No. 660,199. Patented Oct. 23, 1900.

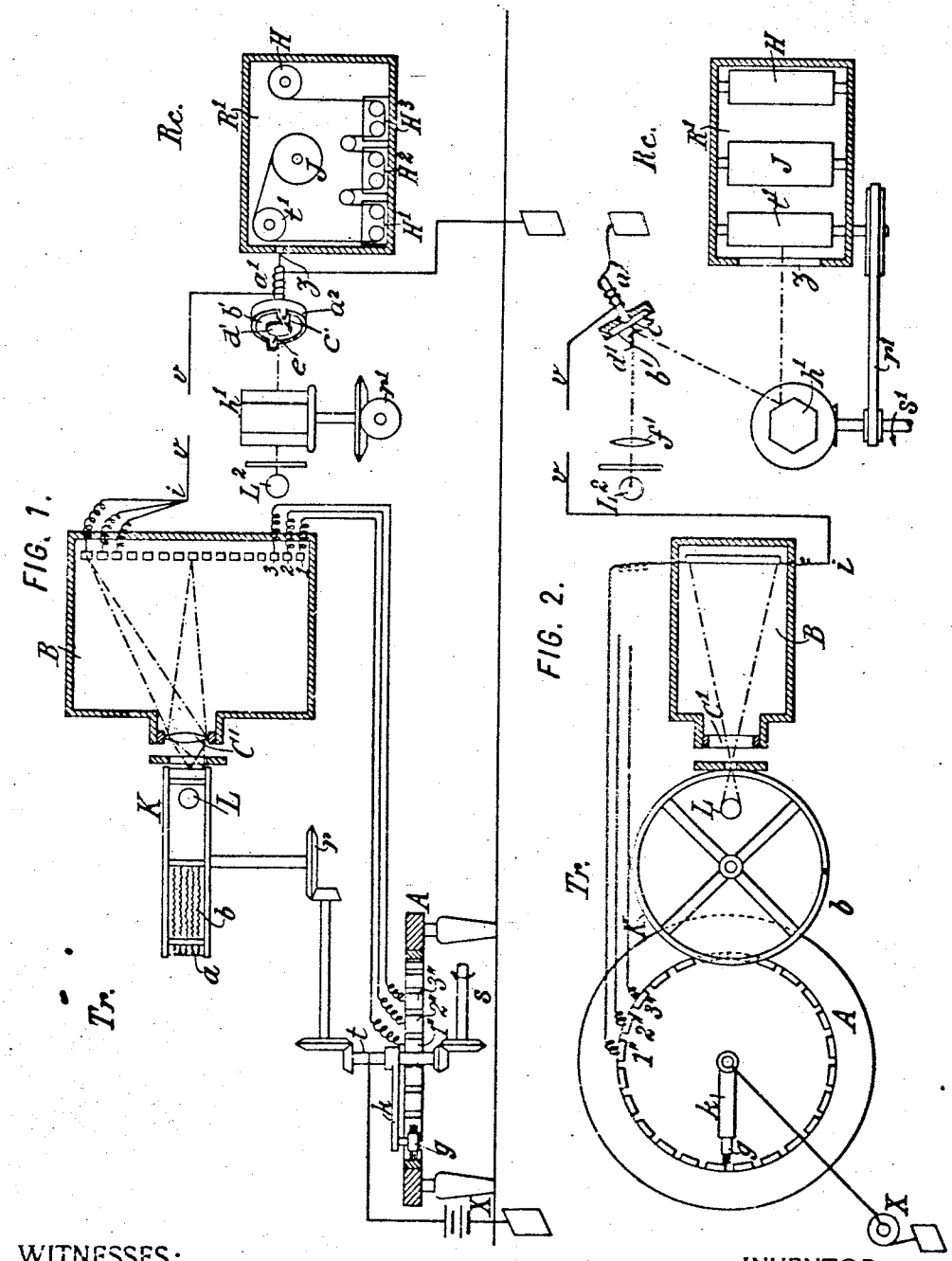
A. POLLAK.

TELAUTOGRAPH OR FACSIMILE TELEGRAPH.

(Application filed May 25, 1898.)

(No Model.)

2 Sheets—Sheet 1.



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(Application filed May 25, 1898.)

