AN IMPROVED CULTIVATOR.

Our engraving represents an ingenious machine constructed by Messrs. Galland & Granjon. It is an improved cultivator that can be easily operated by one man. It appear to us as if it ought to be added to the most interesting of agricultural implements. It is assuredly destined to render services in substituting perfect mechanical work for labor that is laborious when done by hand. If we are to believe the documents communicated to us by the manufacturers, the operator, having to exert a stress of but from nine to ten pounds upon the winch handles, can produce, through the combination of the gear wheels, a stress of from 440 to 450 pounds upon the toothed cylinder, designed to dig up and turn over the earth.

The principle of the invention consists in the use, for the digging and weeding of the ground, of a cylinder armed with steel teeth, to which is communicated a rotary motion for the purpose of causing the curved teeth to penetrate the earth. Upon operating the machine, the earth caught between the teeth is lifted and turned over in a continuous manner. The machine, while operating, causes the carriage that supports it to move forward. The frame of this carriage is provided with a series of knives that pass between the teeth and cut and break the clods of earth at the moment that they are lifted.

Our figure gives so correct an idea of the device that it will not be necessary for us to give a long description of it. It will be seen that the apparatus consists of a central frame, carried by another frame on four wheels. The shaft, which is provided with large teeth or picks, constitutes the digging cylinder. A chain passing over the shaft engages at the top of the upright frame with a sprocket wheel that receives its motion from the winch handles. In order to regulate the tension of the chain, the sprocket wheel and gear wheels are mounted in a cap terminating at the upper part of the frame. The apparatus, as we have said, is supported by four wheels, two in front and two behind. The wheels are mounted at the extremity of levers jointed upon the axis of the digging tool. A special combination formed of connecting rods permits, through the winch handles, of raising or lowering the tool at will. This maneuver serves on the one hand to regulate the depth of the digging, and, on another, to entirely lift the tool above the ground in order to permit of the moving about of the apparatus.

There is a slightly smaller size of the mechanical digger than the one shown in our engraving. It is provided with two wheels only, but works in nearly the same manner as the first model. This cultivator may be advantageously employed for gardening and for the culture of all plants that are grown in rows, such as grapevines, beets, hops, tobacco, etc. The depth of the digging may be regulated at will. One man, with this machine, can perform the same work as five or six laborers using the mattock; besides, the work is much better done, since the earth is turned upside down and the clods are divided into small fragments through being cut by the steel knives mounted between each row of teeth.

The style herewith figured is capable of digging to a depth of from six to seven inches for a width of twenty-six inches. The smallest model digs to a depth of from four and one-half to five inches for a width of from eighteen to twenty inches. The weight of the machine renders it easy to handle. The large size weighs 308 pounds and the small one from 22 to 132 pounds. Let us add that the operator, while the machine is in action, preserves a vertical position, which is much more hygienic than is that of the present method of working.—*La Nature.*

AN IMPROVED CULTIVATOR.

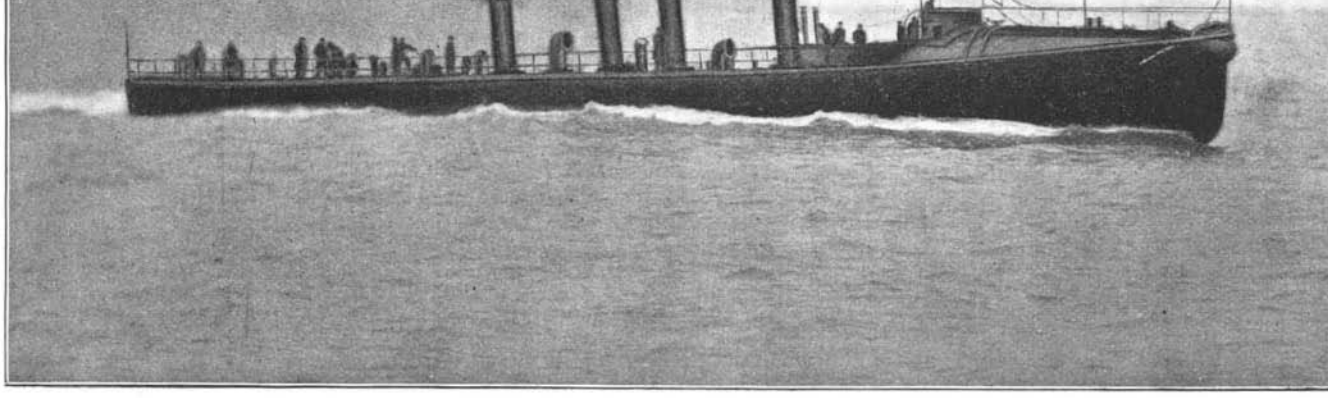
SANTA FE, N. M., was founded in 1605, and is 7,000 feet above the sea.

