and pulley arrangement for raising the hover provides a convenient method of inspection and cleaning under the hover.

It is very important that the operator understand the method of controlling or turning on or off each heating element in the brooder. Some electric brooders are nearly fool proof while others are far from that.

The ½-inch mesh hardware-cloth platform shown in Figure 14 is recommended for use after the first week or two. It will take a day or two for the chicks to become used to it but it is decidedly worth while as a labor-saver and from the standpoint of sanitation. It is as sanitary as if the chicks had been placed on regular roosts at one week of age.

At 5 or 6 weeks wood roosts can be placed on the hardware-cloth platform; or the brooder, if of the suspension type, can be suspended over the regular roosts in the brooder house (see Figure 15). Usually no heat is required after 6 weeks.

Thermometer location. The importance of having the brooder thermometer low enough to record the temperature 2½ to 3 inches from the floor instead of several inches above the chicks cannot be overemphasized.

An experienced brooder operator usually pays little attention to thermometer readings but supplies sufficient heat to quiet the chicks and avoids overheating, which is indicated by chicks with spread wings and beaks open as they breathe. When changing to a new type of brooder and for beginners a thermometer is necessary.

Fig. 14. Electric brooder suspended over hardware cloth ½-inch mesh on 1x3 wood frame, which provides a very sanitary and entirely dry roosting platform to be used after the first or second week.

Pilot light and attraction light. Most electric brooders are equipped with a pilot light controlled by the thermostat. The pilot light indicates that the heat control is in operation as the light goes on or off. This should be a standard lamp so that in case of replacement a standard size 10- or 15-watt lamp can be used instead of some special or odd size as is sometimes installed by manufacturers.

An attraction light is usually provided under the hover to aid in drawing the chicks to the heat. This light should be controlled by a snap switch to be used as desired by the operator. Such a light may be a colored or clear light of 10 or 15 watts. When the chicks are to be confined under the brooder, the usual practice is to turn the room lights off in the evening of the first few nights and turn the attraction light on. By this method all the chicks go under the hover in a few minutes. The hardware cloth can then be put around the hover to keep them under and all lights turned off. After the first few nights, when the chicks are free to go to and from the hover, it is the safest plan to keep the attraction light on under the hover all night until the end of the first week. After this the attraction light is not needed except for inspection under the hover.

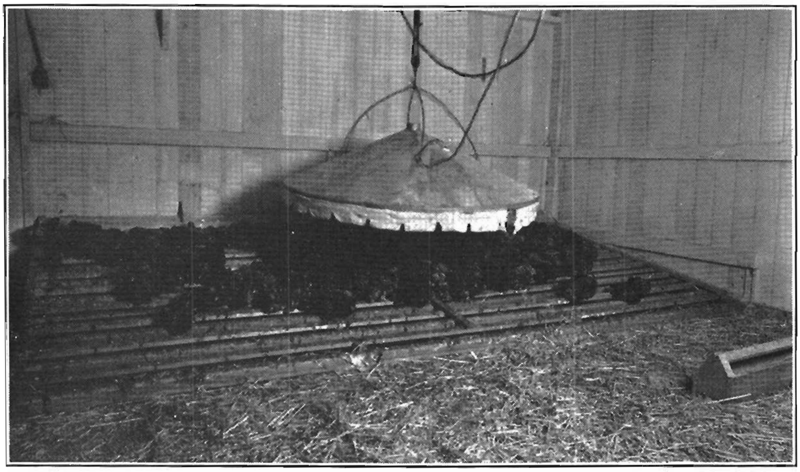

Fig. 15. Seventh week of brooding, heat off, showing electric brooder suspended over the roosts. The brooder and the attraction light under the hover aid in drawing the chicks to the roosts.

Capacity of brooders. It is common practice for manufacturers of all types of brooders to overrate their chick capacity. Table II gives the rated capacity and the square inches of floor space per chick under the hover for eight different brooders varying from 4½ square inches per chick to 7 square inches per chick.

