STENO-TELEGRAPHY.

Steno-telegraphy is a system of transmission invented by M. G. A. Cassagnes, of Paris, and by its means it is possible to transmit a dispatch in short-hand along a single wire, and to print it at a distant station in stenographic characters with a rapidity exceeding that of any telegraphic apparatus now in use.

By the aid of this machine a practical operator can report at the rate of 200 words a minute, that is, faster than the most rapid orator can speak, 80 to 180 words a minute being the limits of speed for the most grave and the most impulsive. In a fortnight one can learn to read the printed characters, while it takes six months' practice to become a rapid operator.

The object of M. Cassagnes' invention is to cause the stenographic machine to produce this band at a distance—it may be of hundreds of miles—with the same rapidity as it does when the paper is in the machine itself. To this end the keyboard and the printing mechanism are connected by a telegraphic wire. Currents from the transmitter are collected by a moving rubber, which transmits them in succession to the line, and at the distant end they are received by a similar rubber, which distributes them in proper order to the corresponding magnets which work the dies. Thus each key is put in electrical connection with the corresponding die several times a second, and if it is depressed, a current is sent to operate the die.

Figs. 1 and 2 are diagrammatic illustrations of the steno-telegraphic system, and Figs. 3 and 4 perspective views. They represent respectively the transmitting and receiving apparatus. The keyboard at the transmitting station is composed of twenty keys, furnished with electrical contacts connected alternately to two positive and negative battery poles, P P^1, the middle of the battery being put to earth. These keys are in connection with the contact segments of the distributer, D. A rubber, F, keyed on the axis of the soft iron toothed wheel, A, is driven continuously, and in passing successively over the contacts it puts them in communication with the line. If it be understood that there exists at the receiving station (Fig. 2) a similar distributer, D^1, of which the rubber, F, turns in perfect synchronism with that of the transmitting station, and of which the segments in contact are in connection with the polarized relays, R^3, R^4, R^5, ... R^{20}, it will be seen that the currents emitted by the depression of the keys at the transmitting station will be received at the distant station in the bobbins of these polarized relays, which will act on their armatures, and will close the circuits of the local battery, P^1_3. The currents furnished by that battery will work the dies of the printing apparatus corresponding to the keys depressed by the operator.

When the stenographic signs corresponding to the keys touched have been printed on the band of paper in the receiver, that band receives a slight movement in advance, in order to permit of a new line of characters, and so on. There is thus obtained by a single wire the exact reproduction of the paper band already described. The printing mechanism (Figs. 1 and 2) comprises twenty dies carrying the stenographic signs corresponding to the twenty keys of the transmitter. Each of these dies can be pressed against the band of paper by the action of the armature of the corresponding electro-magnet. There are twenty of these magnets, the bobbins, *e e e*, of which are connected at one end to the terminal, V, and at the other end to the posts, v_1 v_2 v_3 v_4, of the relays.

Having described the principal features, we will now turn to the details. A stenographic line corresponds to the depression of a certain number of keys, twelve at the most. Suppose, for example, that the keys 3, 4, and 6 are depressed. At the moment when the rubber, F, arrives at the contact, 3, the corresponding rubber, F, is on 3^1, a current traverses the line and draws down the armature of the relay, R_3, upon the post, v_3, the battery, P^1_3, is connected to the electro-magnet, e_3, and the die, p_3, imprints its character upon the band of paper rolled upon G and passing under the dies. The next instant the rubber reaches the contacts, 4, 4^1, then 6, 6^1. The battery, P^1_3, is successively connected to e_4, e_6, and the dies, p_4, p_6, are drawn down, the band of paper remaining stationary. At the moment the line is complete, the relays are readjusted by aid of local currents.

When the last is replaced, no current traverses the circuit of the battery, P^1_3, the armature of the electro-magnet, M, which is in this circuit, is free, and the paper advances by an interval corresponding to a line. A second combination of keys is then depressed, and a fresh line printed, and so on. After each emission of current the line is put to earth by the movement of the rubbers.