Long Distance Transmission of Steam.

At a recent meeting of the American Society of Mechanical Engineers, Eckley B. Coxe described a method he had used in carrying steam a long distance. At a colliery they wished to carry steam to a water works about 4,500 feet over a hill from the boiler plant. A trough was made by nailing the edges of two boards together, so that they formed a right angle. The trough was supported by two stakes driven in the ground and crossing just beneath the trough. The pipe was laid in the trough resting on cast iron plates, the pipe surrounded by mineral wool and a similar inverted trough placed over the top. To allow expansions, a bend was made to one side at the top of the hill, and then it was turned back to its original direction. A large receiver was introduced in the pipe at the pumps. This was made of three sheets of an old boiler, and was 24 inches in diameter. This also served as a separator. As the elevation was 1,800 feet above the sea, the cold was excessive in the winter time, but this arrangement has been in use since 1877, has cost nothing for maintenance, and has given no tronble. Mr. Coxe believed that the secret in carrying steam long distances to an engine without causing a drop in the steam pressure was in the use of a receiver or reservoir.

THE TORPEDO BOAT DESTROYER HORNET.

We have in previous numbers given particulars of the two new sister torpedo boats Havock and Hornet, lately added to the British navy. Both are remarkable for speed. The Hornet has attained 28.33 knots or 32½ miles per hour, which is a little in excess of the speed of the new torpedo boat built in Germany for the Brazilian government, of which an illustration is given in our this week's SUPPLEMENT.



THE BRITISH TORPEDO BOAT DESTROYER HORNET.

The Hornet is 180 feet long and 18 feet 6 inches wide, and is of the usual torpedo boat construction in general appearance. The Hornet has eight boilers. The hull is divided into thirteen compartments by watertight bulkheads, 76 feet amidships being devoted to machinery space, and 30 feet abaft this to the wardroom and cabin, where the officers are berthed, while the crew is accommodated forward, the space under the turtle-back affording a commodious forepeak. The full complement is forty-two, officers and crew. These boats differ from the torpedo boats proper in having at the ends watertight flats, which give the security of a double bottom. The bunker capacity is sixty tons, which gives a radius of action, on fuel carried, of 4,000 miles at ten knots; so that the vessels may be considered "ocean-going" in the widest sense, as they would never be likely to be required to go out of steaming distance of a British coaling port in time of war. The armament consists of one 12-pounder and two 6-pounder guns, one pair of swivel torpedo tubes on deck, and a built-in torpedo tube in the bow. These dischargers are for 18 inch torpedoes. On her trial the mean draught of the hull of the Hornet was 5 feet, but if the propeller be included, the draught would be 7 feet 6 inches, as the blades project below the bottom. The displacement would be about 220 tons at this draught.

The torpedo boat destroyers are all twin-screw, and the engines in the Hornet are of the ordinary tri-compound torpedo boat type, designed by Messrs. Yarrow. The cylinders are 18 inches, 26 inches, and 39½ inches in diameter, the stroke being 18 inches. There is a separate cylindrical condenser to each engine. The usual air-compressing, distilling, electric light, and other auxiliary machinery is carried. There are a 24 foot whale boat and two 20 foot Berthon boats. The safety valves on the boilers are arranged to lift at a pressure of 180 lb. to the square inch.

The boilers are the most interesting feature in this boat. The heating surface in each boiler is 1,027 square feet, and the bar surface 20·6 square feet, the bars being 6 feet 6 inches long. The weight of each boiler with water and all fittings is 5 tons 7 hundredweight, and it has been found on test that a single one of the Hornet's boilers will evaporate 12,500 pounds of water per hour. The boilers are arranged in two groups of four, and are placed in two separate stokeholds.

Seventy Miles an Hour.

