THE HIGH-POWERED TRACTION ENGINE AND ITS MANY USES.

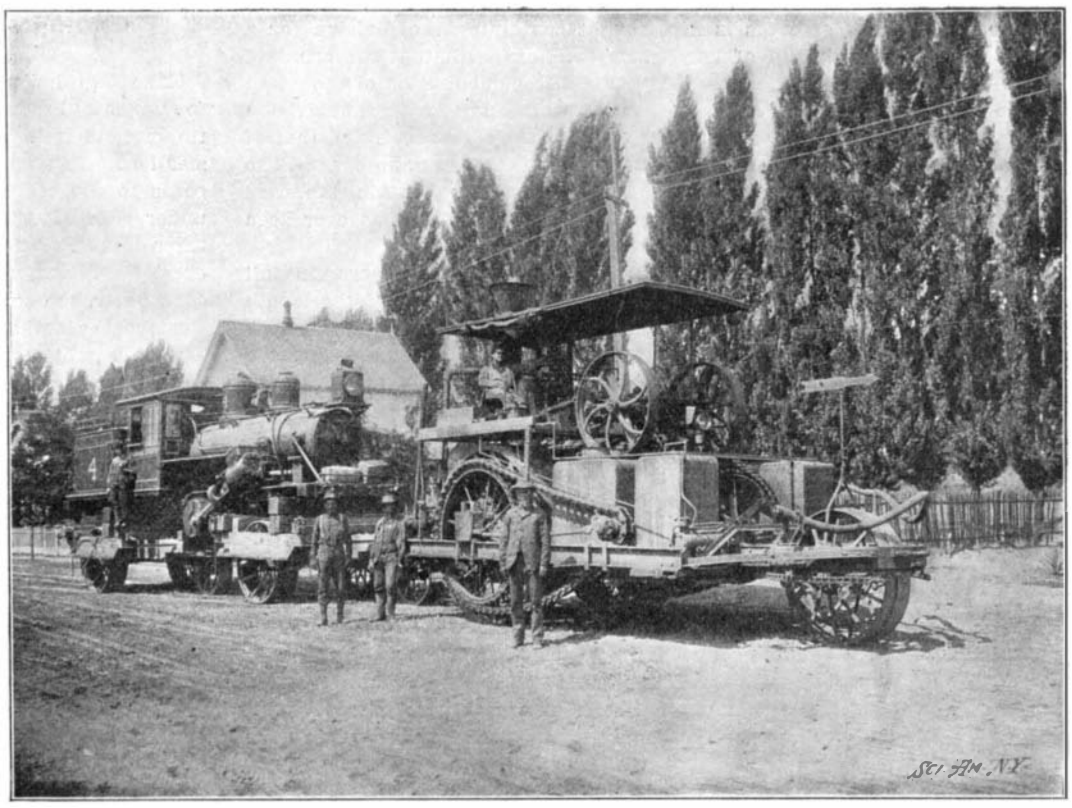
The extensive use of traction engines on the Pacific coast in agriculture and the lumber business attracted attention to their value for other purposes where considerable power is required, and recently they have been employed in California for a variety of novel purposes. In addition to the tractors used for farming and hauling loads of lumber, ranging from 40 to 60 horse-power, another type has been constructed especially for mountain work, such as transporting ore and other freight, in regions where the grades are unusually heavy, or where there are no roads whatever. The ore from the Copper King mines in Fresno County has to be transported a distance of 18 miles to a railway over a very rough country, through the foothills of the Sierra Nevadas. For this service a special tractor has been built, of 100 horse-power. Trains of ore wagons or cars, each having a capacity of 22½ tons, are made up, with one tractor to every two cars, and this method has been substituted for animal power. The freight can be carried more economically and in less time. The engines used are similar in their principal features to those used in the forests, but are more heavily built. They are among the largest of the kind which have ever yet been constructed, and are known as the Best type.

