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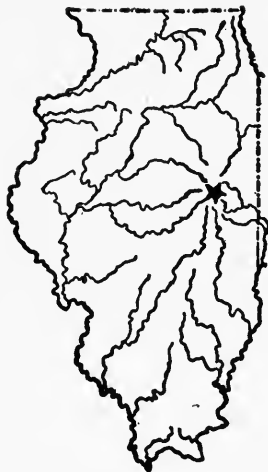


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COMPARATIVE EXPENSE OF
MECHANICAL AND HAND MILKING

By F. A. PEARSON AND H. A. ROSS



URBANA, ILLINOIS, JANUARY, 1923

SUMMARY OF BULLETIN No. 241

Investigations conducted by experiment stations and the experience of a large number of dairymen have shown the practicability of mechanical milkers from the standpoint of their effect upon production, upon the quality of the milk, and upon the physical condition of the cows. The object of this study was to compare the expense of mechanical and hand milking in herds of different sizes. Data were obtained from 32 Illinois dairy farms on which 860 cows were milked mechanically and from 34 farms on which 850 cows were milked by hand. The farms were, as nearly as possible, comparable in respect to efficiency of management and methods of dairying except as to the method of milking.

The average annual expense of caring for a cow milked mechanically was \$18.64. Man labor constituted 76.5 percent of the total expense; power, 13.2 percent, and mechanical milker, 10.3 percent.

The average annual expense of caring for a cow milked by hand was \$23.44, or \$4.80 more than the average expense of caring for a cow milked by machine. The labor requirement was 133.9 hours per cow per annum for the cows milked by hand as compared with 81.5 hours for the cows milked mechanically.

In herds of less than 25 cows, the average annual expense of caring for cows milked mechanically was \$20.55 per cow, and in herds of 25 cows or more, \$17.49 per cow. This difference (\$3.06) was made up of differences of \$1.11 in labor expense, \$1.31 in power expense, and \$.64 in mechanical milker expense in favor of the larger herds. No significant difference in expense of hand milking, due to size of herd, was found.

The average annual saving in expense resulting from the use of mechanical milkers was \$3.23 per cow, or \$61.69 per farm, in herds of less than 25 cows. In herds of 25 cows or more, the saving was \$5.70 per cow, or \$203.49 per farm. These differences were based upon a labor rate of 17.5 cents per hour. When the labor rate was varied from 12 cents per hour to 30 cents per hour, the saving in expense resulting from the use of mechanical milkers ranged from \$.46 to \$9.55 per cow for the smaller herds and from \$2.76 to \$12.37 per cow for the larger herds.

Under some circumstances of size of herd and expense of labor, there is sufficient saving in labor to make a mechanical milker a profitable investment.

COMPARATIVE EXPENSE OF MECHANICAL AND HAND MILKING

BY F. A. PEARSON, ASSISTANT CHIEF IN DAIRY HUSBANDRY,¹ AND
H. A. ROSS, ASSOCIATE IN DAIRY ECONOMY

Mechanical milkers have been in use for a sufficient length of time so that their practicability may be determined from the standpoint of their effect upon production, upon the quality of the milk, and upon the physical condition of the cows. Investigators in general agree in regard to their conclusions based upon the experimental use of mechanical milkers. These conclusions may be summarized as follows:

(1) Mechanical milkers, when operated by competent men, have little or no effect upon the production of the cows. Failure to thoroly strip by hand following machine-milking may cause decreased production. (2) When teat cups are properly fitted and care is exercised in operating the milker, there is no harmful effect upon the udder or teats. (3) Clean milk, and milk with a low bacterial count, may be obtained when a mechanical milker is used, if sufficient care is given to cleaning the machine.

Dairymen and investigators are now generally of the opinion that the use of mechanical milkers in large herds results in a saving of labor. There are available, however, few data on the expense of operation. It is the object of this study to compare the expense of mechanical and hand milking in herds of different sizes. The data are, to a large extent, presented in the form of averages. It is apparent that the cost of mechanical milking may vary widely on different farms; but for the farmer who is thinking of buying a milking machine this study should indicate the probable saving in labor, and by substituting his individual labor rate for the one used, he can better estimate the relative economy of the two methods of milking. It should perhaps also be added, with respect to the cost of mechanical milkers and their repair, that altho the values presented here cannot be taken as an exact measure of their cost at any one time, yet the difference between present costs and the costs entering into this study is not large enough to affect the practical application of the data.

SOURCE AND CHARACTER OF DATA

These data on the expense of mechanical and handmilking were obtained from detailed cost accounts kept on 66 dairy farms in Illinois. These farms were representative of the large group of well-

¹Mr. Pearson was with the Department of Dairy Husbandry from 1912 to 1920.

managed, modern, and practical dairy farms from which whole milk is sold. They were, as nearly as possible, comparable in respect to efficiency of management and methods of dairying, except as to the method of milking. Eight hundred fifty cows were maintained on the 34 farms where milking was done by hand, and 860 cows on the 32 farms where mechanical milkers were used. The following types of mechanical milkers were used on these farms: 14 Hinman, 9 Burrell-Lawrence-Kennedy, 6 Victory, and 3 Sharples.

