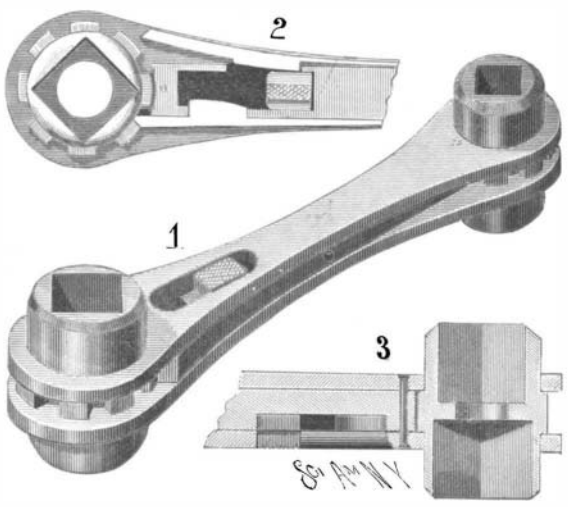
A NEW RATCHET-WRENCH.

Our illustrations picture a new ratchet-wrench invented by Joseph M. Nesley, of Grant, Mont. Fig. 1 is a perspective view, Fig. 2 a partial plan view, and Fig. 3 a partial longitudinal sectional elevation of the tool.

The wrench consists essentially of a lever-body to the top and bottom of which plates are riveted. The plates overhang the sides and ends of the wrench. The overhanging ends are perforated to receive a ratchet-wheel provided with two nut-receiving openings.



THE NESLEY RATCHET-WRENCH.

The teeth of each ratchet-wheel are adapted to be engaged by spring-pawls held between the overhanging side edges of the top and bottom plates previously referred to.

In order that the one or the other spring-pawl may be thrown into engagement with a ratchet-wheel, cams are formed near the ends of the spring-pawls. These cams lie, not directly opposite each other, but are located one somewhat in advance of the other, so that they may be alternately acted upon by blocks sliding in slots formed in the faces of the top and bottom plates. By moving the blocks back and forth, the spring-pawls are in turn thrown in and out of engagement with the ratchet-wheels. The tool can therefore be used as a right or left hand wrench without removal from a nut or bolt head. The construction of the wrench-body with a central lever-bar and top and bottom plates, which overhang to furnish a bearing for a socketed ratchet-wheel at each end, is cheap and compact.

POWER SCRAPERS ON THE ST. LAWRENCE POWER COMPANY'S CANAL.

Where the nature of the ground permitted it, extensive use was made, in the excavation of the St. Lawrence Power Company's canal, of the powerful steam-driven Vivian scraper. The character of the work done by these scrapers is very clearly shown in the accompanying illustration. The plant is composed of a tower and an anchor, which were placed on opposite sides of the canal. The anchor, which in the illustration is in the immediate foreground, carries a sheave, through which passes an endless cable. The tower carries the engine and boiler, and is placed far enough back from the cutting to allow of the formation of a spoil bank for the excavated material. Both the tower and the tail anchor are placed on trucks, which run upon parallel tracks on either side of the canal excavation, this arrangement being adapted to facilitate a change of position for the purpose of making a new cut. An endless cable is attached to the back of an unusually large scraper, which is 8 feet in length, 2 feet in depth, and has a cutting edge of 7 feet. Attached to the forward lower part of the scraper is a drag rope. The scraper is formed with a curved bottom to facilitate its tipping when it is full of material, and by keeping the cutting edge clear of the ground, to allow it to be easily dragged along the ground toward the spoil bank.

In operating this machine, the endless rope is wound in toward the tower, thus bringing the scraper to the commencement of the cut. The scraper is then raised to an angle of about 45°, and standing at this angle, and being pulled at the same time by the drag rope, it is forced into the ground and loads itself as it is drawn by the drag cable toward the tower. When it has been pulled onto the spoil bank, the drag rope is thrown out of gear and the endless rope is thrown in. This dumps the load. The endless rope is then reversed, and the scraper is drawn back to the anchorage for a fresh cut. The only labor required to operate one of these machines is that of an engineer, a fireman and two signal-men. The scraper has a capacity of from 3 to 4 cubic yards, and in favorable material it has made cuttings 26 feet in depth. The total yardage moved by this means at the canal in the year 1898 was 123,350 cubic yards, and in 1899 the total amount for the year rose to 207,500 yards. We are indebted for the illustration and particulars to Mr. John Bogart, the chief engineer of the company.

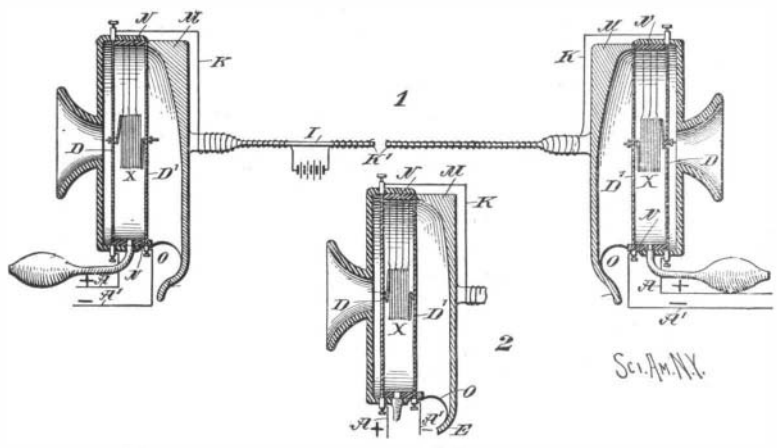
POWER SCRAPER AT WORK ON THE MESSINA CANAL.

