the searchlight. Another interesting detail is that if the burner is changed, it may, after it has been put in place, be turned in such a way that the plane of the light will be parallel with the lens. For this purpose it is furnished with a holder analogous to that employed on a jointed gas fixture. Anyone who has set up a butterfly burner and discovered after having sealed it, that the slot was not set right, will appreciate the special importance of this point.

The Ducellier searchlight (Fig. 4) makes use of any carbide. The generator is integral with the lamp, and the carbide basket is the only part made removable, in order that it may be charged and cleansed.

The details of the lantern may be seen in the two diagrams on the left. The upper of these gives a general view of the system and the lower an outline of the different tubes. The carbide basket, *B*, has a vertical tube perforated with holes, passing through its center and arranged so that the attack on the carbide shall take place from below. A capillary tube, *E*, feeds the water drop by drop from the reservoir, *K*, whence it is conveyed by the tube, *A*, which ends in the chamber, *J*. The reservoir is filled with water through the hole, *M*, which is closed by a cap. After the operator has first closed the plug, *N*, and the cock, *R*, of the burner, the chamber, *J*, fills with air which cannot escape. The air closes the orifice of tube, *A*, and the water cannot flow upon the carbide.

It is only when the cock, *R*, is again opened that the air can escape by passing through the tube, *A*, and the tube, *Z*, which leads to the burner. The water may then pass through *A* and *E*, and the gas generated escapes through the same tube, *Z*, after having passed through the purifier made of horse-hair and carbide. When, in order to extinguish the light, the cock, *R*, is closed, the gas passes through the bent tube, *V*, and the tube, *A*, and forces the water back into the chamber, *J*. As the water then ceases to trickle down on the carbide, the production of gas soon ceases. In case of over-production the gas passes from the chamber, *J*, through the water of the reservoir, *K*, and collects in its upper part whence its escape is provided for by the tube, *D*. A second generator composed of horse-hair and carbide is placed under the burner.

For small vehicles M. Ducellier manufactures the lanterns separate, and arranges them to be connected to a separate generator.

One of the Electrograph Machines, Showing Morse Key.

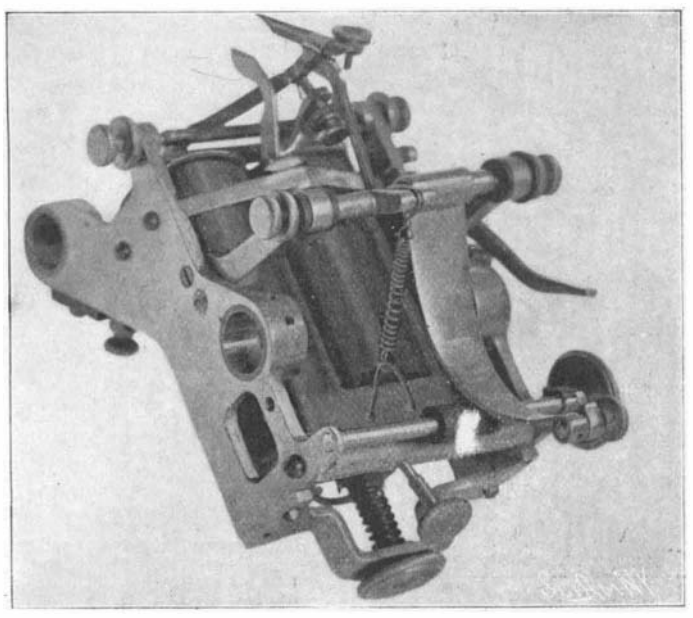
In thus summarily reviewing these different models of searchlights we do not pretend to have exhausted the subject, but have only wished to inform our readers as to the application of acetylene to automobile locomotion by taking as a type the systems which have been called to our attention, as being in actual use.—Translated for the SCIENTIFIC AMERICAN from La Nature.

THE IMPROVED ELECTROGRAPH —A FAC-SIMILE TELEGRAPH.