The brooders having only 5 to 6 square inches per chick may take satisfactory care of the chicks for the first 2 weeks, but if the weather is cold when the chicks are 3 to 6 weeks old the limited space under the hover may cause crowding.

The recommended amount of space under the hover for electric brooders is 7 square inches per chick.

COLD WEATHER ELECTRIC BROODER TEST

In January of 1930 one of the most severe cold waves on record was experienced in Western Oregon. When this cold weather began the official weather forecasts were for continued cold. This appeared to be an unusual opportunity to study the performance of electric brooders in cold weather.

On January 14, a purchase of 700 Barred Rock chicks was obtained from a commercial hatchery and placed under two 350-chick electric brooders without any culling. A Number 3 and a Number 7 electric brooder were used. It was found necessary to use a curtain on Brooder No. 7 in order to maintain brooding temperature 2½ inches from the floor, although this brooder is recommended to be used without a curtain.

The maximum temperature on the day the chicks arrived was 28 degrees, and for the first ten days the maximum weather temperature did not exceed 29 degrees and the minimum was 4 degrees. The minimum temperature for the past 20 years at the Experiment Station in January or February has been 3 degrees above zero (see Table VI).

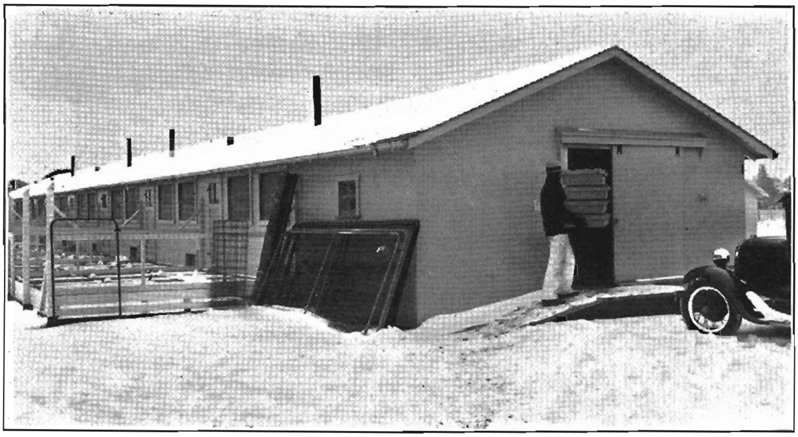

Fig. 16. Receiving chicks for tests of electric brooders in below-freezing weather.

The brooder rooms were not supplied with any heat other than that which was released by the electric brooders. The brooder house had 8 brooder rooms 16 x 16 feet with celo-glass curtains and single-wall construction all in first-class condition.

The complete weather records and brooder-room temperatures for the first 4 weeks of brooding are given in Table VII.

The chicks received their first feed 24 hours after they were received from the hatchery. They were fed at frequent intervals during the first 4 days from 8:00 a.m. to 10:00 p.m. in the unheated room (Table VII) and then the feed was taken away. After the first 4 days feed was kept before the chicks continuously. It was found necessary to keep the temperature under the hovers at 100 to 105 degrees during the first ten days to keep the chicks comfortable. This is a higher temperature than is usually recommended in the normal brooding season. The chicks were kept under the brooder the first five nights as shown in Figure 12. The management after this time was as recommended on page 5.

Mortality. The mortality is shown in tables VIII and IX. There were practically no losses during the first four days, but there were rather heavy losses on the fifth, sixth, and seventh days. The losses during the first week in Brooder No. 3 amounted to 13.9 percent and in Brooder No. 7 to 12.1 percent. This high mortality did not continue after the first week. The mortality for Brooder No. 3 for the second to sixth weeks inclusive was 1.95 percent, making a total mortality of 15.85 percent; for Brooder No. 7 it was 1.13 percent, making a total mortality of 13.23 percent. The cold weather continued during the second week of brooding, thus showing that the losses practically stopped during the cold weather.

