durations of the units of speech. (This is the second part of the complete unit.)

This apparatus consists essentially of (1) a timer which provides a short pulse every second; (2) a stepping relay (or stepping switch); (3) a series of time delay relays, (time delay circuits *B*, *C*, and *D* on diagram); (4) a series of electromagnetic counters.

Every time the subject begins to speak the stepping switch begins to move from contact to contact, in steps of 1 sec, under the control of the impulses emanating each second from the timer, and keeps moving as long as the subject speaks. When the subject stops speaking an impulse goes through the wiper of the stepping switch to a counter, which records that unit of speech as one belonging to a class interval of a fixed duration. The wiper returns to zero and is ready to move up for another unit.

For practical purposes it was convenient to limit the stepping switch to 30 steps. If any period of speech lasts longer than 30 sec, it will be classified in a larger class interval in the following way:

When the wiper of the stepping switch arrives at the 30th contact it energizes a time delay relay circuit, which in turn energizes a counter which will record a halt in the subject's speaking between 30 and 40 sec after zero time. If the subject speaks beyond 40 sec, another time delay circuit will energize another counter which records a halt between 40 and 50 sec, and so on. The last counter will record all the periods of speech which lasted beyond 1 min.

For the study of interruptions a switching and computing system was built which automatically counts the interruptions and classifies them into the following six categories:

1.	A begins to speak,	B interrupts,	A stops
2.	A " " "	B "	B stops
3.	A " " "	B "	both stop
4.	B " " "	A "	A stops
5.	B " " "	A "	B stops
6.	B " " "	A "	both stop

One of the great advantages of this analyzer is that it can be used in the study of any phenomenon distributed in time. It can automatically determine the number of occurrences in a given time, the total duration of a series of individual occurrences, and the frequency distribution of the durations of the events studied. From the frequency distribution the standard deviation can be readily calculated.

In our present work we are adapting this apparatus to the study of speech (verbal activity) as it occurs in the interview situation and in free association during psychotherapy. In studying free association we record the patients' verbal productions on a wire recorder and then play the record back into one of the channels of the automatic speech analyzer.

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Increasing the Efficiency of the Laying Hen

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Work has been under way for many years on increasing the efficiency of the hen by increasing the number and size of eggs, and by reducing losses in the laying houses due to disease. In a long-term attack on this problem and using a unique method of measuring gains, we are able to state that the efficiency of the individual hen, measured by the increase in average weight of eggs per hen per year, has risen by 75.4% since 1923. If the decline in losses is taken into account, the increase in efficiency is 106.8%. This increase has been gained through the consistent use of the family method of breeding—an adaptation of Mendelian principles to the peculiarities of quantitative characters. So far as we are able to learn, no other method of breeding has been developed capable of making so much improvement in efficiency.

References 2–5 give results of the application of this method of breeding in other instances. It has been used by poultry breeders of Massachusetts and vicinity with so much success that poultry breeders in all sections of the United States and Canada are adopting it. The method is effective because each pair of parents is judged by the qualities of all their children. Pairs whose children rate highest in the qualities desired by the breeder are given an opportunity to have more children. Meanwhile, a new generation of parents is selected from members of families with the highest ratings. But of this new generation of parents, only those few whose children rate the highest are retained. This process, repeated generation after generation on a sufficiently large scale, has thus far promoted a constantly rising average of those qualities which the breeder seeks to improve.

The improvement in the efficiency of the laying hen made through consistent use of the family method of breeding suggests that when it is applied to other farm animals and to food plants, similar gains in efficiency will result.

The poultry plant at Mount Hope Farm was begun in 1917. Work on improving the efficiency of the hen began in 1918 with the assembling of the best stock available at that time. Once the assembling of stock was completed, the flock was closed and no other stock added. As it was not necessary for the work to be self-supporting, or to provide a livelihood for a farm family, the work could proceed without the handicaps that confront many poultry breeders. Thus it has been possible to use a method of measuring gains which most poultry breeders have not found feasible.