The data here presented are on the year basis, all expenses and all accounts of labor hours being annual averages. The records from which they were obtained, however, cover seven fiscal years, 1914 to 1920.

EXPENSE OF MILKING WITH MECHANICAL MILKERS

In this study the items of expense involved in caring for cows milked mechanically have been grouped into three divisions: (1) power expense; (2) milker expense; and (3) labor. All the items of expense of maintaining and operating the engines furnishing power for the milkers have been classed as power expense. Expenses directly attributable to the milkers proper have been grouped in the second division as mechanical milker expense. The cost of labor required in caring for the cows and in operating the mechanical milkers constitutes the third division.

POWER EXPENSE

Internal-combustion engines were the source of power on all the farms involved in this study. Gasoline was used as fuel on most of the farms, altho kerosene was used in a few instances. Relatively

TABLE 1.—ANNUAL POWER EXPENSE OF OPERATING MECHANICAL MILKERS ON THIRTY-TWO FARMS WITH 860 COWS

Items of expense	Total expense	Percentage of total expense	Expense per cow
Gasoline and kerosene	\$1,212.28	57.2	\$1.41
Depreciation on engines	452.48	21.4	.53
Repairs on engines	144.88	6.8	.17
Interest on engines	132.11	6.2	.15
Oil	101.79	4.8	.12
Batteries	63.45	3.0	.07
Use of buildings	12.00	.6	.01
Total power expense	\$2,118.99	100.0	\$2.46

small engines were installed, as they require less fuel than the large engines, which develop unnecessary power. Table 1 shows the cost of each of the various power items for the entire group of farms using mechanical milkers. The power expense includes gasoline and

kerosene, depreciation on engines, interest on investment, repairs, oil, batteries, and use of buildings.

Gasoline and Kerosene.—Fuel for the engines, by far the largest item, made up 57.2 percent of the total power expense. The thirty-two farms under consideration used 6,310 gallons of gasoline and 361 gallons of kerosene. The average amount of fuel required in milking one cow for one year was 7.76 gallons, which cost \$1.41.

The average cost of the gasoline used on these farms was a little more than 18 cents per gallon, but as the price of gasoline is subject to wide fluctuation it is interesting to note the effect of lower and of higher prices on the power expense. At 15 cents per gallon, the gasoline cost per cow would have been decreased 25 cents, at 20 cents it would have been increased 14 cents, and at 25 cents it would have been increased 53 cents.

Depreciation.—Depreciation on the engines is the second largest item involved in power expense. This charge for all the farms amounted to \$452.48 annually, constituting 21.4 percent of the total expense. It was calculated in the following manner:

	<i>Number. of engines</i>	<i>Value of engines</i>
Inventory at beginning of the year....	32	\$2,739.27
Purchased during the year.....	3	318.21
Total	<u>35</u>	<u>\$3,057.48</u>
Inventory at end of the year.....	32	\$2,545.00
Sold during the year.....	3	60.00
Total	<u>35</u>	<u>\$2,605.00</u>
Depreciation		\$ 452.48

If depreciation were based upon the inventory value at the beginning of the year, the rate would be 16.5 percent; or if based upon the average of the inventories at the beginning and end of the year, the rate would be 17.1 percent, indicating that about six years is the probable life of the engines.

Repairs.—Repairs on the engines, amounting to approximately 17 cents per cow, made up 6.8 percent of the total power expense. The cost of repairs was equal to 5.3 percent of the inventory value of the engines at the beginning of the year and was about one-third as great as the depreciation charge.

Interest.—Interest on the investment was computed at the rate of 5 percent per annum and was based upon the average inventory value of the engines. The interest charge on the engines on these thirty-two farms was equal to about one-third of the interest charge on the milking machines, and constituted 6.2 percent of the total power expense.

Oil.—Lubricating oil was used at the rate of one pint of oil to three gallons of gasoline or kerosene. The cost of the oil was 4.8

percent of the power expense and was equal to one-twelfth the cost of the gasoline and kerosene.

Batteries.—The cost of batteries for the engines constituted 3 percent of the total power expense. On sixteen of the farms, magnetos were the source of ignition; on the other sixteen farms 169 batteries were used, averaging one battery for three cows.

Use of Buildings.—On a few farms, engines were housed in special buildings and in those cases a small charge for their use has been included in the cost figures. No charge is included when the engines were housed in the cow barns.

Total Power Expense.—The total expense of maintaining and operating the engines which furnished power for the milkers was \$2.46 per cow. As was pointed out in the discussion of fuel expense, this amount will vary slightly with the price of gasoline.

MECHANICAL MILKER EXPENSE

Table 2 shows the expense, exclusive of the cost of power and of man labor, which was incurred in milking the 860 cows on the thirty-two farms where mechanical milkers were used. The items include depreciation on the milkers, repairs, interest on investment, germicidal preparations, and insurance.