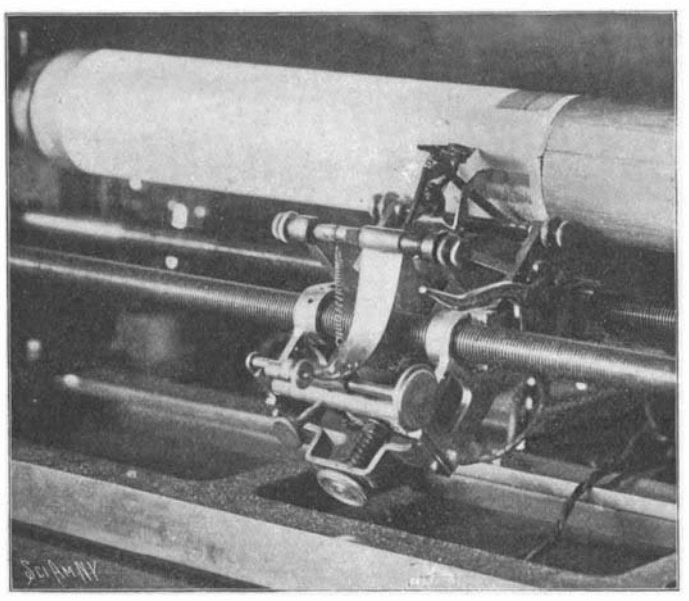
In the SCIENTIFIC AMERICAN for June 15, 1901, there appeared an illustrated description of an instrument which marked a decided advance in facsimile telegraphs. As it was there pointed out, this instrument, called by its inventors the electrograph, did not employ a chemically-printed paper or tissue to receive the pictorial message, but reproduced the picture transmitted, on ordinary paper with an ordinary pen. During the past year the inventors, Herbert R. Palmer and Thomas Mills, have so far improved and so greatly simplified their machine that another description may not be without interest. Through the courtesy of Mr. H. C. Bunting, the electrician in charge of the new machines, we are enabled to give an account of the improvements that have been made. While the new machine does not differ in principle from the old, the device has been changed in design with the result that difficulties met with have been overcome.

The principle of the electrograph's operation, as in all other electrical devices for the transmission of signals over great distances, is to be found in the making and breaking of an electrical circuit at predetermined intervals.

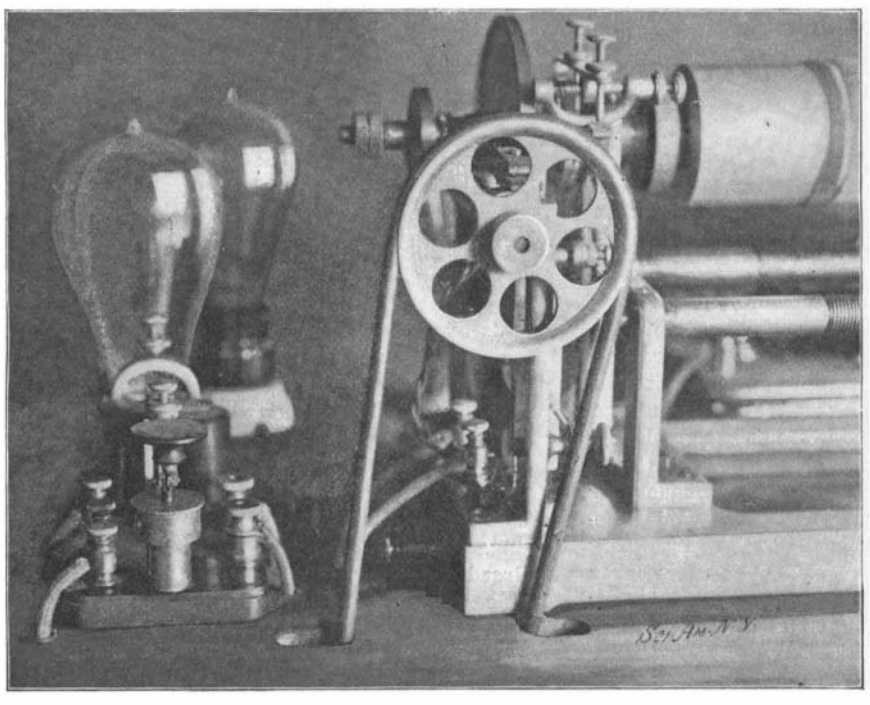
The transmitting and receiving machines are exactly similar in construction. The driving power is obtained from a 1-6 horse power electric motor supplied by a 20-volt storage battery and controlled by suitable switches and resistances. The motor is belted to a worm gear connected with a friction clutch, which ro-



The Carriage, with the Pen Thrown into Operative Position.