In order that such results may be obtained by a single wire, it is imperative that the rubbers shall move with perfect synchronism, and to obtain this the phonic wheel of M. Paul la Cour, of Copenhagen, is employed. The phonic wheel consists of an electric tuning fork, the vibrations of which are maintained by the intermittent passage of a current from the contact battery, P, through the bobbins of the electro-magnet, H. These interruptions are produced by the vibrations of the fork itself, which close and break a contact at the extremity of one of its branches. The vibrations of the second branch are employed to send currents, also intermittent, from the battey, B, into the bobbins of the electro-magnet, E. In order to prevent sparks at the point of rupture of the circuits, two shunts of high resistance are arranged round those points. Opposite the poles of the electro-magnet, E, is a wheel, A, of soft iron, provided with teeth on its circumference, and having on its axis a wooden box filled with mercury and designed to act as a flywheel. Also upon the same axis is the rubber, F, which travels over the distributer, D.

If the wheel be rotated in the first instance by hand, it will continue to turn by reason of the successive attractions on the teeth by the poles of the electro-magnet, E. The wheel will assume a speed which will be determined by the number of vibrations of the forks and by the number of teeth in its circumference. This speed will be sensibly constant.

The receiving apparatus comprises a set of similar apparatus, and if the two wheels have the same number of teeth, and the tuning forks have been regulated to give approximately the same number of vibrations, the two speeds will be about the same. To render them absolutely identical, the sending distributer carries two special contact pieces connected, the one to the positive line battery and the other to the negative. At the corresponding point of the receiving distributer (Fig. 2) there is a single contact, which is in connection with the bobbins of the polarized relay, *r*. The wheels being set in movement and their speeds not being exactly equal, a moment will arrive when the rubber, F, will pass over one of the two correcting contacts at the sending station, just as the rubber, F^1, is on the correcting contact at the receiving end. At this instant there will flow into the relay, *r*, a current, positive or negative, according as F is on one or other of the correcting contacts. The current will make the tongue of the relay move to one side or the other, and will introduce into or cut out of the circuit of the battery, P^1_2, an adjustable resistance. It will thus send more or less current into the coils of the electro-magnet, H^1, and the tuning fork, B^1, will vibrate more slowly or more rapidly as the case may be, with the result of maintaining itself sensibly at the same speed as B. The two wheels will make the same number of revolutions, and the two rubbers, F and F^1, will be on corresponding contacts at the same time.

The steno-telegraph has been subjected to several series of experiments. In the first the transmitting and receiving instruments were placed side by side in a room at the Ministry of Telegraphs, and were connected by a telegraph wire making a considerable circuit. Each instrument had a separate earth contact. In the first experiment (October 28, 1885) an underground circuit of 28¾ kilometers was used. In the second the line ran from Paris to Orleans and back, 245 kilometers (152 miles); in the third it was the same; in the fourth,