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2 Sheets—Sheet 2.

FIG. 4.

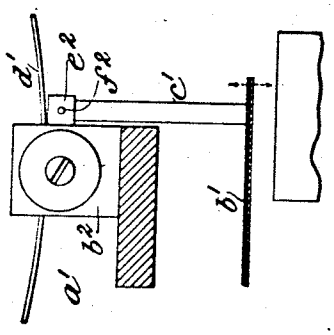


FIG. 6.



FIG. 3.

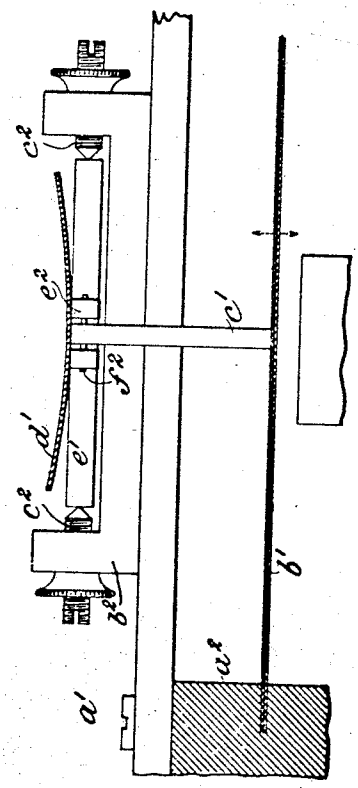
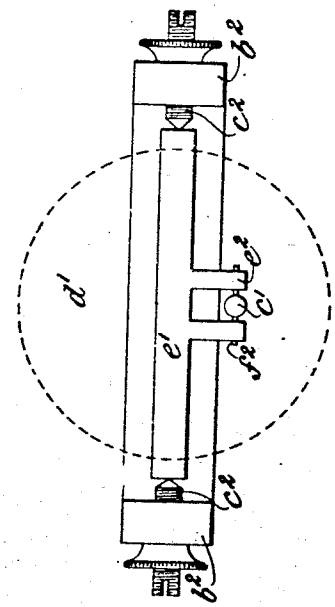


FIG. 5.



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UNITED STATES PATENT OFFICE.

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TELAUTOGRAPH OR FACSIMILE-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 660,199, dated October 23, 1900.

Application filed May 25, 1898. Serial No. 681,729. (No model.)

To all whom it may concern:

Be it known that I, ANTON POLLAK, merchant, of Szentes, Hungary, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Telautographs or Facsimile-Telegraphs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

The object of this invention is the forwarding of despatches in a form corresponding exactly with the original and at a speed which is at least equal to and which may even exceed that of the present electric telegraph. The idea of delivering despatches in a form corresponding to that of the original is not new. The subject in itself is so important that it would be a matter of astonishment if the carrying out of this idea had not already formed the subject of research. The apparatus heretofore constructed for this purpose have, however, not been approved in practice. While the so-called "copying-telegraphs" actually give a copy of the despatch corresponding with the original, the construction of these apparatus is complicated, and they work so slowly that they do not comply with the requirements of practical life. Moreover, the telegram to be transmitted must be written on paper of a particular kind and with a special kind of ink, which, disregarding other circumstances, prevents the general use of these apparatus. In contradistinction to these the apparatus invented by me attacks and solves the problem from quite a different standpoint. In my apparatus a true photographic reproduction of the telegram sent out from the transmitting-station is produced at the receiving-station, where it can be immediately delivered to the addressee.

The construction of the apparatus is very simple and the method of operation is quite automatic, so that only a small working staff is necessary.

