



On the trail to the mine in the crater.

## A Mine in a Meteor-Made Crater

Work of a 15,000-Centimeter Celestial Projectile

By Arthur Chapman



Anvil rock at the bottom of the crater.

UNIQUE mining operations have been carried on, until recently, in the crater of what is known as Meteor Mountain, near Canon Diablo, Arizona.

This is not a volcanic crater, but was formed by the fall of a tremendous meteor in some past age. Scientists who have examined the crater are of the opinion that the meteor which struck the earth there must have been of almost incalculable size and weight. In fact, there is no indication anywhere else of the alighting of a meteor approximating the size of this Arizona visitor.

Acting on the theory that the meteor was of such great weight that it sank into the ground to an extreme depth, a mining company expended much money in driving holes at the bottom of the crater in a search for the main body of the deposit. Five shafts have been sunk at the bottom of the crater, the longest being 125 feet deep. Quicksands and silica, encountered at that depth, prevented further sinking. From the bottom of the deepest shaft borings have been run down to solid formation, but no trace of the meteor has been found.

Several years ago a sheep herder discovered some of the meteoric fragments and this led to further investigation, and it was found that the large hill rising from the level desert, near the spot where the herder had made his discovery, was the rim of a great crater. More fragments were found near this crater, and soon it became the generally accepted theory that a meteor caused the strange formation in the desert, which at first had been ascribed to volcanic action.

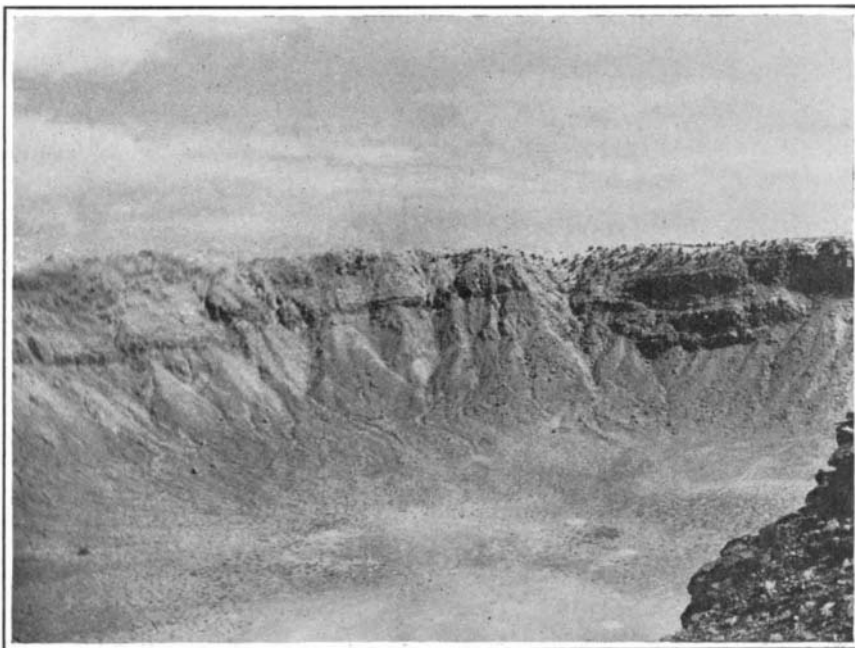
The hill itself does not deserve the term "mountain," as it rises hardly more than 150 feet from the level of the desert. The crater is three-quarters of a mile across and is from 300 to 400 feet deep. There are 300 acres in the bottom of the crater, giving ample room for the mining operations which have been carried on.

So far as its shape is concerned the crater could have been formed equally as well by a blowout as by impact; but the character of a portion of the ejected material points strongly to an impact as the origin. The evidence afforded by other meteoric bodies, in regard to the results in impact and the disturbance of the surface of the earth, is very contradictory and is of little assistance in deciphering the gigantic disturbance here found, for nothing equaling it in size has ever been discovered.

