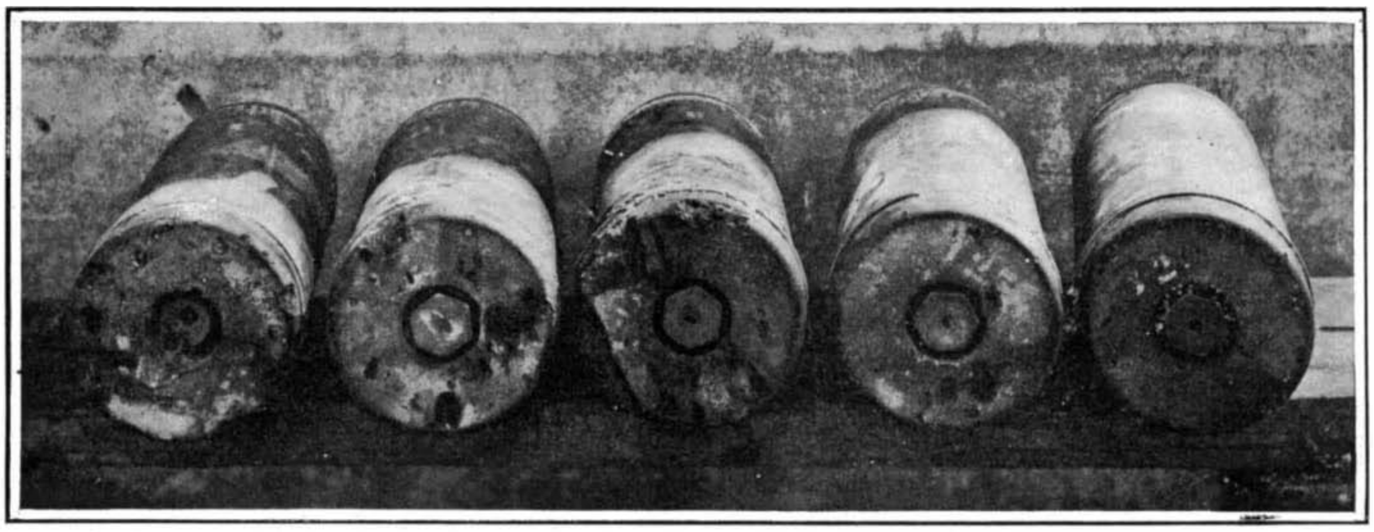
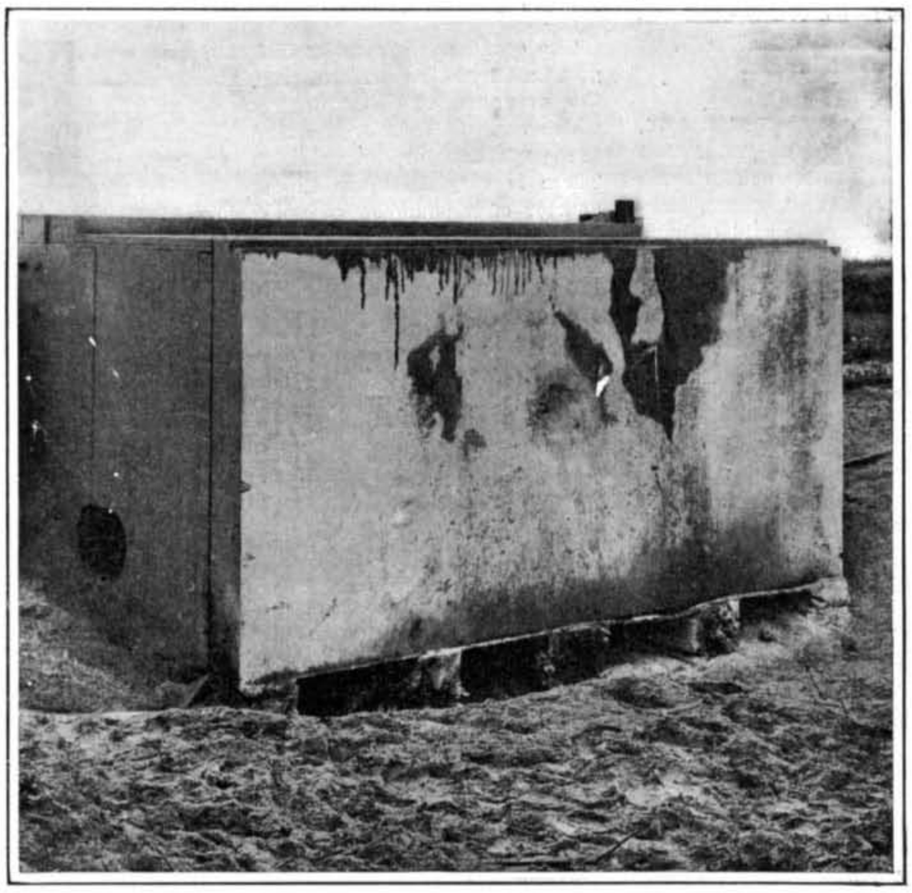
TEST OF A TORPEDO SHELL.