The special train bearing the Vanderbilt inspection party on the Lake Shore recently made some fast time between Cleveland and Buffalo. The run from Cleveland to Erie, a distance of 95½ miles, was made in 95 minutes, including a four minute stop at Ashtabula for water, making the total running time for the 95 miles 91 minutes. From Collinwood yards an 88 mile run was made in 82 minutes, including another four minute stop. From Collinwood to Saybrook, a distance of 42 miles, was made in 36 minutes, or at a rate of 70 miles hour. The run from Kingsville to Dock Junction, 33 miles, was made in 28 minutes, or a rate of 70·7 miles an hour, the fastest time ever made on this division of the road. The locomotive pulling the train was No. 188, one of the Brooks Locomotive Works 10-wheel passenger engines. This run would seem to disprove the statement made by some railway experts that only an 8-wheel type of locomotive was adapted for high speed.

Lehigh Valley engine 655, lately rebuilt, was tried between Buffalo and Batavia, N. Y., on May 7, and ran a mile in the face of a strong wind at the rate of 82¼ miles per hour. It is expected this engine will be able to average 70 miles an hour drawing a heavy passenger train.

CHLORINE water decomposes so readily that if found at all in the stores it is generally of poor quality. Sealed glass tubes containing five grammes of liquid chlorine are now to be had in commerce. With one of these it is possible to extemporaneously prepare one kilo. of chlorine water.

The High-Speed Brake Trials.

The trials of the Westinghouse high-speed brake on the Pennsylvania Railroad, April 10 and 11, were a disappointment, the wheels being slid by the great pressure, and the stops being longer than those made with the ordinary quick-acting brake. The rails were in bad condition, however, and this undoubtedly contributed to the result.

The trials were conducted by officials of the Pennsylvania Railroad in the presence of representatives of the brake company and various railroad companies. The place selected was on the Philadelphia division, and the plan was to run two trains on parallel tracks at the same speed and apply the brakes at the same moment. One train was fitted with the high-speed brake, having a foundation brake which gave a leverage of 180 per cent with an emergency application and the regular air pressure. The pressure in the cylinder was decreased approximately with the speed by a pressure release valve, until the brake power was reduced to the regular amount, viz., 90 per cent of the weight on the wheels. The other train was fitted with the regular quick-acting brake, giving a brake power of 90 per cent of the weight. The result of three simultaneous runs was that in each case the high-speed brake slid the wheels and did not stop in as short a distance as the ordinary quick-acting brake; at forty-four miles per hour the stops were 712 feet and 800 respectively; at fifty-seven and one-half miles they were 1,593 feet and 1,636 feet; at fifty-nine miles, 1,323 feet and 1,454 feet. The track was a down grade of about 27 feet per mile.

After these trials two runs were made with the train fitted with the quick-acting brake, using also the pressure release valve and employing 100 pounds air pressure. The pressures rose to 80 pounds in the cylinder and at fifty-seven and one-half miles the stop was made in 1,155 feet and at sixty-two miles in 1,325 feet. By comparing this with the record of the same trains using ordinary pressures and without the pressure release valve, it will be seen that much better stops were made.

It may be argued that the condition of the rails was against the high-speed brakes, but probably a powerful brake is never required more than when a high-speed train is trying to make its schedule time in bad weather. At first sight the conclusion seems inevitable that with this brake too great a leverage has been employed. But we have heard no one speculate upon the results if the stops had been made at seventy-five or eighty miles per hour. We doubt if the wheels would have slid. And those are the speeds at which we understood this brake was to have been most serviceable. Certainly we are waking up to the requirements of the case at a very late date, if we must have a new form of brake for stops at forty-five, fifty or fifty-five miles per hour.

But granting that the brake would have met expectations at really high speed, is it not going to be a source of danger and expense if improperly applied at speeds under forty-five miles per hour? The one hundred pound pressure quick-acting brake, on the other hand, has already done good service on the Empire State Express, and is a great step in advance of the present practice for high-speed trains. We are informed that the Pennsylvania Railroad will use it on its fast trains.—*Railway Engineering.*

Phenomena of the Upper Air.

At a recent meeting of the Royal Meteorological Society at the Institution of Civil Engineers, London, Mr. Richard Inwards, F.R.A.S., the president, delivered an address on "Some Phenomena of the Upper Air." He said that there are three principal ways in which the higher atmosphere may be studied: (1) By living in it on some of the great mountain chains which pierce many miles into the air in various parts of the globe; (2) by ascending into it by means of balloons; and (3) by the study of the upper currents as shown to our sight by the movements of the clouds.

After describing the effects of rarefied air on animal life and natural phenomena, Mr. Inwards proceeded to give an account of various balloon ascents which had been undertaken with the object of making meteorological observations.