THE PLECHER ELECTRO-PNEUMATIC TELEPHONE.

A new telephone transmitter and receiver has been devised by Mr. Andrew Plecher, of Stanford University, Cal., the peculiar construction of which is shown in the accompanying diagrams. Of these diagrams, Fig. 1 is a view of two combined transmitters and receivers; Fig. 2 is a slightly modified form.

The transmitter and receiver consists of an iron box, *M*, connected by a heavy iron wire, *I*, with a similar iron box, *M*. In each iron box are two thin diaphragms, *D* and *D'*, insulated from each other by a non-conducting marginal ring, *N*, forming an air-tight joint with the diaphragms. Behind the diaphragms in the box, *M*, is a chamber having an opening, *O*, for the admission and discharge of sound waves. In the hermetically-sealed chamber thus constituted a coil, *X*, of fine iron wire is suspended, so wound that the individual turns nearly touch one another. One end of the coil is connected with one diaphragm, *D*, and the other end with the second diaphragm, *D'*. When an electric current passes through the coil, the turns will touch, since the coil becomes magnetic. The vibrations of the diaphragms will separate or bring into contact the turns of the coil, whereby resistance is thrown into or out of the circuit, thereby causing a corresponding fluctuation of the current. For the magnetic action of the current causes the turns of the coils to be attracted. Then when the vibrating diaphragms move outwardly this lateral contact is broken, and the resistance of the whole coil will be thrown in by compelling the current to traverse the coil lengthwise instead of leaping from turn to turn. The air-vibrations propagated by the voice act on the front face of the diaphragm, *D*, through the mouthpiece and on the rear face of the diaphragm, *D'*, through the opening, *O*, whereby the two diaphragms are caused to vibrate in opposite directions. The effect on the resistance varying coil, *X*, is therefore augmented. The fluctuations are transmitted through a circuit composed of a fine wire, *K*, connected with the diaphragm, *D*, and wound around the central stem of the box and the heavy wire, *I*, thereby converting the box and the wire, *I*, into a magnet. The wire, *K*, is connected with one pole of a battery. From the other pole of the battery a similar wire, *K'*, passes around the wire, *I*, and is connected as shown with the diaphragm, *D*. In order to cause the hermetically sealed chamber between the diaphragms to be expanded or collapsed, to regulate at will the amplitude of movements of the turns of the coil, *X*, a bulb is employed to place the air under regulable tension.

In Fig. 2 the ends of the coil have carbon buttons mounted on metal disks. The coil is sustained only by threads. The carbon buttons are arranged to bear with an elastic pressure against the diaphragm-plates, *D D'*.



AN IMPROVED TELEPHONE.

London's New Electric Railway.

The Baker Street and Waterloo Railway, the third electric railroad in London to be propelled by electric traction, is rapidly approaching completion, and one section will shortly be opened to the public. The total length of the line is a little over five miles, and extends from the Elephant and Castle Circus on the south side of the river to Paddington Station, the terminus of the Great Western Railway, in the west end of the metropolis. The route passes under the busy thoroughfares of Northumberland Avenue, Charing Cross, Regent Street, and Edgware Road, and is a connecting link between four of the great trunk railroads of the country, and also the new Central Electric Railway of London and the underground District Railway.

The system of construction is similar to that adopted in the Central London Railway, consisting of two parallel tunnels, throughout its entire length, bored upon the Greathead system. The engineers are Sir Benjamin Baker, K.C.B., Mr. W. R. Galbraith, C.E., and Mr. R. F. Church, C.E. As the railroad passes under the River Thames, advantage was taken of the opportunity of sinking two temporary shafts from a timber staging in the river, since by this means it has been possible to extend the work of boring simultaneously north and south, and to convey the ballast excavated to the top of the shaft and to discharge it direct into the barges, without necessitating any intermediate cartage. Work was also able to be continued incessantly without inconveniencing the traffic in any way, since the shafts have been sunk on one side of the river, so as not to obstruct the river channel in any way. The engineers have successfully driven the tunnel throughout the water-bearing gravel of the bed of the Thames, without the slightest hitch.

The electrical generating station, and depot for the accommodation of the rolling stock, etc., is located about a quarter of a mile distant from Waterloo Station on the southern side of the river. It is anticipated that the trains will complete the whole journey from the Elephant and Castle Station to Baker Street in twenty-five minutes, the speed of the trains being about 13 miles an hour. A three minutes service will be inaugurated, so that rapid transit may be assured. The railway will be exempt from competition, since at the present time the only means of traveling across Central London in this direction is by omnibus, the journey by which occupies about one hour and a quarter. Then, again, the railroad will serve four of the busiest traffic centers of the metropolis. According to the statistics published by the London County Council, the Elephant and Castle is the second largest point of concentration of passenger traffic in London, followed respectively by Charing Cross, Piccadilly Circus, and Oxford Circus. It also taps one of the most thickly populated artisan districts in London, so that the revenue derived from this source alone will be considerable.

The total cost of the scheme will be about $15,480,000. It is estimated that the total gross receipts will amount to $1.350,000 per annum, and that the yearly working expenses, allowing the running of 300 trains daily for six days in the week, and 150 trains on Sundays, will aggregate $500,000. In view, however, of the rapidly increasing suburban traffic of London, and the marvelous extension of the metropolis, there seems every probability, as in the case of the Central London railroad, that the service will be inadequate. In this event the service will be rendered quicker, and longer trains will be run, since the station platforms are of sufficient dimensions to accommodate trains of nine carriages.