In addition to hauling logs and lumber to the mill or railway station, the tractors are also used for loading purposes. Where logs are to be transported, they are generally piled upon trucks specially made for the purpose. The truck is hauled to the place where the logs are waiting transportation, and skids or stout wooden posts are laid against the side of the truck, forming an inclined platform. Around the log to be loaded is fastened a chain or rope for a grip, which ends in a hook or link. To it is attached a wire rope fastened to the tractor. The engine is started, and the log pulled up the skids and onto the truck. Usually the trucks are large enough to hold two or three logs abreast. When the first tier is in position, it is chained to the body of the truck, then the skids are extended from the top of the tier to the ground, and another layer pulled into position in the same manner. In this way the truck can be loaded with three and sometimes four tiers—an operation which would be very difficult with the ordinary donkey engine, or by the use of animals.

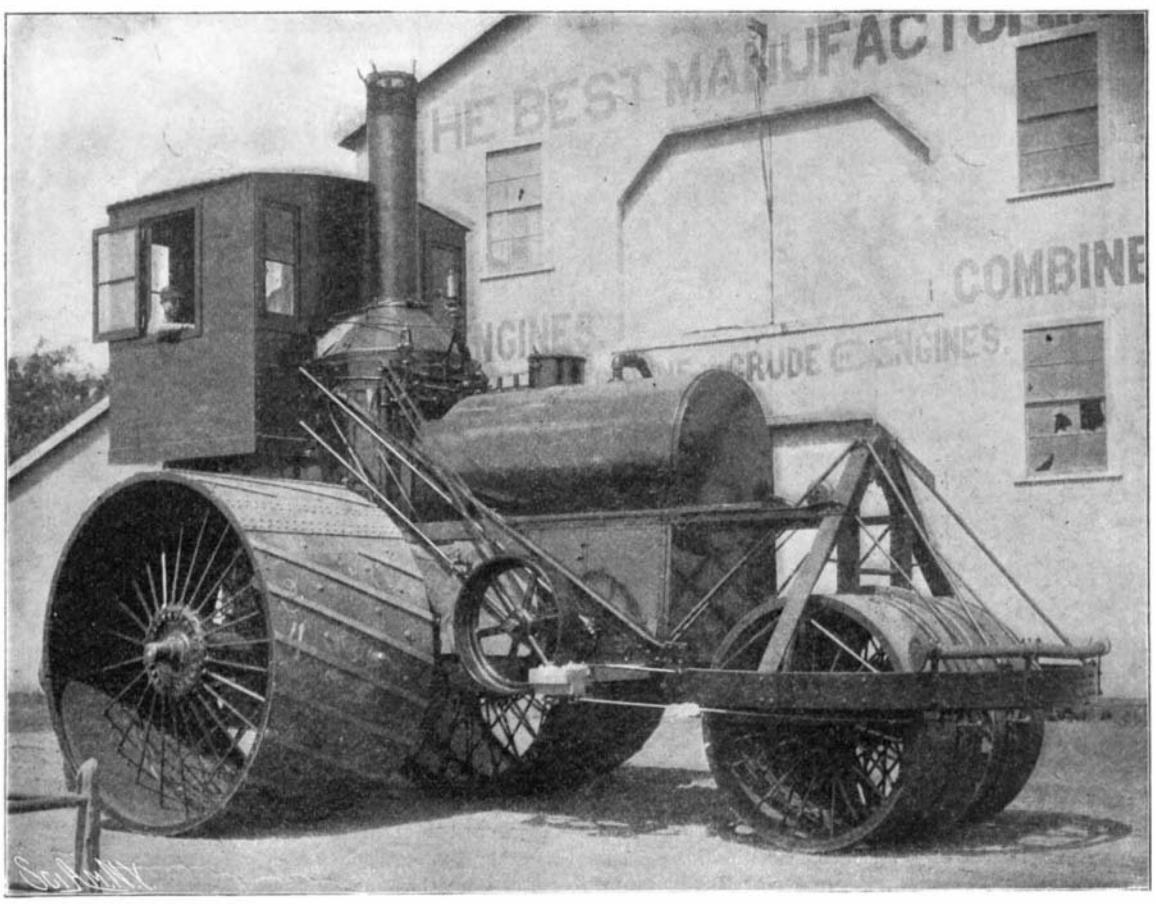
A somewhat novel use of the motor is the moving of dwellings and other buildings from place to place. As a substitute for horses they have been found very successful, as less apparatus is required, and the power can be applied much more easily. In the instance illustrated two 60-horse-power tractors of the Holt type were used for the principal motive power, being connected by cables with the building, which was shored up and placed upon small trucks. As will be noted, they were placed in tandem, while a small tractor was also utilized for hauling purposes, as well as to assist in keeping the building moving in a straight line. The house illustrated was moved over a mile, part of the way being across a field; but frequently buildings are pulled eight and ten miles by this method.