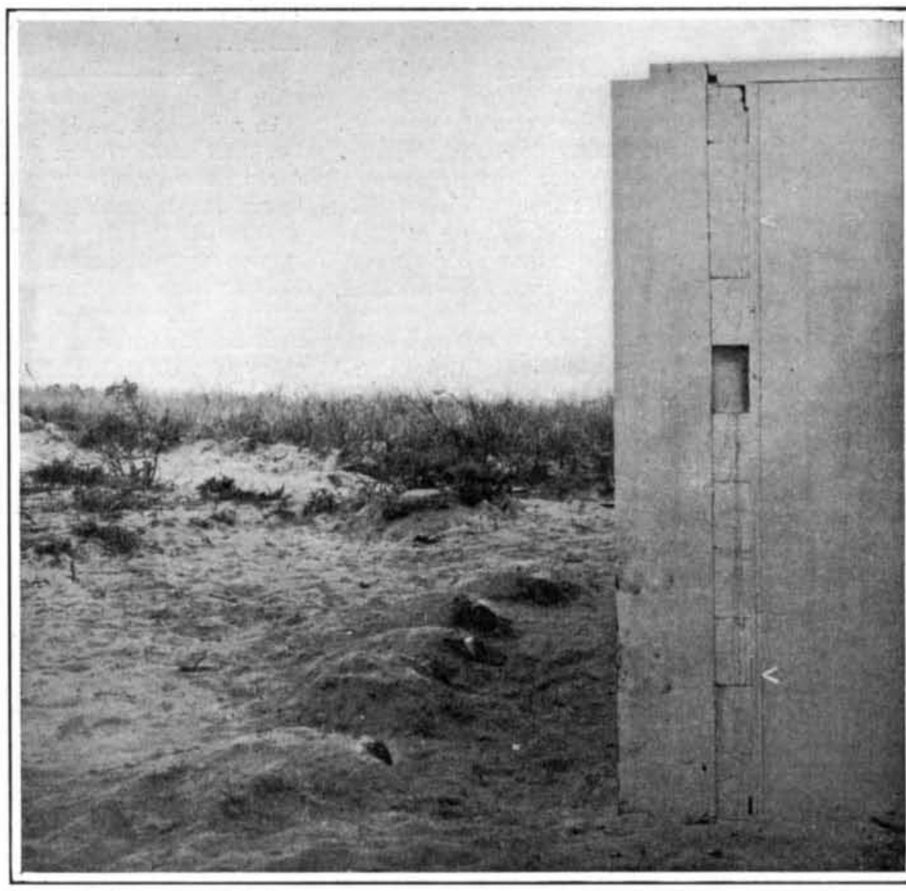
A few years ago the army officials at the Sandy Hook proving ground were called upon to test an aerial torpedo, built on the Gathmann system, for the construction and trial of which Congress, some time previous, had made a liberal appropriation. The test was described in considerable detail in the SCIENTIFIC AMERICAN of November 30, 1901; and our readers will remember that the failure of the shell was greatly emphasized by the fact that, at about the same time, the army high-explosive armor-piercing shell was tested with very flattering results.



Five Shells, Carrying Pressure Gages in the Base, Showing Scoring by Fragments of the Shell.



11½-Inch Plate After Being Struck by Isham Torpedo Shell—Practically Intact.