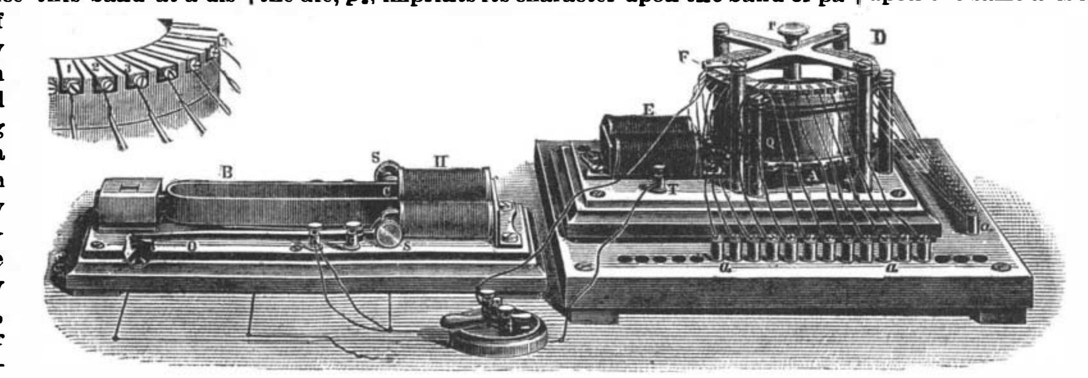
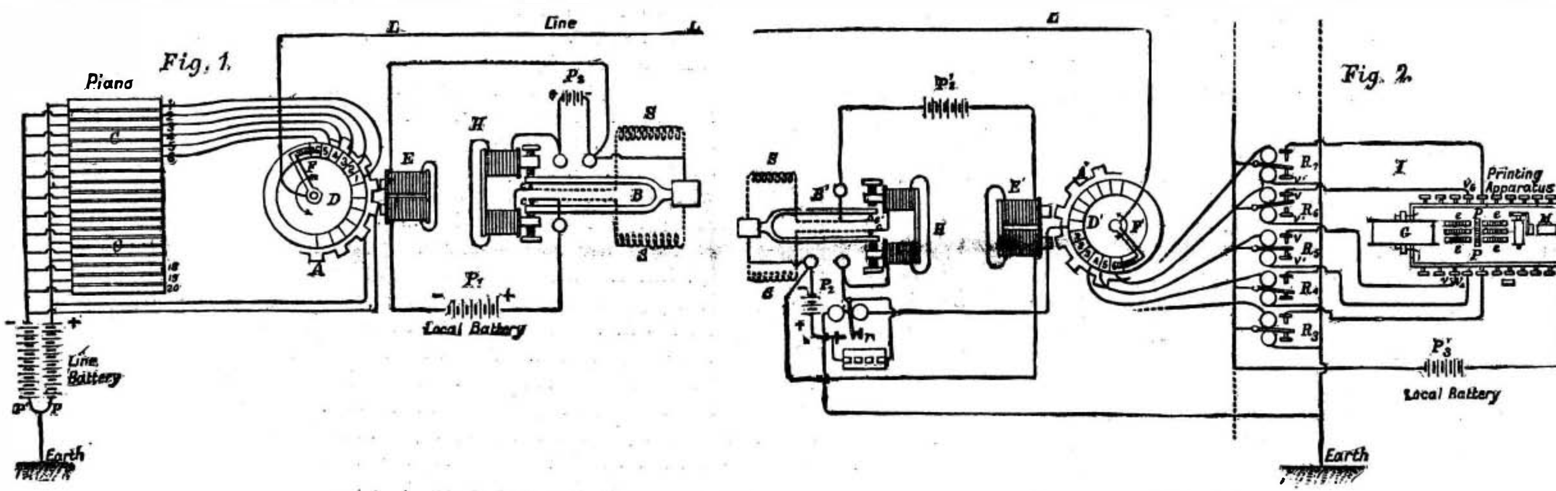


Fig. 3.—THE TRANSMITTER.



DIAGRAMS OF THE CASSAGNES SYSTEM OF TELEGRAPH TRANSMISSION.

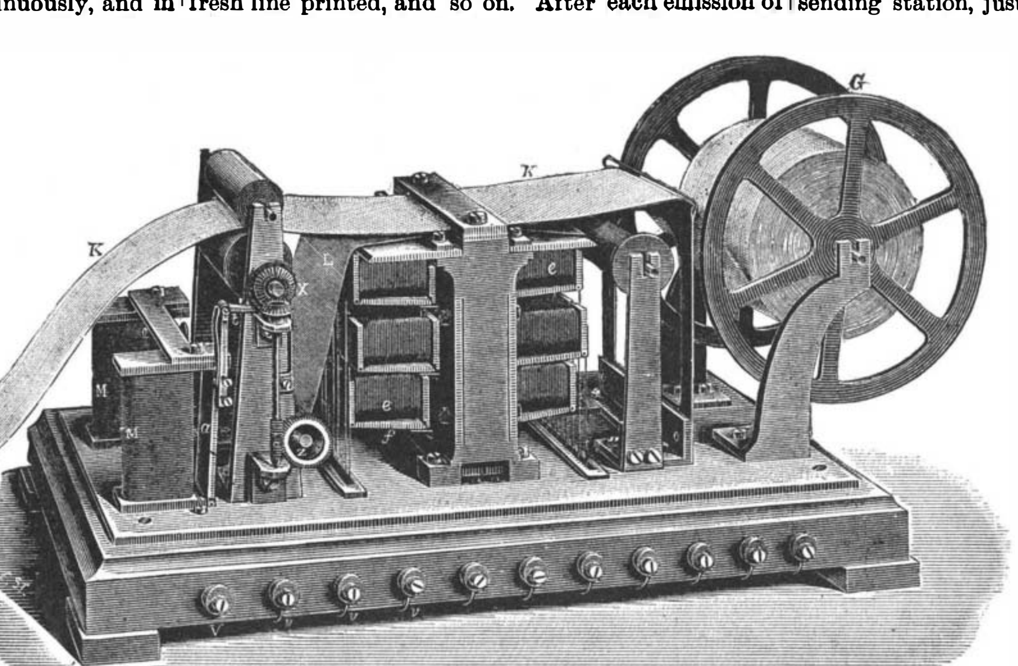


Fig. 4.—THE RECEIVING APPARATUS.