Another illustration of the curious freight which is sometimes transported by this means, may be given. A lumber company decided to build a logging railroad a few miles long between a timber tract which it owned and its mill. The nearest railway station for the delivery of the locomotives, cars, and rails was several miles distant from the tract, and the question arose as to the best method of transporting this material. The company decided to employ a tractor for this purpose, and after the railroad had been completed, all the cars and even the locomotives to be used upon it were drawn across country by this means.

The tractor was utilized in another novel manner in San Francisco recently. It was necessary to replace one of the cables used in a car line upon several of the streets, which have

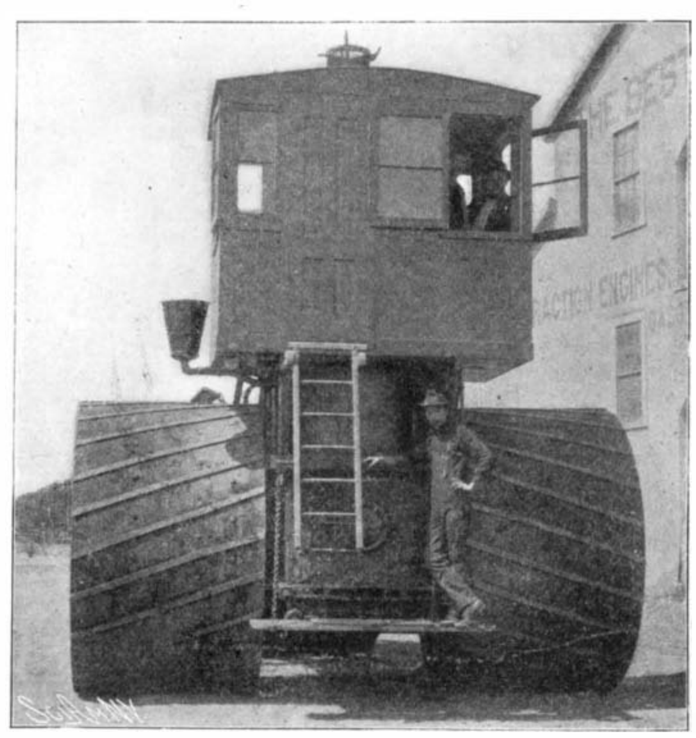


The Tractor Hauling a Locomotive.



A 50-Horse-Power Traction Engine. Driving Wheels, 8 Feet in Diameter and 5 Feet in Width.

The Tractor at Work in the Harvest Field.