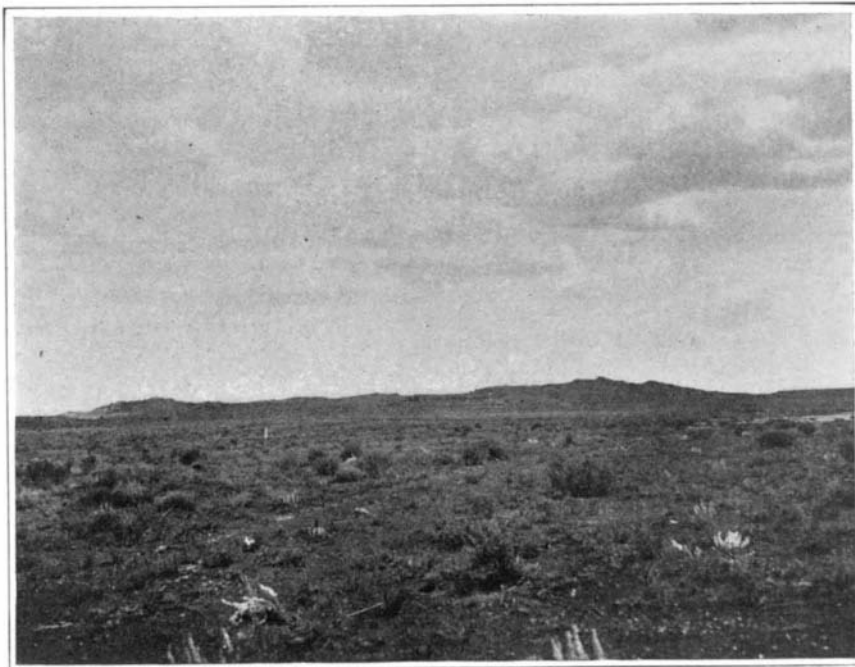
This Arizona meteor must, by the evidence at hand, have struck with sufficient force to crush a layer of limestone 300 feet thick, having an average crushing strength of 12,595 pounds per square inch, and, further, of a layer of sandstone 500 feet thick with a crushing strength of 6,350 pounds; and to meet these conditions the hypothetical case is conceived of a mass of meteoric iron 500 feet in diameter and striking the earth at a speed of five miles a second. The superficial rocks are crushed and thrown back to an amount greater than the bulk of the meteor, and as a projectile under similar conditions will create a crater eight to ten times its diameter the supposed 500-foot projectile could easily have formed the 3,900-foot crater that exists in Arizona. As this huge projectile penetrated below the surface the upward escape of material around the mass would be impeded, and that directly in its path and also that on the sides would become greatly compacted. The heat generated by the rapid down-

ward passage of the body would produce fusion and probably also a partial volatilization and the effect of the impact would convert any moisture present into steam of great explosive power. The result would be that quantities of the surrounding material, together with portions of the meteor itself, would be ejected and thrown back over the rim of the crater and scattered over the surrounding plain. Such is a hypothetical reproduction of the event which would explain this curious crater and the conditions that surround it.

Meteor Mountain is ten miles from Volz's trading post at Canon Diablo, in the heart of the grim Southwestern desert, and is visited by few people. Yet it is one of the most interesting natural attractions of the Southwest. It is believed mining operations will be taken up again and that some way will be found to penetrate more deeply beneath the crater and ascertain whether the greatest of meteors is resting, as many believe, in a solid mass hundreds of feet below the level of the Arizona desert, or whether there is nothing left of the original body of the meteorite but the scattered material now found upon the surface.



The enormous pit produced by the impact and explosion of a giant meteorite.



Meteor Mountain in the background at the right.

### Slaughter in Mines Rivals War

BECAUSE war is a comparative novelty and its horrors are presented to us in appropriate descriptive settings we shudder at its useless slaughter, entirely unmindful of the fact that much more unjustifiable killing is going on daily in our midst as the result of the manner in which some of our commercial enterprises are conducted.

The report of the Bureau of Mines, just issued, shows that during the year 1913, 3,651 men were killed in the mines and quarries of the United States, and the number injured during the same period is estimated at 100,000. This means that nearly three and one half men were killed for every thousand employed, which Dr. Joseph A. Holmes, director of the bureau, declares to be "excessive and unnecessary and a discredit to the industry." Commenting further, he says:

"When we consider that this record is being repeated year after year, the very thought of it becomes appalling. In the last three years, as far back as the records of the Bureau covering certain branches of the industry go, the mines and quarries of the United States have swallowed up 10,487 human lives and have incapacitated temporarily probably a quarter of a million men. And the saddest part of it all is that a great part of this death roll, and a still greater part of the injuries, are not necessary. I believe I am conservative when I say that half of the 3,651 men killed in the year 1913 might have been saved and three fourths of the 100,000 men injured in the same year might have escaped injury had all the various agencies involved, the operators, the miners, and the State and National Governments, done their full duty in the matter. Perhaps no one of these agencies has done its full duty. For the Bureau of Mines, as representing the Federal Government, I can say that, owing to a lack of adequate funds, this Bureau has fallen short of doing its full part in this great safety movement; and I therefore hesitate to criticize the seeming shortcomings of any other agency."