from Paris to Tours and back, 480 kilometers (298 miles); in the fifth, Paris to Havre and back, 290 miles; in the sixth, the same; in the seventh, Paris, Rouen, and back, 180 miles. In some of the circuits there were sections of underground lines, varying from 19 to 22 kilometers, and the resistance of the entire circuits varied from 1,650 to 3,100 ohms. These trials were made under the conditions usual on French lines. The battery did not exceed 100 Calland or Daniell cells, and the wire was of iron with a maximam diameter of 5 mm. With stronger batteries and bronze and copper wires, greater speed can be obtained.

Since commencing the trials, M. Cassagnes has added further improvements to his apparatus. These consist in the addition of a mechanical perforator and an electrical transmitter, thus bringing the steno-telegraph into the category of automatic telegraphs. By the use of a perforator, the keyboard no longer produces the electric contacts directly, but produces mechanically a band on which the signs are represented by holes. This perforated band is placed in the transmitter and drawn through by the same mechanism which effects the rotation of the rubber. A system of feelers emits through the holes in the band the currents which actuate the dies at the distant station. In a series of trials, between Paris and Orleans and back, Paris and Tours and back, Paris and Macon and back, and Paris, Angouleme, and back, distances varying from 200 to 920 kilometers, there was obtained with this apparatus the following speeds of working: Up to 350 kilometers (217 miles), 400 words per minute; up to 650 kilometers (403 miles), 17,000 words per hour; up to 900 kilometers (560 miles), 12,000 words an hour. Each section can act equally well for reception as for transmission, and the results mentioned above represent the total number of words transmitted in either direction, according to the requirement of the stations.—*Engineering.*

The Introduction of Cholera into Chili.

Dr. John Trumbull sends an interesting account of the mode in which the cholera found its way into Chili, despite the greatest precautions taken to prevent its entrance. "No country," he writes, "could be better situated than Chili to withstand the attempted invasion of such a disease as cholera. No better boundaries could be desired than the extensive desert on the north, separating the country from Peru and Bolivia, the Pacific on the west, and the unbroken mountain range on the east. The Andes, furthermore, form a natural watershed, thus preventing contamination of the water supply by the inhabitants of neighboring countries. The sole danger therefore lay in importation of the disease by infected clothing or in the person of fugitives from the eastern side of the mountains. Every port of Chili was absolutely closed to vessels coming from the eastern coast of South America, and guards were stationed at the mountain passes. A dozen of the most frequented passes were thus closed, but, the winter being a dry one, the fall of snow was light, so that more than a hundred of the less well-known passes are said to have been open. The introduction of the disease was traced directly to a party of fugitives coming from the Argentine Republic, where cholera prevailed. A cattle dealer, with four servants, crossed the mountains and remained concealed for a time in the village of Santa Maria. One of the number was sick, and five days later, on Christmas, 1886, the first authentic case of cholera occurred in the person of a laborer in that village. As soon as the nature of the disease was recognized, a military cordon was placed around the infected district, and the branch railroad leading therefrom was closed. But an exodus from the place had already commenced, and on December 30, one of the fugitives died immediately after his arrival at a small station of the main railway line, forty-five miles from the seaport. Four days later the man who had attended this case sickened and died, and thus a second center of infection was established. This case was an exception to the general manner of the spread of the disease, the water having been the carrier of the infection. In Chili, artificial irrigation is relied upon in agriculture, and the river water is carried through small canals (*acequias*), traversing the valleys in every direction, and furnishing the supply needed for drinking, cooking, and bathing. The canals then act as sewers, the water-closets being built over them, are next used for purposes of irrigation, and finally empty again into the river. No cordon could be of avail under such circumstances, and it was along the banks of the acequias carrying the waste matter from the village of Santa Maria that the disease next disclosed itself. After that a section of country miles away, but on the bank of the same river, and drawing its water supply from this source, was invaded. As yet the disease has not spread from the district supplied by the Aconcagua River, but several suspicious cases have appeared elsewhere, and much anxiety is felt concerning the future." Dr. Trumbull's letter, of which we have been compelled from pressure of other matter to give but an abstract, possesses a peculiar interest, since it seems possible that the disease may be brought to this country from the west coast of South America. Cases of suspected cholera are said to have been noted at the Isthmus, and if the disease becomes prevalent there, there will be great danger of an invasion of our own country.—*Med. Record.*

Extracting Tin from Tinned Sheet Metal Cuttings.