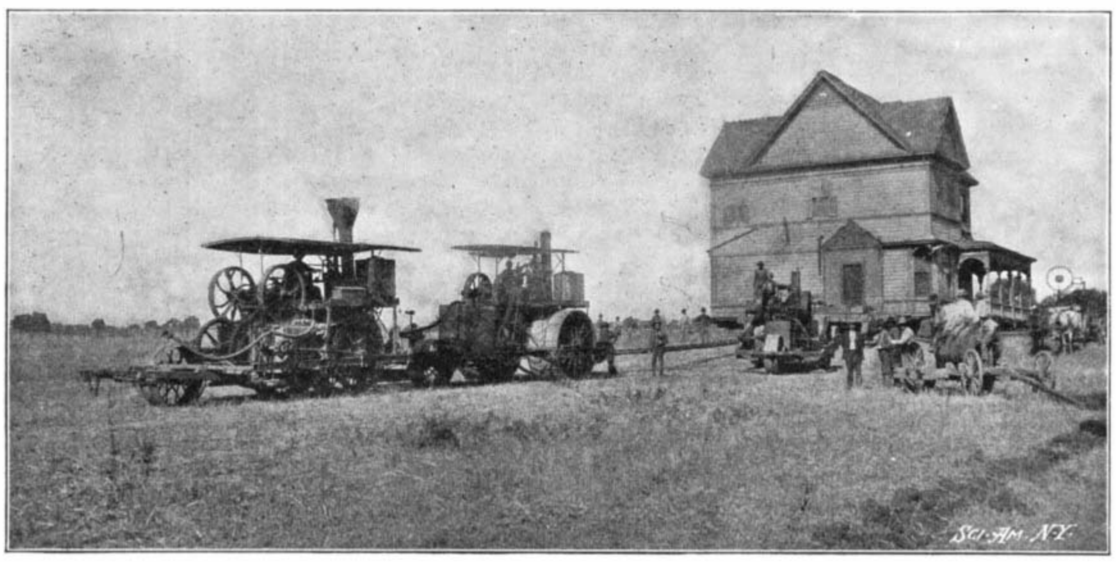


Rear View of the Traction Engine.

THE HIGH-POWERED TRACTION ENGINE AND ITS MANY USES.

very steep grades. A strike among the teamsters made it impossible for the street railway company to secure enough horses to haul the cable to the power house, from which it was to be run through the slot. It was decided to use the tractor, but none could be secured in the city. A telegram was sent to Stockton, which is nearly one hundred miles distant, and one of the largest motors "fired up," and started for San Francisco over the highways. It arrived about twenty-four hours later, and was immediately taken to the wharf, where the cable reel had been placed upon a truck. It was coupled to the truck, and the tractor started for the power house, several miles distant. The route included a climb up a hill on which the grade is over ten per cent, but the load was taken to the top without difficulty, and in two hours from the time the start was made the cable was being unwound.

In addition to plowing, cultivating, and operating the harvester in the grain field, the farm tractor is now extensively used in operating thrashers. Its power is employed to haul the thrashing machines into the field. Then the thrasher is belted to the flywheel of the tractor, and it is used as a stationary engine, although but a small part of its power is required. This type of tractor is provided with a spark arrester of wire, which surrounds the smokestack.



Moving a House in California.

THE HIGH-POWERED TRACTION ENGINE AND ITS MANY USES.

THE BERTILLON IDENTIFICATION SYSTEM.

(*Continued from page 432.*)

bow to the extremity of the middle finger, the forearm being bent at an acute angle with the arm, and the hand extended flat on a table with the nails upward. A specially-constructed table is naturally used—a table rather high and narrow, with trestle-formed supports.

These measurements must be taken accurately. In the Police Department of New York a criminal is measured and photographed in about ten minutes.

As we have already stated, peculiar markings and morphological characteristics are also noted. The color of the aureola and periphery of the eyes is ascertained, together with other peculiarities. The form of the nose is observed—whether the bridge be curved, straight, or convex, whether the base is elevated, horizontal, or depressed. The size of the ear, whether it be large or small, is determined, and also the formation of the lobe.

Characteristics of the teeth, such as their number, whether they have been filled, whether any are broken, are set down. The inclination of the forehead and of the chin is also observed.