These employments, from their nature, must always be hazardous; but the record of European countries of only one man per thousand killed in similar work shows that the above estimate of the easily possible saving of life can and should be realized.

### Marconi Company Wins Again

IN the suit of the Marconi Company against the DeForest Radio Company and the Standard Oil Company for infringement of certain Letters Patent, in which Judge Hough recently granted the Marconi Company a preliminary injunction, the Court has handed down another decision. It appears that subsequent to the former decision the defendants moved to suspend the injunction pending an appeal, in so far as it related to the boats of the Standard Oil Company, and also another motion to vacate or modify the injunction with respect to both the defendants. These motions were brought upon additional affidavits, but Judge Hough, in a decision filed recently, denied all of the motions, thus refusing to suspend the injunction as to the Standard Oil Company, and to vacate or modify the injunction as to both defendants.

### Unprecedented Accident to a Torpedo-boat Destroyer

THE two photographs herewith presented show the result of a boiler explosion which came very near sending one of our latest destroyers to the bottom. The destroyer concerned was the "Aylwin," one of the latest to be designed and built for the United States Navy. This fine vessel and those of her class are about 300 feet in length on the water-line, 30½ feet beam, and 8½ feet draught. Their displacement is about one thousand tons and their speed 29 to 30 knots. The accident was not due to any defect in the vessel itself, but resulted entirely from a defect in the new type of boiler which had been installed on this vessel. The boilers are of the water-tube type, and it was the right-hand lower drum which gave way, the drum being blown off against the ship at about the turn of the bilge. The heavy blow thus struck, together with the pressure developed by the large amount of water which suddenly flashed into steam, served to tear open the starboard side of the boiler room and to produce the extraordinary rent which is shown in our view of the "Aylwin" when she was in drydock for repairs. The accident occurred in the forward boiler room and to the forward boiler of two which occupied this compartment. The explosion caused a leakage in the after boiler room bulkhead, so that two compartments were filled, with the result that the draught increased from 8 feet 5 inches to 13 feet 6 inches. The serious nature of the accident was aggravated by the fact that there was a heavy head sea running off Cape Hatteras, where the explosion took place; and the working of the water within the ship caused a considerable working of the engine room bulkheads, which the officers and crew endeavored to correct by bracing the bulkheads with wood and the furniture of the ship.

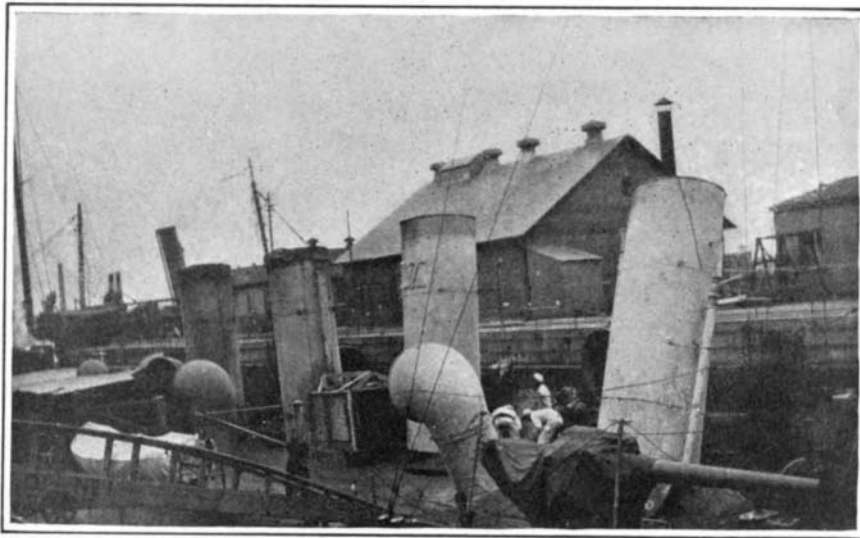
The wounded were conveyed to another destroyer, which took them at 30 knots' speed to the nearest hospital. The "Aylwin" was taken in tow and, in spite of her seriously damaged condition, was brought safely to Newport and placed in drydock.