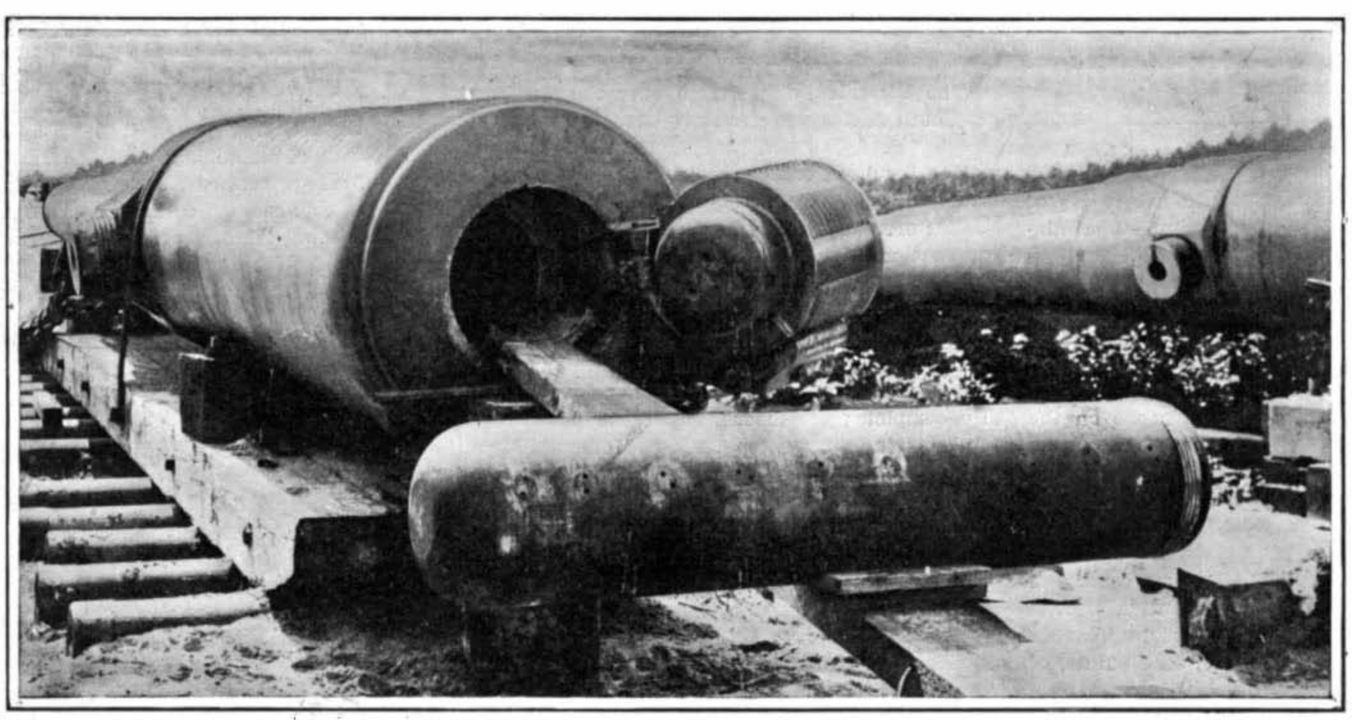


Side View of Plate, Showing the Plate-Steel Backing Uninjured.

We are now enabled, by the courtesy of the War Department, to publish the accompanying illustrations of the test of another type of aerial torpedo, known by the name of its inventor, W. S. Isham. Mr. Isham is of the opinion (or at any rate, was of the opinion) that the fundamental idea governing the design and manufacture of heavy ordnance, as carried out in our army and navy, is wrong. He believes that, instead of endeavoring to penetrate the armor of a ship with a shell having very thick walls and a comparatively small filler of high explosive, designed to burst the shell in the interior of the ship, it would be better to use a larger shell, carrying a heavier charge, and burst it against or near the outside of the vessel. He believes that the energy of the gases of explosion would be sufficient to blow the side of the ship bodily inward at the point of impact, or to create such a vertical pressure upon the water that it would be transmitted to the side of the vessel below the armor belt and crush it in. It was to prove whether these theories were right or wrong, that the shell was recently tested at Sandy Hook; and the results proved very decisively that the theories were wrong.

The target consisted of a Krupp armor plate, similar to those protecting the water line on the battleships "Connecticut" and "Louisiana." It was set up on the Sandy Hook proving ground against a backing which was an exact duplicate of the cellular structure of one of our latest battleships at the water-line, and back of the target was a heavy backing of sand, of sufficient mass to hold the target up to its work. The plate was 11½ inches thick, 7½ feet high, and 16 feet wide. Both the plate and the backing were manufactured at Bethlehem by the Navy Department. The structure was assembled at the Brooklyn navy yard, and taken complete to Sandy Hook, where it was set up among the sand hills at the proving grounds.