The measurements taken must now be classified. This is done by means of cards each 5⅝ inches wide and 6¾ inches high. As the measurer calls out the figures which he reads from the instruments, an assistant jots them down upon an identification card. Assuming that there are sixty thousand of these cards, the first step is to distribute them according to length of head into three primary divisions—"short," "medium," and "long." This classification does not depend upon any personal discretion, but is sharply defined by figures. The medium length of the head is considered to vary from 185 to 190 millimeters. All above this are considered long; all below, short.

We have now three classes of heads, numbering each twenty thousand. Each of these single classes is again subdivided, this time into three groups based on the width of the head, for the reason that the width varies independently of the length, and for the reason that it is impossible to determine from the knowledge of the length of a head what its width may be. The new subdivisions, nine in number, are made up of narrow widths, medium widths, and broad widths. Each of these nine subdivisions numbers approximately 6,666, which is again divided into three groups, according to the length of the middle finger, thus making a total of twenty-seven subdivisions. A fourth subdivision is made on the basis of the length of the foot, which again subdivides each group obtained into three, each containing about 251 groups. Next come three subdivisions based on the length of the forearm, which reduces the preceding number to less than eighty-four. The variations of height divide each of these last lots into three of about twenty-eight each, which are evenly distributed, still on the same principle, into classes by means of the variations of the length of the little finger, and into classes according to the color of the eye. This last group, depending upon the color of the eye, is again arranged according to the increasing size of the ear. In this manner it is possible to arrange a collection of sixty thousand cards into groups of less than a dozen each.

Assuming that the cards are thus classified, how are they used in identifying a criminal? The subject is first measured in the manner which we have already described. Turning to the card catalogue, the group of cards is first sought containing the division for a length of head corresponding to that of the criminal just measured, stopping at the subdivision of the width of his head, and afterward seeking for the subdivision of his middle finger, then that of his foot, and that of his forearm. By one elimination after another, a little group is reached which ought to contain the card sought for, if the criminal in question has ever been arrested before and measured.

As a general rule, it is unnecessary to examine all measurements. It is found in practice that the length and width of the head are in most cases quite sufficient to identify a criminal, for the other measurements conform most admirably to his. By thus placing at the beginning those measurements which have the greatest identifying value, the work of finding a card is considerably facilitated.

It should not be supposed that the measurements of the criminal will conform exactly with the measurements on his identifying card. It is very rarely, indeed, that several measurements of the same subject, taken in rapid succession, will agree exactly. It is difficult, of course, to keep within the proper limits; but then in a system in which so fine a subdivision as the millimeter is used, it is but natural that slight variations occur. It is almost impossible to obtain twice over the same set of figures for the height, the trunk, and the width of the ear. A maximum of negligible error is therefore allowed. In the case of the height, this error is placed at 30 millimeters; of the length and width of the head, at 2 millimeters; of the length of the left foot, at 6 millimeters. Thus, if a criminal who is to be identified has a height of 7 millimeters greater or less than that called for by a certain card, it is absolutely certain that he is the same person, provided the other card measurements conform with his. If, on the other hand, his height is greater or less by 30 millimeters than that called for by the card most closely approximating to his anthropological measurements, it is reasonably certain that he has never before been measured. Such is the precision with which a criminal can be identified by means of his bodily proportions scientifically classified, that simply by means of the figures on the identification cards, and not by means of his name or his photograph, is it possible to ascertain whether or not he has ever before visited the measuring room of the Police Department of the city of New York. Dr. Bertillon himself states that it is impossible to find two exact duplicate cards within a millimeter in the anthropometrical file of a hundred thousand cards in the Parisian Prefecture of Police.