TABLE 2.—ANNUAL EXPENSE OF MECHANICAL MILKERS, OTHER THAN POWER AND MAN LABOR, ON THIRTY-TWO FARMS WITH 860 COWS

Items of expense	Total expense	Percentage of total expense	Expense per cow
Depreciation on milkers.....	\$739.85	44.8	\$.86
Repairs on milkers.....	456.70	27.6	.53
Interest on milkers.....	406.72	24.6	.47
Germicidal preparations.....	38.57	2.3	.04
Insurance on milkers.....	11.35	.7	.02
Total mechanical milker expense.	\$1,653.19	100.0	\$1.92

Depreciation.—Depreciation, the largest item, was 44.8 percent of the total mechanical milker expense. The inventory value of all the milking machines at the beginning of the year was \$8,504.31, and at the end of the year, \$7,764.46; a difference of \$739.85, representing a depreciation of 8.7 percent. This depreciation is based upon the cumulative experience of these thirty-two farmers, and not upon an arbitrary rate of depreciation.

Milking machines have been on the market in considerable numbers for more than fifteen years, and had their use been uninterrupted their rate of depreciation would now be fairly well known. The mechanical milkers were purchased in large numbers about 1906, but they generally proved unsatisfactory, and long before the mechanical parts were worn out many farmers disposed of them because

of the harmful effects upon udders, the insanitary conditions, etc. These difficulties were due in part to imperfections in the machines and in part to failure of the dairymen to follow directions, either thru carelessness or lack of mechanical ability. Agricultural experiment stations, farmers, and manufacturers, however, have found many of the causes of the difficulties and the necessary remedies or precautions. Thru much publicity by bulletins, farm papers, advertisements, and, not the least, by discussions between farmers, the knowledge necessary to operate the machines satisfactorily became widely known. As this knowledge became widespread, and as it became more difficult to secure labor during the period of the war, the installation of mechanical milkers was greatly stimulated. If the depreciation were based upon the past experience of the earlier years, when machines were discarded after short trials, it would represent a considerable proportion of the initial cost, if not all of it. In recent years the machines have been much more satisfactory, but they have not been in operation a sufficient length of time for their probable life to be accurately estimated.

Repairs.—The cost of repairs on the milkers constituted 27.6 percent of the total milker expense. The repair expense was approximately three times as great for the mechanical milkers as for the engines, and was three-fifths as large as the depreciation charge. It is difficult to segregate with exactness the repairs and depreciation, as in many cases the repairs represent replacement of parts, such as hose, pulsators, and cup linings. In this study the replacements have been classified as repairs.

Interest.—The interest charge for mechanical milkers is calculated at 5 percent per annum on the average inventories at the beginning and the end of the year. This constitutes 24.6 percent of the mechanical milker expense on the thirty-two farms. The interest charge varies with the type of machine, as there is considerable difference in the purchase price of the different types.

Germicidal Preparations.—The cost of germicidal preparations used in solutions for the immersion of the rubber parts of the milkers amounted to 4 cents per cow. These preparations included lime, salt, calcium chlorid, and various commercial preparations.

Insurance.—Insurance was the smallest item of the mechanical milker expense, being but .7 percent of the total expense.

Total Mechanical Milker Expense.—All of the items of expense classified as milker expense amounted to \$1.92 per cow per annum.

AMOUNT AND COST OF MAN LABOR

The labor included in the present study covers only the man labor generally classified as chores. It includes the time consumed in

milking, feeding, cleaning, and bedding the cows, and in caring for the mechanical milker and milk utensils. It does not include the care of young stock, the marketing of the milk, or the hauling of feed. On a few farms the amount of labor devoted to each separate operation—milking, feeding, bedding the cows, cleaning the milkers, and doing the other chores about the dairy—was recorded separately, but this detail caused so much clerical work on the part of the farmers that it was discontinued and the chores were thereafter listed as one item. Consequently the data do not permit the separation of the time consumed in caring for the milking machines and gasoline engines from that used for the other dairy chores.

The cost of labor is based upon the average wage of farm labor (17.5 cents per hour) for all the farms considered in this study. The labor cost constituted such a large part of the total expense that the price paid for labor was the principal factor determining the economy of mechanical milking. The relation between various labor rates and the comparative expense of mechanical and hand milking is discussed in detail on page 505.

TABLE 3.—AMOUNT AND COST OF MAN LABOR USED ANNUALLY IN CARING FOR 860 COWS ON THIRTY-TWO FARMS WHERE MECHANICAL MILKERS WERE USED

	Total annual cost	Total number of hours	Annual cost per cow	Number of hours per cow
Man labor	\$12,264.75	70,084.25	\$14.26	81.5

Table 3 shows the amount and cost of man labor used in caring for the 860 cows on the thirty-two farms where milking machines were used. The average number of hours of man labor per cow was 81.5, and the average annual expense per cow was \$14.26.

TOTAL EXPENSE OF MILKING WITH MECHANICAL MILKERS

The total expense of milking with mechanical milkers is summarized in Table 4. It will be noted that man labor constituted 76.5 percent of the total expense; power, 13.2 percent; and mechanical milkers, 10.3 percent. The total expense per cow aggregated \$18.64, with \$14.26 for labor, \$2.46 for power, and \$1.92 for the mechanical milker.