In 1850 Messrs. Barral and Bixio, when they had ascended to 20,000 feet, found the temperature had sunk to 15° Fah., but this was in a cloud, and on emerging from this 3,000 feet higher, the temperature fell as low as minus 38°, or 70° below freezing point. In 1862 Mr. Glaisher and Mr. Coxwell made their famous ascent, when they reached an altitude of about seven miles from the earth. A short time ago a balloon, without an aeronaut, but having a set of self-recording instruments attached, was sent up in France, and from the records obtained it is shown that a height of about ten miles was attained, and that the temperature fell to minus 104° Fah.

Clouds are simply a form of water made visible by the cooling of the air, which previously held the water in the form of invisible vapor. Every cloud may be regarded as the top of an invisible warm column or current thrusting its way into a colder body of air. After referring to the various classifications and nomenclatures of clouds, of which that proposed by Luke Howard in 1803 is still in general use, Mr. Inwards said that whatever system of naming and classifying clouds be adopted, it should depend on the heights of the various clouds in the air, and he gave a few rough rules by which the comparative altitudes of the clouds may be judged when there is no time or opportunity to make exact measurements. Among the indications by which a cloud's height in the air may be gathered are its form and outline, its shade or shadow, its apparent size and movement, its perspective effect, and the length of time it remains directly illuminated after sunset. By the last method some clouds have been estimated to have been at least ten miles above the surface of the earth. The cloud velocities at high altitudes have been carefully noted at the Blue Hill Observatory, Mass., U. S. A., and show, practically, that at about five miles height the movement is three times as fast in summer and six times in winter as compared with the currents on the earth's surface.

Cable Tramway Signaling System.

In cable tramway work in America, where, as a rule, says the *Railway World*, a speed considerably greater than would be permitted in England is usual, the absence of some method of instantaneous communication with the engine room has been not infrequently the cause of serious accidents. While the gripman of a cable car has ordinarily complete control of its movements, there is just the possibility of the gripper becoming entangled with the cable in case of a partial fracture of the latter, so that the gripman may find it impossible to drop the cable. In this case the car continues its course with a speed equal to that of the cable until the accident has been notified to the power stations, and the cable has been stopped by shutting off steam from the engines. Meanwhile, the danger to pedestrians and general traffic is imminent, as the conductor is powerless to check the speed of the car. Instances of this occurred soon after the opening of the new cable line on Broadway, New York, before the gripmen had become accustomed to the management of the cable, and on one or two occasions a runaway car did serious damage before the cable could be stopped. As a consequence, the system was subjected to much unmerited abuse, which, now that the gripmen have acquired experience and accidents no longer happen, has turned to commendation. But the misfortunes of the Broadway line have resulted in the invention of an electric signaling system, embodying some novel features, which apparently precludes the possibility of any danger from a stranded cable, even in the case of the most unskilled gripman.

The system is now in working order on the Third Avenue Cable Railroad, of New York. This line extends from the Post Office to 130th Street, and is worked by two power stations; one located at Bayard Street and the other at 65th Street. From the former the cable extends south to the Post Office and north to Sixth Street, about a mile in each direction; from the latter are driven two cables—one to Sixth Street, a distance of 2¾ miles, and the other to 130th Street, a distance of 3¼ miles. Throughout all these lines has been installed the new signaling system, of which Mr. Fred Pearce, of New York, is the inventor and manufacturer.

With this apparatus it is possible to signal either power station from any point of the road. There is practically but one warning that a car conductor requires to send; that is, "Stop the cable." This would occur only when he was unable to detach the gripper; in every other case he can drop the cable and stop his car without the necessity of communicating with the power station. But the new system provides for an indefinite number of signals, and in addition secures communication with any one of the five stations.

Placed between the tracks, at regular distances from each other, are manholes, each containing a so-called "automatic," from which lead the wires of cables to the power house and telephonic stations. Plug switches are provided, where the wires of the telephone can be attached when it is necessary to talk from any manhole to any other manhole, or to any of the stations.