The Isham shell, which is 12 inches in diameter and 59 inches long, is divided into ten compartments by means of circular diaphragms equally spaced throughout its length. It was loaded with 182¾ pounds of explosive gelatine composed of 90 per cent of nitroglycerine, 8 per cent of gun cotton, and 2 per cent of camphor, the last-named substance being used as a deterrent. Each of the separate chambers in the cell is provided with a screw plug opening through which the high explosive can be poured into the shell; the plugs being afterward screwed tightly down into position, as shown in one of the accompanying photographs. The object of dividing the interior of the shell into compartments is to limit the amount of pressure on the high explosive at the base of the shell at the instant of firing. The inertia of the explosive causes it to bear upon the base of



The Isham Shell and the 12-Inch Gun from Which It Was Fired.

Diameter of shell, 12 inches; length, 59 inches; charge, 183 pounds nitro-glycerine.

TEST OF A TORPEDO SHELL.

the shell with a pressure which is proportional to its mass, and were there no dividing diaphragms there would be a risk of detonating the charge in the gun. The provision of the transverse diaphragms, however, brings the inertia effects well within the limits of safety.

In the recent test the shell, which weighed 970¼ pounds, was loaded into a 12-inch 35-caliber gun, and fired with a charge of 82 pounds 10 ounces of smokeless powder with a velocity of 1,417 feet per second at the muzzle of the gun. It struck the target, which was 500 feet distant, with a velocity of 1,400 feet per second, which would be about the striking velocity of the shell, if fired with a full powder charge, at a range of 9,000 yards. The projectile struck the target at about its center and exploded with results which were so insignificant as to be practically negligible. There was a slight indentation of the surface of the plate made by the head of the shell, which was about 12 inches in diameter and 1½ inches deep at the center.

The blast of the gases blew a depression in the sand at the base of the target which was about 5 feet in width, measured from the face, and about 26 inches in depth. The sand was also driven back somewhat from underneath the target, and the ends of the 16 x 16-inch longitudinal timbers upon which the target rested were somewhat split and broomed up. The whole target was moved 2 or 3 inches to the rear, and settled, due to the blowing out of the sand beneath, to about the same number of inches. The integrity of the plate steel structure representing the side of the battleship which formed the backing of the plate was uninjured.

In order to give an approximate test of the soundness of Mr. Isham's theory that the downward pressure of the gases of explosion would drive the water through the side of the ship below the armor belt, five 6-inch shells were buried in the sand at a distance of about 3 feet back from the face of the target, with the axes of the shells placed radially to the center of explosion. In the base of each shell was placed a pressure gage of the type used in determining powder pressures in the gun when large guns are under test. On examining these gages after the shot was fired, the base of the shells presented the appearance shown in the accompanying engraving, which represents the shells after they had been recovered from the sand. In the case of three of them the pressure gage had been struck by flying fragments of the shell and, of course, the pressures recorded were valueless. The first shell, from left to right, was struck by a fragment on the pressure gage, as shown, and revealed a pressure of 16,120 pounds to the square inch. The pressure gage of the second shell was also struck and showed 14,120 pounds to the square inch; the third pressure gage was not struck by fragments, but as it was covered with sand its low pressure of 1,800 pounds to the square inch was considered, like those of the two preceding gages, to be of no value for the purpose of the experiment. The fourth shell, whose pressure gage was struck by a fragment, showed 8,950 pounds to the square inch. The fifth shell, however, was not struck by fragments, and its pressure gage was clear of sand and any obstruction, and therefore, received the unobstructed blast of the gases. Its gage showed a pressure of 4,800 pounds to the square inch, and this must be taken as a fair indication of the downward thrust of the explosion—altogether too small to overcome the inertia of the water, and produce a horizontal component at a depth of, say, 5 to 10 feet, sufficient to burst in the side of a ship.

The failure of this shell, coming after that of the Gathmann shell, should settle once and for all the question of the value of torpedo projectiles for use against modern armored vessels.

Prize Competition for the Prevention of Lead Poisoning.