TABLE 4.—TOTAL ANNUAL EXPENSE OF CARING FOR 860 COWS ON THIRTY-TWO FARMS WHERE MECHANICAL MILKERS WERE USED

Items of expense	Annual expense	Percentage of total expense	Annual expense per cow
Cost of man labor	\$12,264.75	76.5	\$14.26
Power expense	2,118.99	13.2	2.46
Mechanical milker expense	1,653.19	10.3	1.92
Total expense	\$16,036.93	100.0	\$18.64

EXPENSE OF MILKING BY HAND

Records were kept of the number of hours and the cost of man labor used in caring for 850 cows on thirty-four farms where the milking was done by hand. This labor, as on the farms on which the cows were milked mechanically, included the time consumed in milking, feeding, bedding, and cleaning the cows, and in caring for the milk utensils. The labor used in hauling milk and feed and in caring for young stock was not included.

The average amount of labor required per cow, as shown by Table 5, was 133.9 hours, and the average cost was \$23.44. The labor rate (17.5 cents per hour) here used in determining the cost of labor was the same as that used on those farms where the cows were milked mechanically.

TABLE 5.—AMOUNT AND COST OF MAN LABOR USED ANNUALLY IN CARING FOR 850 COWS ON THIRTY-FOUR FARMS WHERE MILKING WAS DONE BY HAND

	Total annual cost	Total number of hours	Annual cost per cow	Number of hours per cow
Man labor.	\$19,920.29	113,830.25	\$23.44	133.9

COMPARATIVE EXPENSE OF MECHANICAL AND HAND MILKING

The average amount of labor required to care for one cow for one year on the farms where the milking was done by hand was 133.9 hours, and cost \$23.44; while on the farms where machines were used, an average of only 81.5 hours was required, and the cost was \$14.26. Thus, there was a difference of 52.4 hours in time and of \$9.18 in expense. This saving in labor expense is offset, to some extent, by the other costs of mechanical milking classified as power expense and mechanical milker expense.

TABLE 6.—COMPARISON OF TOTAL ANNUAL EXPENSE INCURRED IN CARING FOR 860 COWS MECHANICALLY MILKED, WITH THAT INCURRED IN CARING FOR 850 COWS MILKED BY HAND

Method of milking	Number of cows	Total annual expense	Annual expense per cow
Mechanical milking.	860	\$16,036.93	\$18.64
Hand milking.	850	19,920.29	23.44

Table 6 shows a comparison of the total expense of mechanical and hand milking. On the thirty-two farms where mechanical milkers were used, the total expense incurred in caring for one cow for one year was \$18.64, while on the thirty-four farms where hand milking was practiced, the total expense of caring for one cow was

\$23.44. Thus, there was an average annual saving of \$4.80 per cow which may be attributed to the use of mechanical milkers.

The use of mechanical milkers results indirectly in another saving which is more difficult to determine. During the crop season the number of hours in the field is limited somewhat by the time required in milking, and the longer time required for hand milking results in earlier stabling of the horses and the consequent loss of their labor. The importance of this factor in determining the relative economy of the two methods of milking will vary, of course, with the individual dairyman, and such saving as may be involved does not admit of numerical expression on the basis of the present study.

RELATION BETWEEN SIZE OF HERD AND EXPENSE OF MILKING WITH MECHANICAL MILKERS

Dairymen frequently inquire as to the size of a herd necessary to make economical the use of a mechanical milker. No definite answer can be given to this question because of varying conditions and labor costs on different farms. The data in this study indicate to some extent, however, the relative saving resulting from the use of mechanical milkers in large and in small herds.

In order to determine the relation between the number of cows on the farms and the expense of mechanical milking, the farms on which mechanical milkers were used are divided into two groups. In Group I are classed seventeen farms having less than 25 cows in each herd, with a total of 325 cows and an average of 19.1 cows per herd. Group II consists of fifteen farms with 25 cows or more in each herd, a total of 535 cows, and an average of 35.7 cows per herd. The total expense of mechanical milking has been here divided into the three classes (power expense, mechanical milker expense, and cost of labor), as was done when all farms were considered together.

TABLE 7.—RELATION BETWEEN SIZE OF HERD AND THE POWER EXPENSE OF OPERATING MECHANICAL MILKERS

	Group I	Group II	All herds
	Less than 25	25 or more	
Number of cows in herd.....			
Number of herds.....	17	15	32
Total number of cows.....	325	535	860
Annual Expense per Cow			
Gasoline and kerosene.....	\$1.89	\$1.12	\$1.41
Depreciation on engines.....	.78	.37	.53
Repairs on engines.....	.21	.14	.17
Interest on engines.....	.17	.14	.15
Oil.....	.17	.09	.12
Batteries.....	.06	.09	.07
Use of buildings.....		.02	.01
Total power expense.....	\$3.28	\$1.97	\$2.46

RELATION BETWEEN SIZE OF HERD AND POWER EXPENSE

As may be seen from the data in Table 7, the expense of power per cow was less for those farms having more than 25 cows to the herd than for those having smaller herds. The expense for Group I was \$3.28 per cow, and for Group II, \$1.97, a difference of \$1.31. All items classed as power expense, except the two minor items (batteries and use of buildings), were greater per cow for the smaller herds than for the larger. The large difference between the two groups in the cost of fuel was not, however, due entirely to the number of cows per herd; it was due in part to the fact that a greater proportion of kerosene, which cost less than gasoline, was used on the farms having the larger herds. The average amount of fuel per cow necessary to operate the milkers for one year was 8.88 gallons in Group I and 7.07 gallons in Group II.