Each signal sent consists of a certain number of strokes on a gong, each having an arbitrary meaning. One stroke means "stop the cable;" two strokes, "go easy;" three strokes, "go ahead;" four strokes, "fire." In the engine room of each power house are two gongs, a large one and a small one, and on these gongs the signals are sounded. Two gongs are used in order to distinguish between the different portions of the road. When the larger gong rings it means that one of the 65th Street cables must be stopped instantly, and the engineer at the Bayard Street house knows that the difficulty is not with his line. At the same time an annunciator is dropped at the signal box in the 65th Street house to indicate whether the "up" or "down" cable from that house is in trouble. When the smaller gong rings the Bayard cable is stopped, and the 65th Street house ignores the signal. So far, this only provides for the stopping of either cable, and is done, presumably, by either the gripman or conductor of a car.

When the conductor raises the cover of the manhole he lifts the automatic by means of its handle. This strikes one in each power house, on either the large or small gong, according to the location of the automatic sending the signal. This is all he is expected to do, except to replace the cover, which he cannot do without first depressing the handle of the automatic. Raising the automatic to send the first signal, "winds up," so to speak, the mechanism of the automatic, so that it is prepared to send its own number automatically when the tripping occurs.

Every signal sent is printed upon a tape, and the time of its receipt is also recorded.

When a signal is received the wrecking wagon from the nearest station is sent to the automatic from which the signal was sent. This carries a telephone, by means of which conversation can be carried on with either telephone station or either power house. After the trouble has been remedied, the automatic is again brought into use to signal the engineroom. The automatic is raised once for each time it is desired to strike the gong.

From the foregoing it will be seen that the cable can be quickly stopped by any employe of the company, the engineers considering the notice to stop as imperative.

The fact that the automatics are operated by the breaking of a closed circuit is a point of the greatest value. As is well known, it means that upon the breaking of the circuit at any point, and from any cause, the signal is instantly transmitted to each station. If this signal is not followed within a reasonable time by the number of an automatic, the conclusion is reached that the circuit is broken, and repair to the line is needed.

Lifting a Locomotive under Difficulties.

The *Portland Transcript* gives the following account of the raising of a Canadian Pacific mogul engine that ran off an embankment into Harvey Lake on the night of January 13. The work was carried on under great difficulties, with the thermometer often being 30° below zero, and a snow blowing over the lake at times more than 50 miles an hour, causing a suspension of the work for days at a time. In preparing to raise the locomotive, weighing 60 tons, sixteen holes, 3¼ inches diameter and 20 inches deep, were drilled in the solid rock and as many steel posts were planted and set in lead. These were for fastening guy lines and purchases, and the men who drilled and set the posts were kept from freezing by the aid of fires kindled upon the snow. A number of ingenious fastenings for purchase blocks were made very near the track by sinking heavy oak timbers in trenches at the ends of the ties that were tamped with gravel and wet, which after twenty-four hours were frozen so solid that they were quite as strong as the iron fastenings upon the bluff. Very heavy shear poles, 30 feet in length, were built and erected to overhang the embankment, and were provided with two sets of very heavy ship blocks and falls for lifting, and two of equal strength were placed in position for pulling from the bluff. As no diver was employed, everything was done from the surface, and every precaution was taken to prevent delay to trains. By the aid of a swinging mirror attached to a long pole, with light thrown upon it in the night by a dark lantern, successful fastenings were made to the engine 15 feet under water with heavy grappling hooks. The driving wheels were badly entangled in bowlders, rendering it next to impossible to move the monster. With three locomotives working upon independent purchases, and aided by the buoyancy help of the water, it was finally drawn to the surface. At one time, while attempting to raise the engine and tender, it was found that the locomotives were exerting a force of 240 tons.

How to Give a Fomentation.

Only those who have not tried the remedial effects of water, both hot and cold, doubt its efficacy in many forms of disease. It is perfectly safe to apply a fomentation in case of severe pain before a physician is summoned, and very often it relieves the sufferer before he arrives. This is the way to do it: Take half a dozen thicknesses of flannel large enough to more than cover the seat of the pain, fasten them together, for convenience in handling, wring them out of very hot water (use a clothes wringer to save the hands) and apply as hot as the patient can bear it. A dry flannel may be put between the skin and the wet cloth, if preferred, and over all a large flannel should be placed to keep the heat in. When the cloth begins to feel cold, it should be wrung again. Three or four applications will generally relieve a stiff neck or an attack of rheumatism in a joint.

A fomentation may be needed when there is no hot water in the house. It may be quickly prepared by wringing out the flannel compress in cold water, laying it between the folds of newspaper and putting it on a hot stove or holding it around a stove pipe until hot. The paper protects the cloth, and when steam begins to come out can be easily removed.