### Cutting Up a Bridge With the Oxyhydrogen Torch

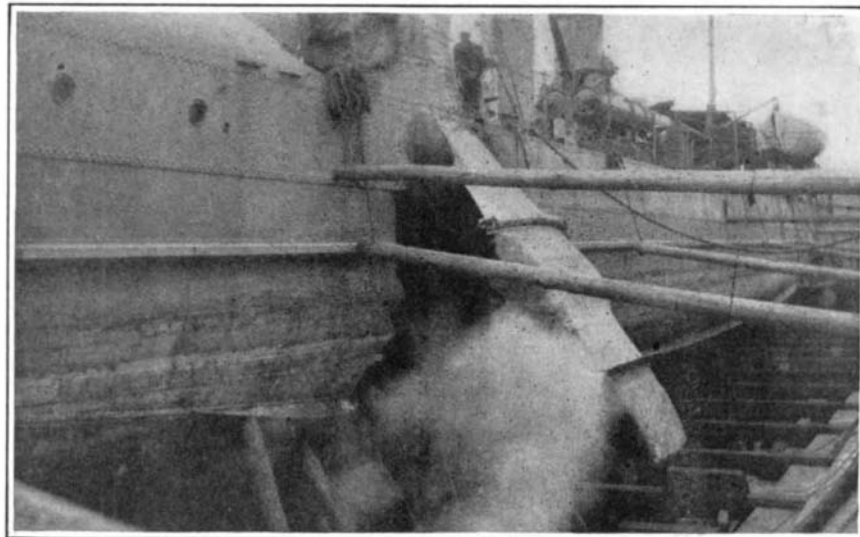
IT is well known that the oxyacetylene or oxyhydrogen torch is very useful in cutting up old structural iron work that has to be removed in sections; for it provides the easiest and quickest way of cutting through the material. Ordinarily the metal has to be "pre-heated" to the point of ignition when it is actually burned by combining with the oxygen. Ordinarily the "pre-heating" of the metal is continued during the entire process of cutting. However, there is a system in use in Germany, in which the work is merely started with the oxyhydrogen flame, and once the metal has reached the proper temperature the cutting is continued to the end by supplying it with oxygen alone.

This process is illustrated by heating a piece of iron wire in the flame of a Bunsen burner and then sending a stream of oxygen upon it, when the iron will be found to burn with brilliant sparks. A special form of blow pipe has been devised to carry out the same principle on a large scale. First, tubes lead in oxygen and hydrogen to produce the pre-heating flame, and then means are provided for cutting off the hydrogen and permitting the oxygen alone to strike the glowing spot. This results in melting the metal and cutting it rapidly.

The accompanying photograph shows the work of one of these torches in cutting up an old bridge over the Rhine at Cologne. The upper part of the structure was first cut up into short sections, which were removed one after the other, leaving the floor structure intact. After that a pair of caissons were floated under the floor and when the latter had been cut free with a blow pipe water was pumped out of the caissons, permitting them to



Destroyer "Aylwin," showing smokestacks displaced by explosion.



"Aylwin" in drydock, showing a strip of her side, 15 feet wide, blown outward by the boiler explosion.

rise and lift up the structure. Thereupon, it was successfully transported some distance down the river and finally landed on a neighboring bank.

Here the floor of the bridge was further cut up into small parts by the use of the oxyhydrogen torch.

farmers and truck growers have a few rows of these valuable trees or a border of them around their fields, and, as the business progresses, the crops from these will either be regularly distilled at home or else hauled to community "stills." The outlook now is that within another dozen years or less the camphor trade of the United States will be revolutionized. The monopoly of Formosa will be a thing of the careless past.

### Iceland's Railway

FOR years the people of Iceland have been planning to build a railway on their island and at last their hopes have been realized. The Althing, or Iceland Congress, has passed the bill, and at no very distant date the steed of steel will worm its way between the glaciers and among the hot springs of Iceland.