RELATION BETWEEN SIZE OF HERD AND MECHANICAL MILKER EXPENSE

Table 8 shows the relation between size of herd and the mechanical milker expense per cow. Depreciation and interest may be considered fixed expenses, and the expense per cow for these items would therefore be expected to decrease as the size of the herd increased. In the

TABLE 8.—RELATION BETWEEN SIZE OF HERD AND THE EXPENSE OF MECHANICAL MILKERS, OTHER THAN POWER EXPENSE AND COST OF MAN LABOR

	Group I	Group II	All herds
Number of cows in herd	Less than 25	25 or more	
Number of herds	17	15	32
Total number of cows	325	535	860
Annual Expense per Cow			
Depreciation on mechanical milkers	\$.92	\$.83	\$.86
Repairs on mechanical milkers . . . . .	.79	.37	.53
Interest on mechanical milkers . . . . .	.51	.45	.47
Germicidal preparations . . . . .	.08	.02	.04
Insurance . . . . .	.02	.01	.02
Total mechanical milker expense	\$2.32	\$1.68	\$1.92

present study, however, this decrease was not so great as would be expected, because the investment per farm was over 60 percent greater on those farms having the larger herds. This greater investment was due to the use of more expensive types of mechanical milkers rather than to the needs of the large herds. Despite this fact, depreciation and interest, as well as the other items of mechanical milker expense, were greater per cow in herds of less than 25 cows than in herds of more than 25 cows. The average annual expense per cow was \$2.32 in the group of smaller herds and \$1.68 in the group of larger herds.

RELATION BETWEEN SIZE OF HERD AND THE AMOUNT AND
COST OF MAN LABOR

For the purpose of this study, the labor of caring for cows milked mechanically may roughly be divided into three kinds: (1) milking; (2) feeding and cleaning; and (3) care of the milking machine. The cost per cow for the first two labor items is little affected by the number of cows in the herd. The time required to milk one cow bears little or no relation to the size of the herd. The labor of feeding and cleaning may be slightly less per cow in large herds than in small herds because of more efficient methods or better barn equipment, but any such economy of time will be slight. It is in relation to the third item that saving of labor per cow is affected by the size of the herd. Considerable time is required to wash, sterilize, and assemble the mechanical milker, and unless more milker units are added, this is practically constant whether fifteen or fifty cows are milked. For this part of the labor, the time per cow therefore decreases rapidly as the size of the herd increases. In this study, 85.4 hours of man labor were necessary to care for a cow for one year in herds of less than 25 cows, and 79.1 hours in herds of more than 25 cows. The difference in labor expense, as shown by Table 9, was \$1.11 per cow.

TABLE 9.—RELATION BETWEEN SIZE OF HERD AND THE AMOUNT AND COST OF MAN LABOR USED IN CARING FOR COWS MILKED WITH MECHANICAL MILKER

	Group I	Group II	All herds
	Less than 25	25 or more	
Number of cows in herd.....	17	15	32
Number of herds.....	325	535	860
Total number of cows.....	85.4	79.1	81.5
Annual number of hours per cow...	\$14.95	\$13.84	\$14.26
Annual cost per cow.....			

Whether or not this slight difference in time (6.3 hours per cow) was due to the difference in the size of herd, may best be judged by reference to the data contained in Table 13, which shows how the amount of labor required to care for a cow varied on the different farms. The variation in time among the farms within each group was greater than the difference between the averages of the two groups. However, on fifteen of the seventeen farms in Group I more than 80 hours of man labor was required per cow, while on only seven of the fifteen farms in Group II was the labor requirement greater than 80 hours per cow. The data are too limited to permit any definite conclusions to be drawn in regard to the relation between the size of herd and the labor requirement of cows milked mechanically, but they indicate that the time per cow decreases slightly as the size of the herd increases.

RELATION BETWEEN SIZE OF HERD AND TOTAL EXPENSE OF
MILKING WITH MECHANICAL MILKERS

The total annual expense of mechanical milking in herds of less than 25 cows was \$20.55 per cow, as shown by Table 10. The total annual expense in herds of more than 25 cows averaged 14.9 percent less, or \$17.49 per cow—a difference of \$3.06.

TABLE 10.—RELATION BETWEEN SIZE OF HERD AND TOTAL EXPENSE OF CARING FOR COWS MILKED WITH MECHANICAL MILKER

	Group I	Group II	All herds
Number of cows in herd.....	Less than 25	25 or more	
Number of herds.....	17	15	32
Total number of cows.....	325	535	860

Annual Expense per Cow

Cost of man labor.....	\$14.95	\$13.84	\$14.26
Power expense.....	3.28	1.97	2.46
Mechanical milker expense.....	2.32	1.68	1.92
Total expense.....	\$20.55	\$17.49	\$18.64

RELATION BETWEEN SIZE OF HERD AND EXPENSE
OF MILKING BY HAND

The thirty-four farms where the cows were hand-milked were also divided into two groups according to the size of the herds. In Group I were nineteen farms with a total of 350 cows and an average of 18.4 cows per herd. In Group II were fifteen farms with a total of 500 cows and an average of 33.3 cows per herd. Table 11 shows the average amount and cost of man labor per cow in each of the two groups.