The Carriage, Lead-Screws, and Paper-Wrapped Receiving Cylinder.



Automatic Switch (to the Left); Driving-Gear; and Rocker-Arm Switch.

An Electrogram—Portrait of President McKinley. (Reduced.)

Cylinder Bearing McKinley's Portrait.

THE IMPROVED ELECTROGRAPH—A FACSIMILE TELEGRAPH.

tates a shaft carrying the synchronizing and regulating devices, and an aluminium cylinder 24 inches long by about 2 inches in diameter.

The motor also drives the gears operating the double-lead screws which control a carriage upon which are mounted a transmitting stylus, recording coils, and a pen. By using storage batteries for furnishing power to the motors, one of the most exasperating faults encountered in the old machines, the fault of speed variation, has been remedied. The motors of the old machines having been arranged for direct connection with the power or lighting circuit, a sudden drop of potential due to the falling on or off of a heavy load, as that of a motor driving a printing press or other heavy machinery, would cause a wide variation in the speed, thereby rendering it a matter of no little difficulty to regulate the machines. The storage batteries now used are connected with the lighting or power circuit in such a manner as to continue charging while the machines are in operation. It therefore follows that an approximately constant speed is maintained at all times. Still other improvements to be found in the new machine are longer cylinders, by means of which greater scope has been attained. Furthermore, the addition of an extra lead-screw has given the carriage greater stability and has increased the accuracy of the line-spacing mechanism. In general, the construction has been reduced to a model of simplicity, in which new features of adjustment have been combined.

In order to transmit a picture, a transmitting cylindrical sheet of zinc is employed, which is merely an enlargement of a half-tone plate of the picture. Since the variations in the surface of the zinc sheet cylinder are considerably more pronounced than those of the small original, the transmission of lights and shades is facilitated. The interstices of the zinc plate are filled with a non-conducting material, so that the entire surface is perfectly smooth. Thus treated a zinc sheet presents a fairly smooth, partially metallic and partially insulated surface.

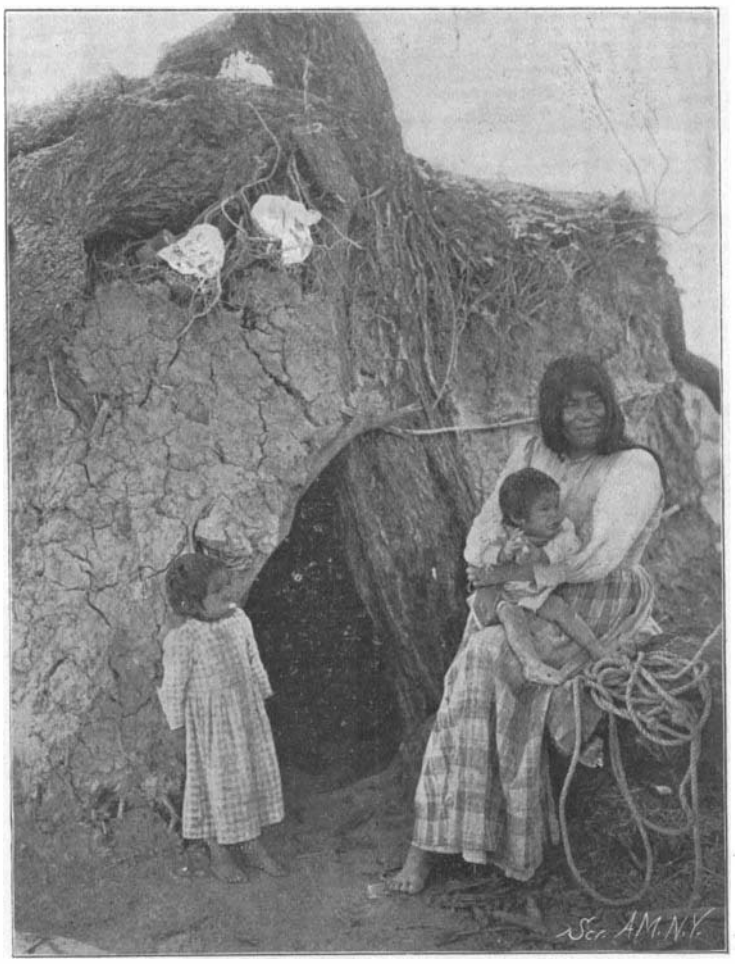
The filled zinc plate is curled around the cylinder of the transmitting machine. Upon the surface of the zinc plate glides a stylus, which is caused to travel along the rotating cylinder by means of a carriage, very much as the reproducing stylus of the phonograph is caused to travel along the sound record. Thus the stylus comes into contact with every portion of the transmitting cylinder, describing a continuous spiral as the cylinder rotates and the carriage travels. Upon a piece of ordinary paper wrapped upon the cylinder of the receiving instrument plays an inked pen, which is caused to travel along the cylinder. Since the same instrument can be used either in transmitting or receiving messages, the carriage is provided with both a stylus and a pen so mounted that either can be thrown into or out of operative position. The stylus, as the cylinder rotates, glides over a surface partially metallic, partially insulated. When in contact with the metal a circuit through the line and receiving instrument is completed, and a line or dot is traced by the pen of the reproducing instrument, corresponding in length with that traced by the transmitting stylus. When the stylus is in contact with an insulated portion of the zinc sheet, the circuit is broken, and the pen of the receiving instrument is withdrawn from the paper. Thus an electrogram, a facsimile of the original picture is made.