The main line of this railway will run from Reikjavik, the capital, to Thorsjaa; here the road will divide, with one branch to the geysers and the other to Oerbak. The total distance to be covered by rail is about 100 kilometers, or about 62 miles, and the system is to cost approximately \$1,000,000. At the present time the facilities for traffic and trade are still most primitive. Travelers are obliged to ride on any animal which may be available, while freight is moved in rude carts. The roads are for the most very bad and they are often made impassable by mountain torrents.

### Early Use of Pilot Balloons

A NOTE in the *Monthly Weather Review* calls attention to the fact that the famous exploring expedition sent out by the French government under La Pérouse in 1785 carried a few small balloons, some of paper and some of goldbeaters' skin, for use in studying the winds in the upper atmosphere, and that the instructions prepared for the expedition by the Academy of Sciences pointed out the special importance of using these balloons in the trade-wind region in order to ascertain at what altitude the direction of the wind changes in that region. Thus the recent soundings of the trade winds carried out under the direction of Prof. Hergesell appear to have been anticipated by more than a century.



Cutting up an old bridge over the Rhine, at Cologne, with the oxyhydrogen torch.



### Explosive-proof Safe

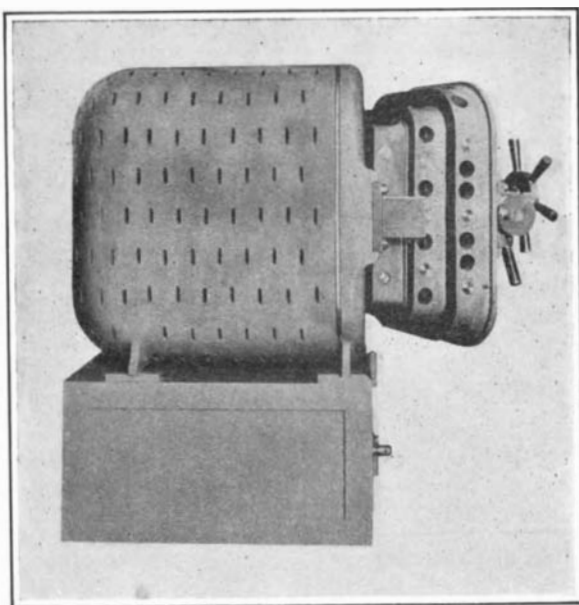
UNLESS he is provided with an oxyacetylene or oxyhydrogen torch, a burglar will find great difficulty in opening the safe shown in the accompanying photograph; indeed, the task may be considered well-nigh impossible. The safe is constructed with three walls of manganese steel, the outer and middle walls being perforated, the inner walls solid. These walls are separated by air spaces. The perforations in the outer walls do not register with those in the middle wall, so that it is impossible to work a drill through from the outside to the solid interior wall. There are three doors of manganese steel, one for each wall, each with its own set of bolts, and all arranged to swing on a single hinge. The object of perforating the walls is to preclude the possibility of confining gases generated by explosives and thus thwart the bank robber who depends upon blowing open a safe with nitroglycerin. To prove the efficiency of this safe, a test safe was made of soft steel with its door held in place by  $\frac{5}{8}$ -inch cap screws in place of the regular bolts. Five and a half ounces of nitroglycerin were exploded behind the outer walls of the safe without doing any damage, and after the explosion the door opened freely.

### The Horse-power of a Man

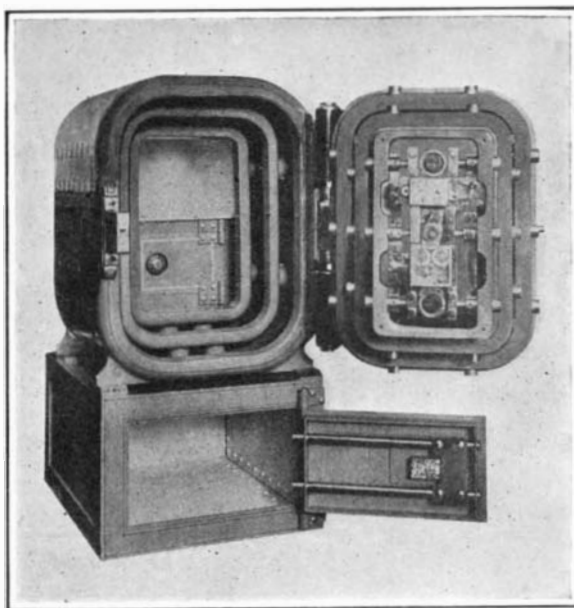
THE superintendent of a sanitarium in Battle Creek, Mich., has invented an apparatus for testing the strength of his patients and recording it in terms of horse-power. The machine consists of a bicycle with its front and rear wheels removed and its sprockets geared to a brake wheel. Straps run over the shoulders of the individual whose strength is to be tested and are attached to the floor. This enables him to use more power on the pedals. In the test he is required to keep the machine going at a predetermined rate. While he works the brake is gradually applied on the brake wheel, until the friction load is such that the rider is unable to "make the grade." The period at which he is forced to give up determines the horse-power he is able to develop. With this machine it has been shown that the average horse-power of a normal man is one fifth and that of a woman one tenth.