Power interruptions. About 6:00 p.m. of the fifth day of brooding the power went off and stayed off for one hour. The outside temperature was 20 degrees when the power went off and the chicks were out from the brooders at the feed troughs. The chicks were returned to their respective brooders by the attendant and kept there by a hardware-cloth screen. Sacks were thrown over the hovers as an extra precaution, but no additional heat was applied. Recording thermometers showed that one brooder had a temperature drop from 100 degrees to 90 degrees, and the other brooder dropped from 99 degrees to 93 degrees. These figures would indicate that the chicks were not injured by this power interruption. During this interruption plans were being made to supply extra heat if the brood-

TABLE VI. MINIMUM TEMPERATURES FOR EACH MONTH FOR TWENTY YEARS (1910-1930)—OREGON AGRICULTURAL EXPERIMENT STATION

January	+3°	April	24°
February	16°	May	28°
March	22°	June	32°

TABLE VII. MAXIMUM AND MINIMUM TEMPERATURES
January 14 to February 24, 1930—Oregon Agricultural Experiment Station.

Date	*Outside temperature Maximum	*Outside temperature Minimum	Brooder room temperature Maximum	Brooder room temperature Minimum
January 14	28°	13°	30°	22°
15	28°	23°	30°	26°
16	28°	22°	30°	24°
17	24°	18°	27°	21°
18	24°	17°	34°	29°
19	28°	20°	34°	27°
20	29°	19°	32°	20°
January 21	29°	4°	23°	5°
22	27°	12°	33°	16°
23	29°	23°	32°	30°
24	35°	25°	34°	31°
25	31°	12°	36°	20°
26	32°	21°	40°	35°
27	40°	24°	44°	36°
January 28	38°	22°	48°	36°
29	40°	32°	55°	47°
30	45°	36°	....	....
31	53°	34°	....	....
February 1	55°	46°	53°	46°
2	54°	45°	56°	44°
3	53°	34°	57°	51°
February 4	54°	37°	56°	52°
5	61°	45°	60°	51°
6	50°	32°	59°	52°
7	55°	43°	65°	56°
8	55°	30°	67°	52°
9	49°	28°	66°	56°
10	52°	44°	68°	57°
February 11-17	63°	31°	....	....
February 18-24	54°	30°	....	....

*Weather data furnished by Soils department, Oregon State Agricultural College. Cooperative Observer, United States Weather Bureau.

ers had dropped very much below 90 degrees. Quart jars were ready to be filled with hot water to be placed under the hovers if needed.

In conclusion. These cold-weather electric brooding data are not given to convey the idea that the Oregon Agricultural Experiment Station recommends the use of electric brooders without supplemental room heat during below-freezing weather but rather to indicate what can be done under such conditions. The results of this experiment, moreover, serve as further indication that the vigor and vitality of the chicks are not impaired by brooding with electric brooders in rooms without supplemental heat. This test should eliminate all fear of using electric brooders during 28- to 30-degree weather, which is the minimum temperature for the normal brooding season of Western Oregon.

TABLE VIII. COLD WEATHER BROODER EXPERIMENT

Electric Brooder No. 3

January 14-February 24, 1930

Age in weeks	Power used	Power cost at 3c kw.-hr.	Feed cost at 3½c per pound	Weight	Percent of mortality
	kw.-hr.			*oz.*	%
1	66	$1.98	$1.08	1.66	13.90
2	85	2.55	3.23	3.28	1.39
3	56.5	1.70	3.06	5.76	0.00
4	62.5	1.88	6.22	8.80	0.00
5	62.5	1.88	7.70	12.16	.28
6	77.0	*2.31	8.50	16.96	.28
Totals	409.5	$12.30	$29.79		15.85%

Weight of day-old chicks—1.23 oz.
Number of chicks at start of run—360.
Number of chicks at end of 6 weeks—303.
No heat used after 6 weeks.
*High power cost of sixth week due to suspending brooder over roosts taking more heat.

