old hog lots and on permanent pastures. The accumulation of manure and litter in permanent hog lots is especially favorable to the perpetuation of earthworms which thrive and multiply in such places, presumably because of the abundant food supply which they obtain from the manure. Well-drained, cultivated fields, on the other hand, have been found to contain relatively few earthworms. In some fields which had been cultivated seasonally, very few earthworms were found after a rather prolonged search.

In the light of these findings, it is evident that lungworm infestation in swine is likely to be present and troublesome when these animals are raised in hog lots and on permanent pastures. This was actually found to be the case in investigations conducted in the States mentioned. A large percentage of earthworms, obtained from old hog lots and from permanent pastures on which hogs had been raised year in and year out, were found to be infested with lungworm larvæ. In some cases 1,000 or more larvæ were found in a single earthworm.

In view of the rooting habits of swine, it is easy to see how they would become heavily infested with lungworms should they happen to swallow, as they are likely to do, only two or three heavily infested earthworms. As already stated, earthworms were obtained in only very small numbers from hog lots and pastures which had been cultivated seasonally, and in these cases the degree of infestation of the earthworms with lungworm larvæ was usually slight, or infestation was altogether absent. Low areas outside the fences of these cultivated fields usually harbored a fair supply of earthworms more or less heavily infested.

Keep Pigs Confined in Clean Fields

It is evident from these findings that control of lungworm infestation in pigs necessitates raising the animals on new pastures or cultivated fields, and preferably on fields which are well drained. In this connection it is important to have good fences in order to keep the animals from getting outside the fields. Pigs should not be raised on old hog lots and permanent pastures, as these places harbor not only earthworms, the source of lungworm infestation, but also eggs and larvæ of various other swine parasites and the germs of infectious diseases.

BENJAMIN SCHWARTZ, *Bureau of Animal Industry.*

TENDERNESS Tester for Canned Goods Aids in Food Law Enforcement

The McNary-Mapes amendment to the food and drugs act, signed July 8, 1930, charges the Department of Agriculture with the responsibility for fixing standards of quality and condition for certain canned foods. The amendment requires a special form of low-quality branding on all products falling below the announced standards. Faced with the necessity of measuring the various quality factors in some accurate and objective manner, the department's scientists were forced to invent an apparatus for measuring tenderness, a major factor in the quality of many canned foods.

After exhaustive experiments, a device [3] was perfected that is sufficiently versatile to measure with precision the tenderness of such

[3] This apparatus is described and illustrated in Department Circular No. 164, An Apparatus for Determining the Tenderness in Certain Canned Fruits and Vegetables.

widely different canned foods as peas, peaches, apricots, and pears. In every case, department findings have tallied with the consensus of expert graders as to the point at which lack of tenderness becomes definitely objectionable.

The advantages of an impersonal method of tenderness measurement, independent of personal judgment, capable of and giving accurate results in the hands of any intelligent operator, are obvious. The canner can assure himself, by his own tests, that his product conforms to the tenderness requirement. On standardized products, like peas for example, where tenderness is a paramount quality factor, the consumer is warned against hard and tough canned food by the low-quality legend required by law. Last, and most important of all, the farmer now seems to have some hope of getting, in the future, a satisfactory reward for producing fruits and vegetables of the proper stage of maturity for canning. There seems to be no reason why the apparatus should not prove equally satisfactory for measuring the tenderness of many raw food products of various sorts, and of other canned foods not yet under standardization. The device is illustrated in Figure 138.

FIGURE 138.—V. B. Bonney using apparatus designed by him and other chemists to test the tenderness of canned peas

As used on fruits, the device is very simple, consisting essentially of a vertical metal plunger sliding freely in a close-fitting sleeve. On its lower end is a cylindrical rod of specified diameter, which is made to penetrate the fruit by means of a load of mercury applied at the upper end of the plunger. Penetration is abrupt and complete, and the weight of plunger, flask, and mercury at the moment of penetration constitutes a precise measure of the tenderness of the fruit under test.

Resistance to Crushing Measured

With a canned food, such as peas, the device becomes more complicated. Crushing is a better measure of tenderness here than penetration, and the rod is accordingly replaced by a horizontal metal disk.

The end-point is not definite as in the penetration test for fruits, and thus it is necessary to crush the pea to some predetermined fraction of its original thickness. This necessitates a micrometric method of measuring the diameter. This is effectively accomplished by a long lever so pivoted as greatly to magnify the measurements, which are then read off on a graduated scale. Scale and lever are so insulated that a buzzer will sound when the disk is depressed to any predetermined distance from the "zero point," which is, of course, the point where the disk is in contact with the surface which supports the material under test. The adjustment is such that, in this position, the lever reads zero on a graduated scale. If, now, a pea is found to measure 28 on the arbitrary scale, one can set the lever at 7 and be assured that the buzzer will sound when the pea has been crushed to exactly one-fourth its original diameter by the load of mercury. Mercury, flask, and plunger are then weighed as in testing fruit.

W. B. WHITE, *Food and Drug Administration.*

TIME-LAPSE Motion-Picture Camera Helps Department's Research[4]

For several years the Department of Agriculture has possessed a so-called time-lapse motion-picture camera, designed for making accelerated-action cinematographs. This equipment, consisting of an ordinary motion-picture camera, with clock movement, motor, and associated automatic switches, enables the cinematographer to make exposures at intervals ranging from a fraction of a second to one hour, thus making film that, with normal projection, presents action accelerated in proportion to the length of time between exposures.[5]

Time-lapse shots have been made with this device from time to time for use in departmental motion pictures, but it was not until 1928 that the experimenters began to realize the possibilities of time-lapse cinematography in research. At that time, while they were running time-lapse shots of germination tests for the seed-testing laboratory of the Bureau of Plant Industry, something developed that gave them a new conception of the time-lapse camera as an instrument for research.

The work had been planned to show the progress of a germination test as a minor feature of a general film on seed testing, but the behavior of certain seedlings, that germinated but failed to grow, proved so unexpected and interesting that an entirely new set of tests was started solely for the purpose of observing the peculiarities of these abnormal seedlings. The time-lapse camera was run for many weeks on these tests and the result was so enlightening to those who conducted the experiment that they took the film to Rome on the occasion of the fifth congress of the International Seed Testing Association and showed it before that body. Edgar Brown, in charge of the seed-testing laboratory, relates that it was necessary to run the film many times in succession in order that the audience might have an opportunity to observe carefully the action of the abnormal seedlings in question.

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[4] This article summarizes the material presented in an article by the same writer in the Journal of the Society of Motion Picture Engineers, Vol. XVI, No. 5.

[5] This mechanism, originally designed by George R. Goergens about 10 years ago, was built and perfected by the late Howard Greene.