This method, established in 1923, consists in setting aside entire families of full sisters, which are all held—good, bad, and indifferent—for 15 months after the first hatch is placed in the laying houses. Beginning in 1927, these families have come from parents hatched the previous season. These parents are, therefore, not progenyproved. Records are kept in detail. Management has been maintained as nearly as possible like that in 1923.

TABLE 1

Year*	Average† egg weight in oz	Average number of eggs per hen per year	Average weight in oz of eggs produced by each hen per year
1923	1.85	168	310.8
1929	1.85	220	407.0
1946	2.30	237	545.1‡

* Records begin in the autumn of the year the birds are hatched. 1946 is the last year on which completed records are available.

† Taken during the spring.

‡ The 1948 flock promises to exceed 600 ounces.

The birds are housed in units of 100. The number of pullets in this group has ranged from a low of 300 in some years to a high of 800 in other years. The daughters of parents already proved good are kept in a separate group. Their records are not included in this report.

The average annual egg production of these flocks multiplied by the average egg weight gives the amount of product of each hen. From 1923 to 1929, efforts were concentrated on increasing the number of eggs, the size remaining constant. Then, forced by the demand for larger eggs, efforts were made toward increasing and fixing the size of eggs desired by the trade and toward making such gains in egg number as the inverse correlation between egg size and some of the factors entering into egg number permitted. The results of this work are shown by the averages in Table 1.

As Table 1 shows, the average hen in today's flocks is laying 234.3 oz more eggs than in 1923. This is an increase in efficiency of 75.4%.

Inspection of the table shows that the rate of gain from 1929 to 1946 is about half that from 1923 to 1929. It proved much easier to increase number of eggs, leaving egg size constant, than to combine the desired egg size with high rate of lay and early maturity, but this has finally been accomplished.

The enormous losses in the laying houses from deaths due to disease were not generally recognized when the present method of measuring gains in efficiency was established in 1923. This happened because these losses were obscured by the prevalent practice of culling nonproductive birds. A few years later the New Jersey Agricultural Experiment Station (*1*) stated that losses from death and culling during the year sometimes reached 60%. This was confirmed later by the Ohio Agricultural Experiment Station (*6*). Meanwhile, the losses from deaths in our unculled flocks, under exceptionally high standards of sanitation, were reaching the same amount in some years, thus indicating that culling merely anticipated deaths that would otherwise occur.

TABLE 2

Year	Number of pullets at beginning of year	Number dying during year	% dying
1923	304	138	45.4
1929	399	99	25.0
1946	801	148	18.5

The losses in the laying flocks for the three years of Table 1 are shown in Table 2.

A reduction in mortality increases the efficiency of a poultry plant by permitting it to operate toward maximum capacity. If the plant of 1923 had operated at full capacity for the year, i.e., without deaths, each unit of 100 hens would have produced 31,080 oz of eggs. As the records show that deaths occur at a fairly uniform rate throughout the year, each unit operated with an average of 77 hens for the year, thus producing only 23,932 oz of eggs. In 1946, however, with each unit operating with an average of 90.8 hens, it produced 49,495 oz of eggs—an increase of 25,563 oz, or an increase of 106.8% in the efficiency of the plant over 1923.

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Low Temperature and Survival of Embryonic Tissue

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The effect of low temperature on embryonic tissue has a practical as well as a theoretical interest. Various reports have appeared in the literature on hypothermia in relation to neoplastic tissue (*6, 33, 15*). Preyer (*11*) observed that no further development of the incubating chick occurred after the temperature went below 25° C. But the individual embryonic tissues survive a much lower temperature. Hetherington and Craig (*8*) found that small fragments of chick heart may be stored in Ringer-Tyrode's solution at 0° C for as long as 15 days with little apparent effect on viability. Stone (*14*) concluded that the best temperature for preserving alive the enucleated eyes of the salamander was between 4° C and