TABLE 11.—RELATION BETWEEN SIZE OF HERD AND THE AMOUNT AND COST OF MAN LABOR USED IN CARING FOR COWS MILKED BY HAND

	Group I	Group II	All herds
Number of cows in herd.....	Less than 25	25 or more	
Number of herds.....	19	15	34
Total number of cows.....	350	500	850
Annual number of hours per cow...	135.9	132.5	133.9
Annual cost per cow.....	\$23.78	\$23.19	\$23.44

Altho in this study slightly less time was required per cow in the larger herds than in the smaller, the difference has no significance. This is shown by the distribution of individual records (Table 13) based on the hours of labor per cow. There is no evidence from these data of any relation between the size of the herd and the amount of labor required per cow in caring for cows milked by hand.

COMPARATIVE EXPENSE OF MECHANICAL AND HAND MILKING IN HERDS OF DIFFERENT SIZES

Table 12 shows the relative amount of labor and the comparative expense of mechanical and hand milking in herds having less than 25 cows and in those having 25 cows or more. In this study, the use of mechanical milkers resulted in an average annual saving of 50.5 hours of man labor per cow in the smaller herds and of 53.4 hours in the larger herds. Table 13 shows that altho there was considerable variation among the individual herds in regard to the labor requirement per cow, the saving in labor resulting from the use of mechanical milkers was marked.

TABLE 12.—COMPARATIVE EXPENSE OF MECHANICAL AND HAND MILKING IN HERDS OF DIFFERENT SIZE

Group	Number of cows in herd	Number of herds		Average number of cows in herd		Hours of labor per cow		Annual expense per cow	
		M. milk	H. milk	M. milk	H. milk	M. milk	H. milk	M. milk	H. milk
I.....	Less than 25	17	19	19.1	18.4	85.4	135.9	\$20.55	\$23.78
II.....	25 or more	15	15	35.7	33.3	79.1	132.5	17.49	23.19
All herds..	.....	32	34	26.9	25.0	81.5	133.9	18.64	23.44

TABLE 13.—SHOWING HOW THE AMOUNT OF MAN LABOR USED IN CARING FOR ONE COW FOR ONE YEAR VARIED ON THE DIFFERENT FARMS

Hours per cow	Number of herds					
	Group I		Group II		All herds	
	Less than 25 cows	25 cows or more	Mech. milk	Hand milk	Mech. milk	Hand milk
50—59.9.....	..	..	3	..	3	..
60—69.9.....	1	..	3	..	4	..
70—79.9.....	1	..	2	..	3	..
80—89.9.....	7	..	3	..	10	..
90—99.9.....	5	..	4	..	9	..
100—109.9.....	3	1	..	2	3	3
110—119.9.....	..	5	..	4	..	9
120—129.9.....	..	2	..	3	..	5
130—139.9.....	..	3	..	..	..	3
140—149.9.....	..	2	..	2	..	4
150—159.9.....	..	2	..	1	..	3
160—169.9.....	..	4	..	3	..	7
Total.....	17	19	15	15	32	34

The annual saving in expense resulting from mechanical milking averaged \$3.23 per cow in herds of less than 25 cows and \$5.70 per cow in herds of 25 cows or more. This saving was based upon the average labor rate (17.5 cents) on all farms involved in this investiga-

tion. What the difference between the expense of mechanical milking and that of hand milking on the farms involved in the present study would have been if other rates for labor had been used is indicated by Table 14. The difference in expense in the group of farms having herds of less than 25 cows would have ranged from \$.46 per cow with labor at 12 cents per hour to \$9.55 per cow with labor at 30 cents per hour. The difference in expense is, of course, greater in the herds having more than 25 cows and amounts to \$12.37 per cow per annum with labor at 30 cents per hour.

TABLE 14.—COMPARISON OF DIFFERENCE IN EXPENSE BETWEEN HAND AND MECHANICAL MILKING ON THE FARMS INVOLVED IN THE PRESENT STUDY WHEN VARIOUS LABOR RATES ARE USED

Labor rate	Saving in expense per cow	
	Group I Herds of less than 25 cows	Group II Herds of 25 cows or more
\$.12.....	\$.46	\$2.76
.13.....	.97	3.29
.14.....	1.47	3.83
.15.....	1.97	4.36
.16.....	2.48	4.89
.17.....	2.98	5.42
.18.....	3.49	5.95
.19.....	3.99	6.50
.20.....	4.50	7.03
.21.....	5.01	7.56
.22.....	5.51	8.10
.23.....	6.02	8.64
.24.....	6.52	9.17
.25.....	7.03	9.70
.26.....	7.53	10.23
.27.....	8.03	10.77
.28.....	8.54	11.30
.29.....	9.04	11.83
.30.....	9.55	12.37

These data indicate that the cost of labor is the principal factor determining the relative economy of mechanical and hand milking.