In order to find effective means for the prevention of lead poisoning to which all workmen occupied in mining, milling, smelting, and refining lead ore, or employing metallic lead or materials containing the same are exposed, a competition is proposed by the International Association for Labor Legislation, Basle, Switzerland, subject to the conditions hereinafter specified. The following prizes are offered:

1. One prize of $1,200 for the best treatise on the prevention of lead poisoning in the operation of mining and milling lead ores or ores containing lead.

2. One prize of $2,400 for the best treatise on the prevention of lead poisoning in smelting and refining works.

3. Two prizes, viz., one first of $600, one second of $300, for the best treatises on the prevention of lead poisoning in the chemical application of lead, as in white lead works, manufacture of other lead paints, of electric accumulators (storage batteries), etc.

4. Four prizes, viz., one of $360, one of $240, two of $180 each, for the best treatises on the prevention of lead poisoning in the trades of house, ship, coach painting, interior decoration, varnishing, and the like.

5. Four prizes, viz., one of $360, one of $240, two of $180 each, for the best treatises on the prevention of lead poisoning in those trades where raw and manufactured lead are consumed or handled on a large scale, as in type foundries and printing offices.

Each treatise is to contain a systematic review of the special causes giving rise to lead poisoning, in conjunction with a description of the various processes of manufacture, pointing out the dangers occasioned at every phase of procedure, including handling and transportation.

Reference to be made also to the causes due to working at places in which a prolonged occupation is liable to affect the health, to want of cleanliness, lack of proper guidance and instructions, carelessness, poor and inadequate food, irrational way of living, and unhealthy dwellings of the workmen. In connection with the statement of the causes of lead poisoning, measures for their prevention are to be proposed.

Substantial evidence should be given for the proposed preventives as regards their technical, hygienical, and economical feasibility.

The papers may be written either in English, French, or German. Already printed books cannot be taken into consideration by the jury. The ready manuscripts must be put in an envelope bearing only a motto, and lodged with the International Labor Office at Basle on or before the 31st December, 1905.

All letters, inquiries, and other matters pertaining to the present competition, are to be addressed to the International Labor Office, at Basle (Switzerland).

Dynamics of Dreams.

In a recent issue of the New York Medical Record, Dr. Axel Emil Gibson discourses on the "stuff that dreams are made of." In this lengthy article some interesting information is given. For instance, Harvey, of the vascular circulation fame, is said to have recorded a dream in which a bumble-bee stung him in his left thigh, on a place where a couple of days later appeared an ugly ulcer, and Malesherbe, the renowned French author, found himself in a dream attacked by a rowdy who stabbed him in his left breast with a dagger in an area where the following evening he felt the first attack of a severe lobar pneumonia. "The archives of medical reports," the author informs us, "are heavy with cases of a similar character, which have either received no explanation at all, or else have been explained away entirely."

The doctor calls attention to the fact that dreams depend on some other media than those known to us as the five senses. A most conclusive evidence in favor of this view is found in the circumstances that even the blind are able to see in dreams—as witness the experiences recorded by Helen Keller, "Blind Tom," the poet of "Paradise Lost," and others. Hence the conclusion seems to be unavoidable that it is only as far as physical vision is concerned that the optic nerve guides and limits the field of vision.

The author finally arrives at the deduction that dreaming and waking differ in degree and form of manifestation only, not in principle and essence. "Like waking consciousness," he avers, "the dream reveals, but does not create. The same world that surrounds the waking individual surrounds the dreaming, only the viewpoints and media of observation are changed."

Ordinary dreams, Dr. Gibson tells us, are merely undigested consciousness, being made up of longings, desires, anticipations, idle hopes, and miscarried realizations, which, occupying the mind during the day, are overtaken by sleep before having reached their fruition.

The Current Supplement.

The Victoria Falls Bridge over the Zambezi gorge in South Africa was formally opened on September 12 last by Prof. Darwin, head of the British Association, which has been touring and lecturing in South Africa. Harold Shepstone, in the opening article of the current SUPPLEMENT, No. 1557, describes the ceremonies on that occasion, and likewise gives a succinct account of the bridge, illustrating his text with two photographs. The seventh installment of Sir William White's discussion of submarines is also published. The treatise on the iron and steel hull steam vessels of the United States by J. H. Morrison is continued. He completes the discussion of the previous number and starts a new topic, "the Modern Shipbuilding Plants on the Atlantic Coast." Prof. J. C. McLennan contributes the results of his investigations of the induced radio-activity excited in air at the foot of waterfalls. V. Quittner discusses magnetic alloys. An interesting 40-ton block crane with 150-foot radius is described by the English correspondent of the SCIENTIFIC AMERICAN. As part of his paper read before the South African meeting of the British Association for the Advancement of Science Prof. G. H. Darwin gave a graphic description of the evolution of a star. This account will be found in the current SUPPLEMENT. Elie Metchnikoff, sub-director of the Pasteur Institute, gives his views on old age and senile diseases in general.