The pen of the receiving machine is actuated by electromagnetic coils, by the making and breaking of the circuit, so as to reproduce the dots of the half-tone plates. These coils are operated up to a very high speed without perceptible lag. The pen is lifted from the paper with a speed equal to that of its closing impulse. The description of the magnetic coils previously published applies to those used in the present machines, for which reason it is unnecessary to go into details.

In order to synchronize the two rotating cylinders so that the picture may be exactly reproduced, resistance coils are employed which can be cut in and out of the field of the motor. It is clearly necessary to synchronize the two rotating cylinders, in order that the picture may be clearly reproduced. For this purpose a special synchronizing device has been invented, which operates a rocker-arm serving the purpose of alternately cutting in and out the regulating and recording relays at the proper portion of the revolution.

About one-eighth of each revolution is used for regulating purposes; in other words, during that portion of the revolution the rocker arm, operated by a cam on the main shaft, cuts out the picture circuit and throws the regulating relay into operation. Whatever gain one machine may make over the other during the revolution is corrected at this time, the fast machine being held until the slower machine reaches a corresponding position, whereupon both are started together again. Ordinarily both machines are set to stop at the end of every revolution. Just as they enter the regulating portion of the revolution, the line is opened for a short space of time at both the transmitting and receiving ends. The first machine finishing the revolution closes the line through its own regulating relay; but as the line is opened at the other end no action results until the machine at that end also reaches the end of the revolution. The line is then closed and both machines start simultaneously on the next revolution, by the releasing of the "control" magnets.

One of the characteristic features of the new machines is an auxiliary device for automatically changing from the ordinary Morse instrument to the electrograph and *vice versa*. At one side of the machine is a lever arm attached to an ordinary telegraph sounder, which arm is controlled through the combined action of its magnets. A spring and a liquid dashpot automatically switch the main line. When the picture mechanism is in operation, the lever arm is held down and the picture circuit cut in; if, however, the line is opened and held open for from five to ten seconds, the arm is slowly raised. When the arm reaches the upper position the electrograph is cut out and the Morse instrument switched into circuit. In operation the machines are connected with a telegraph wire in the same manner as the regular Morse instruments without any change whatever.



AN INDIAN MUD AND ROOT HOUSE IN ARIZONA.

The picture is sent at the rate of one inch per minute of the cylinder length; that is, a picture or cut which occupies the whole length of the cylinder, 24 inches, will be transmitted in 24 minutes' time. The speed of transmission, of course, varies with the fineness of the mesh in the original picture. It has been estimated that the space occupied by a cut in a newspaper could be filled by an equivalent number of words telegraphed by an ordinary operator at a speed of 25 or 30 words per minute. Hence, the time required in transmitting a picture by means of the electrograph is exactly the same as that consumed in telegraphing a verbal message. About forty minutes are required to prepare the zinc plate for transmission, and about thirty minutes to prepare the electrogram for newspaper printing. On a 1,500-mile circuit only eighty minutes are required to prepare a zinc enlargement, transmit the picture, and reduce the electrogram for the press. That this can be practically attained has been proven by severe tests made over the Western Union, American Telephone and Telegraph Company, and the Associated Press wires. That the machine has probably considerable newspaper value is demonstrated by the fact that Mr. Arthur Leslie has undertaken its commercial introduction.