CONCLUSIONS

The data obtained from this study indicate that considerably less labor is required in caring for cows milked mechanically than is required in caring for cows milked by hand. The average saving of labor on the farms studied was approximately 40 percent. This saving of labor appears to be greater in large herds than in small herds, but in view of the small number of farms studied the difference found between herds of different sizes was too slight to be conclusive.

The cost of maintaining and operating the mechanical milkers offsets to some extent the saving in labor expense. Hence the relative economy of hand and mechanical milking is largely determined by the

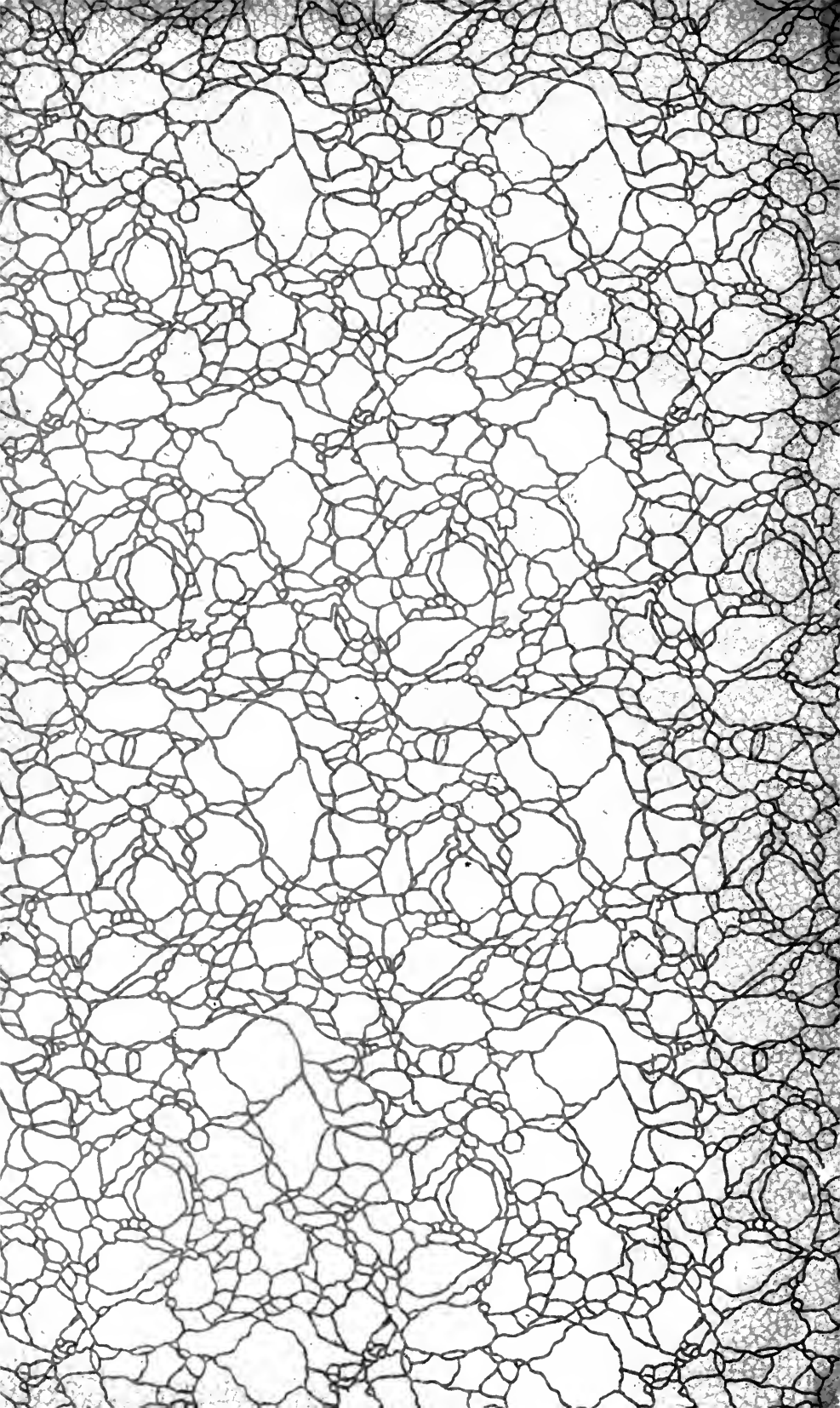
rate paid for labor. As the labor rate increases, the advantage accrues more and more to mechanical milking. For example: the average saving in expense per herd of 36 cows in the present study would have been \$156.96 with the labor cost computed at 15 cents per hour, or \$349.20 with labor at 25 cents per hour.