### Toothless Saws for Cutting Stone

IT may not be generally known that stone is cut with toothless saws which run in continual contact with the stone and with steel shot that is constantly being poured into the saw kerf by means of an automatic spreader. As a lubricant, lime is used. The steel shot consists of small balls,  $\frac{1}{32}$  inch in diameter. In the cutting of sand stone these toothless saws cut about three inches per hour, while in granites, which offer a great resistance, the action is very much slower. Some of the saws have pieces punched out of them every foot or so, to a depth of 2 inches, in order to carry the stone "sawdust" in the kerf to the end of the stroke. The accompanying photograph depicts a number of slabs of stone that have been cut with saws, and also a number of the saws, showing their warped condition after they have been used for a period of seven days. At the



Safe constructed with perforated outer walls to prevent confining of gases generated by explosives.



top is shown a saw before use.

### Auxiliary Motor Wheel for the Bicycle

ANY bicycle may be converted into a motorcycle in a few minutes by attaching the motor wheel illustrated in the accompanying engraving. It consists of a compact power plant mounted on a small wheel fitted with a heavy motorcycle tire. It furnishes enough power to carry the rider a hundred miles on a single gallon of gasoline. The motor is a one-cylinder four-cycle engine with high tension magneto and carbureter. The driving gear and gasoline tank are also carried on

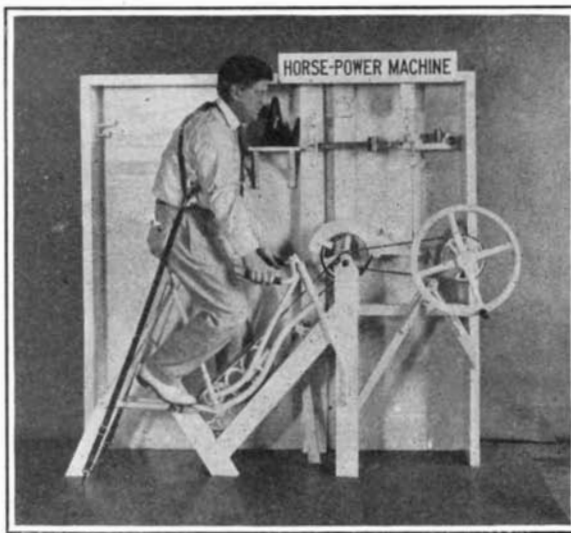
the motor wheel. The motor is controlled by a lever attached to the handlebars, and both bicycle and motor are therefore under perfect control of the rider. The device may be very quickly attached to the bicycle frame beside the rear wheel.

### A Gasoline Switching Locomotive

IN some places it is considered a luxury to use a switching locomotive because of the expense of maintenance and the consumption of fuel while the locomotive is not in service. Hence, unless there is enough work for the locomotive to do the twenty-four hours of the day the work of switching is done by the engines of freight trains. In order to provide a suitable locomotive for such conditions, in which there will be a minimum of expense for operation and no expense during the idle hours of the locomotive, a gasoline switching engine has been designed and is now in use at Matador, Texas. A photograph of this locomotive is shown herewith. It has a 300 horse-power engine and exercises a tractive effort of 12,000 pounds, at six miles per hour. The engine is of six-cylinder type, with cylinders 11 by 15 inches. The power transmission, which is pneumatically operated, is effected by means of a sprocket on the crankshaft connected by chain to a sleeve working free on the rear driving axle and is then transferred under multiple disk friction-clutch to the forward driving axle, where, by an octaroon clutch, the power is either magnified by a series of gears to produce heavy tractive effort and high torque for starting processes, or is delivered direct to the driving wheels. Once the locomotive is in motion the gears are cut out, and it is operated by the direct connection.