Engineering Notes.

The question is often asked whether in case of installing a certain horse-power of boilers, say 300 horse-power, it would be more economical to have three boilers of 100 horse-power each or two boilers of 150 horse-power each. By all means have the two larger units, as it will always be found that the larger boilers have less radiation, less air leakage and better combustion than a corresponding horse-power in small units. If it is necessary to have a spare unit for cleaning, let there be another one provided of the same size.

Most of the largest bridges and other steel structures which have been built in late years have been designed by engineers not connected with manufacturing establishments. The manufacturer should confine himself to his legitimate field of manufacturing structural steelwork at so much a pound. The line between engineers and manufacturers will be even more marked in the future, when the same distinction will prevail as now exists between the architect and the contractor. The manufacturers of structural work, in the future, will devote their energies to improvements in their tools and machinery and methods for handling material. Their engineering force will consist of mechanical experts, shop draftsmen and engineers, who, with a thorough knowledge of shop-practice, are skilled in putting the engineers' designs into convenient shape for the workshop.

The economy in burning fuel is a matter requiring great skill and experience, and depends entirely upon the evenness, thickness, and condition of the fire, which controls entirely the air supply, and, therefore, the perfection or imperfection of the combustion. There is very little use in "splitting hairs" over a quarter of a pound of steam consumption of the engine, while the fireman may be losing ten times this quantity of fuel from inefficient boilers or poor firing. It is too often the case that the demands for increased horse-power are met by grate surface too large in proportion to the heating surface of the boiler or forced draft, and too little attention is given to careful firing, with heating and grate surfaces in proper proportion to give best economy, and frequently a great deal of money is spent in obtaining high-class engines and condensers, whereas the principal loss is in the boiler and fire room.

Some interesting experiments upon the use of waste products for motive power have been carried on at Noisel, France. In general the portable or fixed engines which are used on the farms are obliged to use coal which must be brought to the spot at a considerable expense. It is estimated that the engines take 6 or 8 pounds of coal per horse power, costing from four to six cents. The use of gasoline or oil motors is too expensive to be practicable at present on the farms. To see whether the problem of cheap power could not be solved by the use of the different kinds of vegetable waste products which are so abundant, the present experiments were undertaken, and the various products were burned in a gas generator which in turn ran a duplex motor. Wheat straw, oats, waste hay, leaves, reeds, etc., were used. The idea in the present case is to form groups among the neighboring farmers who would possess the apparatus in common, in which case the first cost would not be a heavy one and they would then have a source of cheap power, using a 50-horse-power gas engine. In the present trials the products were collected and after drying were formed into bales weighing 800 pounds per cubic yard. The straw was chopped before baling. We give some of the results which were obtained by burning the different forms of waste material in the gas producer. The latter, which is of the Riché pattern using an upright column, only requires a little coke to keep up the operation. In the case of waste hay, it takes 2.25 pounds to produce a horse-power-hour, and the cost is estimated at $0.0112 in this case. The hay was charged in the gas-producer without taking any special precautions and was packed down with a rod. The alkaline slag which comes from the furnace may be used as fertilizer. In the case of wheat or oat straw the ash and water are somewhat less than in the former case. The horse-power-hour can be produced by burning 2.3 pounds of straw, at a cost of $0.0114, or practically the same as with hay. Reeds or moss cannot be used to advantage in the producer unless they are well dried. In fine weather they can be spread in the sun. The cost is greater than above. In the case of dead leaves (ash leaves) which had fallen in the autumn before, allowing the cost of collecting, transporting, and compressing to be $1.2 per ton, we find that the horse-power-hour comes as low as $0.0086. With buckeye leaves it is $0.0112. Sawdust, shavings, and wood splinters were also tried. Poplar sawdust takes 3.1 pounds to give a horse-power-hour, costing $0.010. These results show that by the use of proper apparatus it is possible to secure motive power from waste products at a very low rate, and this would be a great advantage on the farm, especially in regions where coal is high.