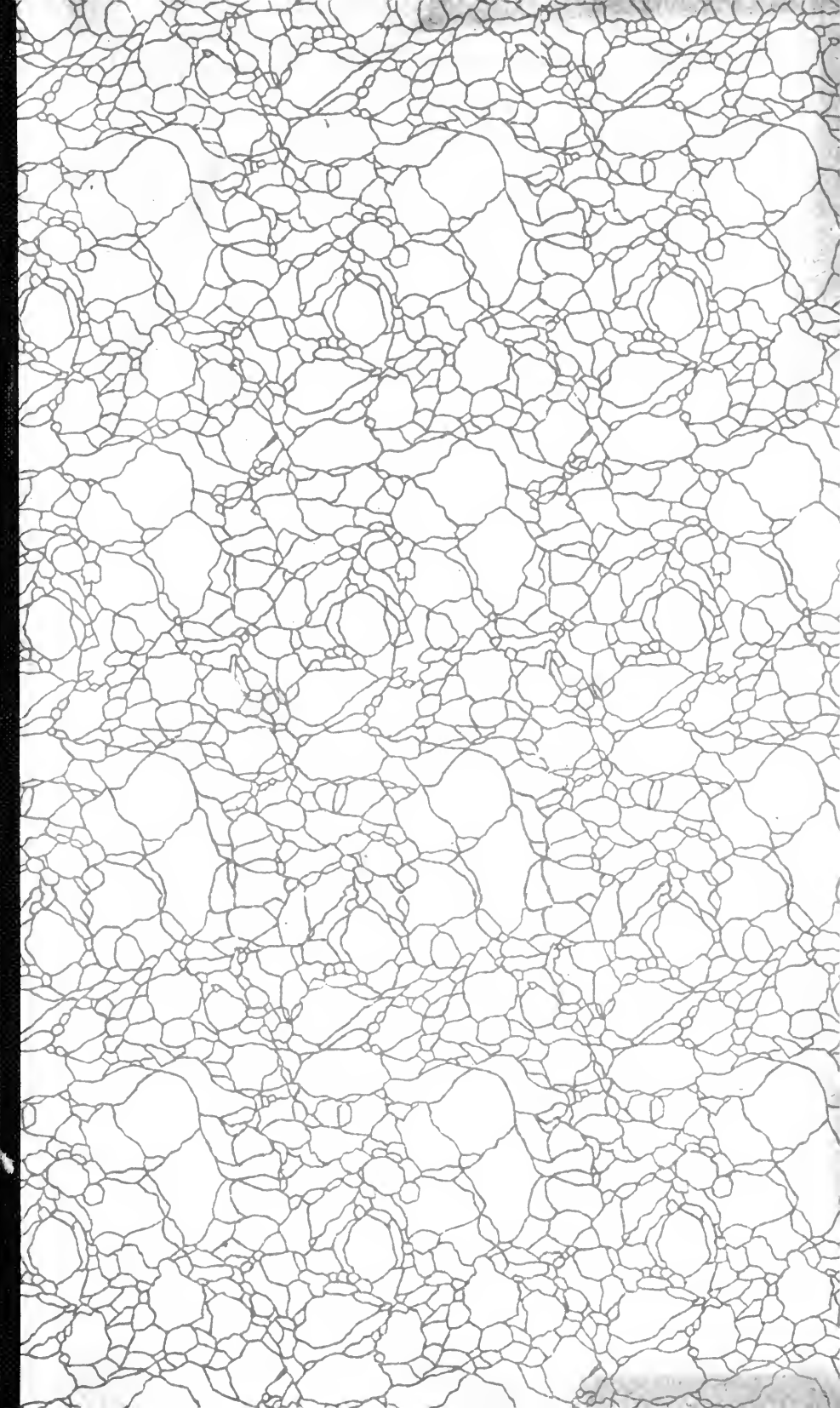
Because of certain fixed costs in mechanical milking, the expense per cow for power and milkers decreases as the size of the herd increases. It may therefore be concluded that the use of mechanical milkers is more economical in large herds than in small when labor rates and other factors are equal. However, a dairyman who has a small herd and is paying a high price for labor, may find mechanical milking more economical than would a dairyman who has a large herd and is paying a lower rate for labor.

SOME PUBLICATIONS ON MECHANICAL MILKING

1. BRIGHT, J. W. Milking machines: V, The production of high grade milk with milking machines under farm conditions. N. Y. (Geneva) Agr. Exp. Sta. Bul. 472. 1920.
2. HUMPHREY, H. N. Labor requirements of dairy farms as influenced by milking machines. U. S. D. A. Bul. 423. 1916.
3. REUHLE, G. L. A., BREED, R. S., AND SMITH, G. A. Milking machines: III, As a source of bacteria in milk. IV, Methods of maintaining in a bacteria-free condition. N. Y. (Geneva) Agr. Exp. Sta. Bul. 450. 1918.
4. RIDDELL, F. T. Machine vs. hand milking. Mich. Agr. Col. Exp. Sta. Quart. Bul. 1, No. 4. 1919.
5. SMITH, G. A., AND HARDING, H. A. Milking machines: Effect of machine method of milking upon the milk flow. N. Y. (Geneva) Agr. Exp. Sta. Bul. 353. 1912.
6. WOLL, F. W. Investigations with milking machines. Cal. Agr. Exp. Sta. Bul. 311. 1919.







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