SOME CURIOUS HOMES.

The Indian question is arousing some interest in California on account of the dispossessing of the Indians who have so long lived on what is known as Warner's Ranch, in San Diego County. These people have been here for generations, and failing to understand that the property belongs to the white man, have made a protest; but despite this they will have to move on, the government proposing to purchase a large tract for them, where, doubtless, they will be allowed to remain in possession for all time.

Contemplating the Indians of the Southwest, one is impressed with the fact that here are a people corresponding almost exactly to the people of the so-called stone age. This was essentially true of the coast and island natives. Within comparatively a few centuries they were provided with weapons and implements of stone, wood and shell, having no metals of any kind. In some camps of the Southwest Indians to-day almost a similar condition of affairs is seen; the people preferring to grind their grain in a stone *metate*, with a stone pestle—one of the commonest objects found in graves and kitchen middens; but in modern times the temptation is too strong, and the average Indian will buy a cheap basket from a store, or a mill, or a wooden pestle, and a set of tin dishes, than undertake the arduous process of making these articles.

Many of the Indians, so far as their habitations go, represent a very low type of civilization. This is well illustrated in the accompanying photograph, which shows the home of a Pima Indian, which in construction compares with the dens, nests, or abodes of many animals. The maker selected a tree with spreading root and overhanging branch. Against this he piled a few logs or limbs, packed the interstices with brush and filled the holes with a coating of mud. The door, as seen, was made by leaning a small limb against the tree and packing mud against it. On the top, as a roof, brush of various kinds was thrown. This is "home" to a Pima family which appears to thrive; a house which, while not as low in the scale as those of the native Australians, differs from them only in rank in being permanent. The beautiful structures of the orioles, the elaborate house of the gardener bird, with its lawn and freshly-plucked flowers, the neatly-made nest of some of the stickle-backs or the nests of some insects, as mere dwellings for a greater or less time, show that some animals are far ahead of some human beings in mere constructive ability.

All Pima dwellings are not of this class. Some of the huts resemble huge bee hives, and are made as were the early coast native huts of four hundred years ago. Eight or ten poles are thrust into the ground, ten or fifteen feet apart, and jointed at the top, over which fine branches are placed, points down, until the entire hut is covered with a mass of vertical twigs. Around it, at various heights, are bands of wood, made of limbs, holding the pseudo shingles in place. The base is banked up with earth to keep out the water, a small opening or entrance, three feet in height, being left on one side; and in lieu of a door a gunny sack. Among the Pimas, who number on the Pima agency of Arizona forty-two hundred, some attempt is being made to better their physical and moral condition. Among the Papagos at San Xavier, two hundred and ten are Catholics. Presbyterian missionaries are working among them and the Maricopas, but they have succeeded in obtaining a church membership of only one hundred and seventy-four out of about twenty-five hundred. The Catholics support the fine old mission of San Xavier del Bac near Tucson, and one at Santa Cruz. The women, many of them, are excellent basket makers, and this art is being encouraged as a means of making the tribe self-supporting.

The Yuma Indians are almost equally destitute of anything that savors of improvement. Father Englehardt, in referring to them and the Mojaves about the Needles, says: "They are in a most deplorable condition as to morals and progress toward civilization. They live under sheds made of sticks in summer, and in sweathouses or artificial caves in winter. When one of their number dies, all his property, as ponies, etc., is burned along with the body. In addition, relatives sacrifice large amounts of property, buying silks and clothing to add to the splendor of the funeral pyre. This custom along with drunkenness and gambling absorbs all the Indians' earnings."

It is an interesting fact that at the present time the best railroad laborers in the vicinity of the Needles are Indians, and despite their peculiar methods of living, they are highly regarded as laborers by the railroad authorities; in fact, they are about the only people who can endure the terrific summer heat of this region. All the Indians in this vicinity have for years, in fact for centuries, received the earnest attention of the missionaries of the Catholics, and schools of various kinds are maintained by different denominations, but doubtless little can be accomplished, especially among those who live near the border or railroad towns.