BY S. MONTAGUE, NANTES.

This invention consists in conveying hydrochloric acid gas into a closed vessel containing the tinned sheet metal, the separation of the tin of which is desired. After the closed vessel has become completely saturated with hydrochloric acid gas, whereby the latter combines with the tin, a shower of water is allowed to fall over the sheet metal, and the gas is converted into liquid protochloride of tin; the tin, entirely removed from the sheet metal, is dissolved in the protochloride of tin. The protochloride is drawn off, and the tin is precipitated either by means of zinc or by lime wash, the tin obtained being almost pure.

THE following is said to be a good recipe for map engraving wax: Four ounces of linseed oil, half ounce of gum benzoin, and half an ounce of white wax; boil two-thirds.

THE PORCUPINE IN THE BERLIN ZOOLOGICAL GARDEN.

The class of rodents includes mostly harmless animals, such as the dormouse, the beaver, the mouse, and the hare, and none of them, except the family of the porcupine, are armed with weapons of attack or defense. All the members of this sub-class are armed with longer or shorter pointed quills, and to these lance-bearing rodents the Canada porcupine (*Erethizon dorsatum*) belongs. This animal is about 2½ feet long, and its body is covered with thick, dark brown hair, from which project quills which are 3 or 4 inches long. Its head is short and thick. Its long and strong claws, of which it has four on its fore feet and five on the hind ones, are of the utmost importance to the animal in gaining its food. Its tail is a weapon to be dreaded. It is about 7 inches long, is flattened, and is provided with bristles underneath and spines on top. Woe to him who comes near this weapon! Quick as lightning, the animal strikes laterally with it, and is sure to hit his real or imaginary foe.

The quills will penetrate the thickest covering, and remain in the skin of the person attacked. If this porcupine cannot use its tail to advantage, it rolls itself into a ball like the hedgehog and presents a wall of spears to his attacker, and in this position it seems really unconquerable. A dog which has risked an attack turns back after the first bite, terrified and howling, for the spines stick fast in his mouth. A naturalist found a lynx which had suffered severely from such a combat. It was nearly dead, its head being very much inflamed and its mouth full of quills.

The same observer states that dogs, wolves, and even the cougar die from similar wounds. If a hunting dog comes in contact with a porcupine it is sure to be badly hurt, and therefore porcupines are heartily disliked by hunters.

The *Erethizon dorsatum* lives in the woods of North America, spending most of its time on trees, which it climbs with wonderful ease. Its food is the bark of trees, and it will entirely strip young branches, especially of elms and poplars, so that the woods inhabited by this animal look, as a certain naturalist says, "as if a fire had raged in them." Indians eat its flesh, and use the quills for decorating belts, hunting bags, etc. In captivity, the Canada porcupine soon becomes tame, and accustomed to its keeper; but as soon as occasion offers will escape to the trees.—*Illus. Zeitung.*

THE PORCUPINE IN THE BERLIN ZOOLOGICAL GARDEN.

BRILLIANT RED COLORING MATTER.—Professor Rennie, of Adelaide, has examined the coloring matter which is present in the tubers of *Drosera whittakeri*, a plant which grows plentifully on the hills in the neighborhood of Adelaide. Mr. Francis, of Adelaide, had previously extracted the coloring matter by means of carbon bisulphide, and found that it could be used for dyeing silks with various mordants. The substance is of a brilliant red color, is volatile, and can be obtained in a crystalline condition. The yield from the tubers is very small, as four quarts were required to furnish 5 grm. of the pure dye. By suitable solvents, it can be extracted from the root, and obtained in a state sufficiently pure for analysis. The numbers obtained by Prof. Rennie agree with the formula $C_{11}H_8O_5$, and from subsequent investigation, it appears that the compound is trihydroxymethyl naphthaquinone.

After crystallization of the dye, the mother liquor was further examined, and found to contain another derivative of methyl-naphthaquinone; but additional experiments are needed before the exact nature of this second compound is satisfactorily determined. It remains to be seen whether, with such a small yield, the plant can be grown in sufficient quantities to produce a dye which is capable of competing with the artificial coloring matters of similar constitution.