The descriptive marks which are noted upon the identification card serve simply as an aid to the figures. Exclusive reliance is not placed upon them by any means, because it is possible for blemishes in the skin to be removed, because the color of the hair changes with age, and that of the eye as well. The shape of the nose, the ear, and the inclination of the forehead and chin, however, are more trustworthy data. Dr. Bertillon has stated the rule of applying these distinctive marks as a means of identification as follows: All the marks indicated on an old card should be still recognized on the subject if this card really applies to him, but on the other hand, it is not necessary that all marks on the present subject should appear without omission on the old card.

The scientific accuracy of the Bertillon system of identifying criminals is now beyond question. What was previously guesswork in many cases has now given place to absolute certainty. A criminal over twenty-two years of age who has once been measured must be identified if he is ever arrested, convicted, and measured again.

Substitution of Electricity for Matter.

BY EDGAR L. LARKIN.

Take two hollow spheres of wood, each three or four inches in diameter. Cover their surfaces with tin or gold foil. Fill both with fine shot through a small hole in each. Cork, invert, and suspend by silk cords to the ceiling. The apertures will be in their under side. Let the distance between them be, say three inches. A force, or activity named gravity, will exert attraction, and they will draw slightly nearer each other, the cords being drawn out of the vertical. Remove the corks, and allow all the shot to escape. The balls will separate until the strings above are in direction of a plumb line again. Now, charge the metallic films on the globes with unlike static electricity, and they will move toward each other as before. And the charge can be of such intensity that it will attract with the same force as the gravity inherent in the shot. Conceive the spheres to be in an absolute vacuum, so that no trace of electricity will leave the surfaces of the metals. Now imagine that all the wood could be removed without disturbing the coatings. The balls will still attract. And let the metal all be removed from the interior surfaces, out to an external layer whose thickness is the diameter of a Thomsonian corpuscle. Then the electricity, ever moving outward, as layer after layer of corpuscles are removed from the inside, would reside on the extreme external surfaces of the corpuscular films. Attraction would be the same as in the outset. The films might weigh the one-quadrillionth of a gramme. Assume that they would; for corpuscles are of the one-thousandth part of the mass of a hydrogen atom. No mind is able to conceive how thin the layer is when only one corpuscle deep.

Next contract the shell to one-half its original diameter. Its surface will be reduced to one-fourth; but the thickness of the film is four layers. The three interior layers can be dispensed with. The electricity will move to the external layer, and its density will be doubled; but attraction between the globes, mere shells of corpuscles, will be the same as the first, filled with shot. Continue the shrinking; then for each reduction of the radius to one-half, three-fourths of the corpuscles may be cast aside. How far this process could go is unknown; but it is reasonable to believe that it could be carried out theoretically until matter almost entirely disappears. Still attraction is not affected. Of course, it is not known to what density electricity can be forced in a perfect vacuum, nor whether attraction is able to act in the entire absence of matter between the spheres. But it now appears that electricity and gravity are either identical or very closely related.

An Old Clock.

The oldest working clock in Great Britain is that of Peterborough Cathedral, which dates from 1320, and is conceded to have been made by a monastic clockmaker. It is the only one now known that is wound up over an old wooden wheel. This is some twelve feet in circumference, carrying a galvanized cable about 300 feet in length, with a leaden weight of three hundredweight. The cable has to be wound up daily. The gong is the great tenor bell of the Cathedral, which weighs 32 hundredweight, and it is struck hourly by an 80-pound hammer. The gong and striking parts of the clock are some yards apart, communication being by a slender wire. The clock is not fitted with a dial, but the time is indicated on the main wheel of the escapement, which goes round once in two hours. This clock is of most primitive design, more so than the famous one made for Charles V. of France by Henry de Nick.

In the new coal bunker at the New York navy yard precautions against spontaneous combustion have been taken. Each bin is provided with two galvanized iron pipes 4 inches in diameter, 20 feet long, which are so hung that a thermostat may be moved through the entire depth of coal. Each thermostat is connected with a suitably placed annunciator, so that a constant watch can be kept on the temperature of the stored coal.