TABLE IX. COLD WEATHER BROODER EXPERIMENT

Electric Brooder No. 7

January 14-February 24, 1930

Age	Power used	Power cost at 3c kw.-hr.	Feed cost at 3½c per pound	Weight	Percent of mortality
wks.	*kw.-hr.*			*oz.*	%
1	95.0	$2.85	$ .96	1.77	12.10
2	118.0	3.54	3.56	3.28	.57
3	145.5	4.36	3.46	5.92	0.28
4	157.5	4.73	5.97	8.80	0.00
5	177.0	5.31	6.93	12.64	0.28
6	158.0	4.74	7.92	16.96	0.00
Totals	851.0	$25.53	$25.80		13.23%

Weight of day-old chicks—1.28 oz.
Number of chicks at start of run—356.
Number of chicks at end of 6 weeks—309.
No heat used after six weeks.

TABLE X. WEIGHT AFTER THE SIXTH WEEK

Average from Brooders No. 3 and No. 7 (cold weather test)

Age of chicks	Weight of cockerels	Weight of pullets
wks.	*lbs.*	*lbs.*
7	1.4	1.25
8	1.84	1.50

ELECTRIC BROODING OF TURKEYS

In the spring of 1929 a cooperative project was arranged with Mr. and Mrs. Fred Wiese and Mr. and Mrs. F. G. Taylor and the Oregon Agricultural Experiment Station whereby two lots of "poults" were to be brooded with electric brooders on their respective farms.

The No. 3 electric brooders were used for the four lots of poults. The Wiese farm used the 350-chick size (56 inches in diameter) and the Taylor farm used the 200-chick size (42 inches in diameter).

On May 10 the Wiese farm received 250 poults and the Taylor farm received 75 poults, which were placed under the 56-inch and 42-inch hovers respectively. The eggs were produced on the two farms and hatched by a commercial hatchery.

The brooder management was the same as recommended for chicks (page 15) except that the brooder temperature was kept slightly higher considering the type of brooder and the weather temperature. This seemed to be necessary to make the poults comfortable and quiet. Owing to the greater size of the poults it was necessary to keep curtains and brooder slightly higher for them than for chicks of the same age. The poults grow so rapidly that it is a particular advantage to be able to suspend the brooder with a rope and pulley and raise it as the turkeys grow.

Brooder capacity for poults. Brooder No. 3 which was used for these tests is rated at 350 chicks for the 56-inch hover and 200 chicks for the 42-inch hover. This rating provides 7 square inches per chick under the hover, which is the space recommended by the Experiment Station. When 250 poults were brooded under the 56-inch hover they appeared to be slightly crowded. In the second brooding 190 poults were placed under the same size and make of brooder, and this was found to be a very satisfactory number, though this number could probably have been increased to 200 with the same results. This capacity rating would provide 12 square inches per poult or nearly double the space that is recommended for chicks.

Mortality and power costs (see Table XI). The highest mortality for the four broods of poults for four weeks was 9.6 percent and the lowest was 8 percent. The losses after four weeks were slight, but exact records were not kept.

The power costs for six weeks were highest in the May brooding with the small brooder at 3.6 cents per poult and lowest in the June brooding with the larger brooder at 2.3 cents per poult.

Conclusion. The electric brooders were very satisfactory to the farmers using them for brooding poults for the following reasons.

1. The full automatic heat control provided a uniform brooder temperature at all times. This was a particular advantage in preventing overheating during warm weather.

2. The elimination of fire hazard was very important.

3. The mortality record was very good.

4. The power cost was quite reasonable.

5. The electric brooders required very little attention, thus saving labor.

TABLE XI. ELECTRIC BROODING OF POULTS

Farm	Start brooding	Number of poults	*Power consumption for 6 weeks Amount	Cost at 3c per kw.-hr.	Cost per poult	Percent of mortality 4 weeks
Wiese	May 10	250	243.5	$7.30	2.9c	8.0
Wiese	June 7	190	146.0	$4.38	2.3c	9.6
Taylor	May 10	75	90.0	$2.70	3.6c	6.7
Taylor	June 15	63	55.0	$1.65	2.6c	8.0

*No heat used after 6 weeks.
Mortality records not kept for fifth and sixth week.