### Holding Tacks for Driving

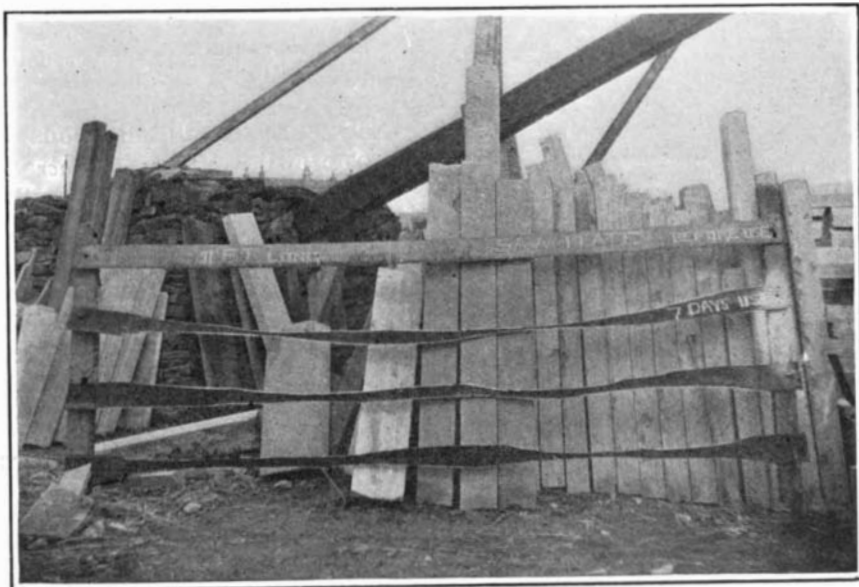
IT is usually found difficult to hold a small tack in place for driving, and this is especially true for round-headed tacks or small nails. M. Rene Engel of Paris uses an ingenious holder which anyone can make. Take a strip of sheet metal and cut a narrow slot in one end just large enough to allow a small nail to pass in easily, then fold the strip at the middle so that it takes the shape of a pair of pincers. The tack is placed in the slot so that the head can be gripped by the pincers, and the tack thus held firmly can be placed at the desired point in the wood. Striking the top with the hammer drives in the tack, then the piece is removed and the tack driven home.



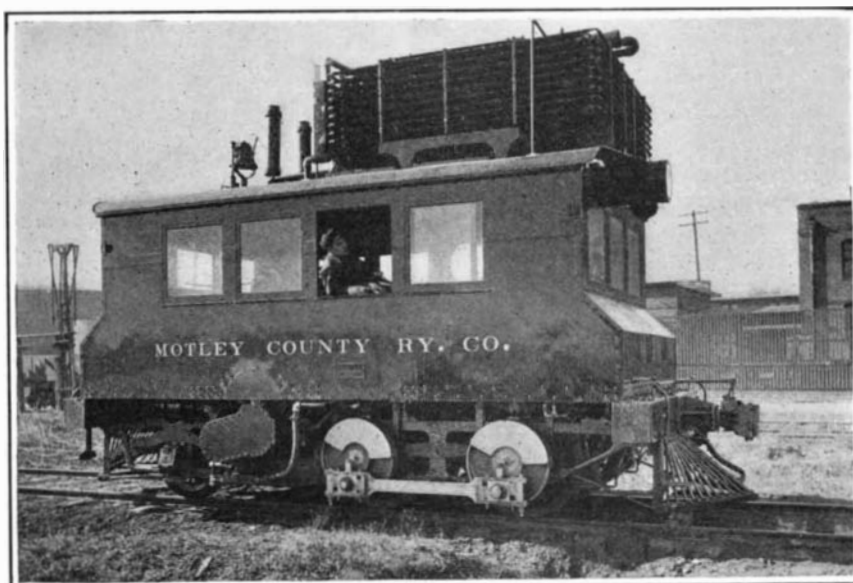
Testing the horse-power of a man.



Bicycle converted into a motorcycle.



Toothless saws for cutting stone.



A 300 horse-power gasoline switching locomotive.