The principle of the apparatus is, shortly stated, as follows: The picture of the despatch is projected in a suitable manner onto a series of selenium cells or cells of other substances the electrical resistance of which rises and falls in accordance with the illumination thereof. Through the cells is successively passed a current of a certain strength from a suitable source of electricity. This current, according to the greater or less illumination of such cells, (which will hereinafter be referred to as "selenium" cells,) experiences a lesser or greater resistance, and therefore leaves the cell as a current of greater or less strength and is so conducted to the receiving-station. Here the current passes through the windings of one or more telephone-like apparatus the diaphragm or diaphragms of which are set in vibration in accordance with the strength of the current supplied, which vibrations can be used in various ways, so that a strip of film or paper which is sensitive to light and is continuously fed forward in a dark or closed chamber can be correspondingly lighted thereby in exact accordance with the varying illumination of the selenium cells, and in this manner a photograph of the telegram projected on the selenium cells is produced. One has merely to take care that at the transmitting-station the single points of the despatch act successively upon the selenium cells at a suitable speed and that the vibrations of the telephone diaphragm or diaphragms are transmitted in a suitable manner to a film or paper which is sensitive to light by the aid of a source of light in order to obtain an exact copy of each single point of the despatch, and therefore a copy of the whole despatch.

In the drawings illustrating my invention, Figure 1 is a view, partly in section and partly in elevation, showing the entire device, consisting of a transmitting and a receiving apparatus. Fig. 2 is a plan of Fig. 1, partly in section. Fig. 3 is an enlarged side elevation of the telephone apparatus. Fig. 4 is a similar view of the end thereof. Fig. 5 is a plan view showing separately the means for mounting the reflector, and Fig. 6 is a perspective view of a detail.

I will first describe the transmitting apparatus, which is shown at the left in Figs. 1 and 2.

On the rotary wheel or disk K at the trans-

mitting-station Tr are arranged the manuscripts *a b* of the despatches. The source of light L is in the interior of the wheel if the despatches are written on a transparent sheet, while the illumination is effected from the exterior if they are written on ordinary paper.

In the box B is arranged a series of selenium cells 1 2 3. The light issuing from the wheel K passes through the cylindrical convex lens C' to the selenium cells. The number and size of such cells is varied according to circumstances. Their size must be such that they possess sufficient sensitiveness and that their resistance shall be of suitable amount. Assuming that cells of $2^{mm} \times 2^{mm} = 4^{mm2}$ are employed, the despatch to be transmitted should be written on paper seventy millimeters broad and each point one-third of a millimeter large of the despatch should fall on one cell, so that the magnifying power of the lens must be such that the image of each point of the despatch of one-third of a millimeter diameter shall cover one cell. In the case taken, therefore, the number of cells employed would equal the number of times one-third of a millimeter is contained in seventy millimeters, or two hundred and ten cells. The unit of one-third of a millimeter is chosen on the basis that the several points thereof shall not exceed a maximum size of one-third of a millimeter diameter, since the clearness of the photograph to be produced requires that this size should not be materially exceeded. The several series of points of the photograph should likewise be at a maximum distance of one-third of a millimeter apart. In consequence of this the wheel K must turn through one-third of a millimeter during the time a series of points comes into position for projection on the cells. It is obvious, however, that the apparatus can be adjusted to different units—as, for example, one-fourth of a millimeter—in which case a correspondingly-larger number of cells will be required. It has, moreover, been found that the trustworthy operation of selenium cells depends, essentially, on their size, and by my invention I therefore effect the illumination thereof in such manner that a large surface of each cell can be illuminated without employing an apparatus of large or bulky construction. This is attained by forming the convex lens C' as a cylinder-lens. In this manner, taking the breadth of the selenium cells as two millimeters, each point of the despatch can be one-third of a millimeter in diameter, while the cylinder-lens expands said point to substantially the length and breadth of a cell. If desired, the lens may be so formed as to expand the point in one direction only or two lenses may be employed. By reason of the larger dimensions of the cell its resistance is reduced and the sensitiveness increased, thus making the operation more trustworthy.

The wheel K is in connection through the gearing and shaft *r t* with one end of an arm *k*, which is made of conducting material, and with the driving-gear *s*. At the other end of the arm *k* is the brush *g*. This brush moves in a circle along the contact-pieces 1' 2' 3' of the commutator A. Each of the contact-pieces is electrically connected to one of the selenium cells. The commutator is preferably constructed in such a manner that a series of contact-pieces 1' 2' 3', corresponding in number with the selenium cells, is arranged on the inner edge or surface of a circular ring made of insulating material, each of these contact-pieces being electrically connected to a cell. The current passes through the shaft *t* and arm *k* to the brush *g* from a source of current X through said cells in succession. The arm *k*, with the brush *g*, is moved by means of the driving-gear *s* around the inner circular surface of the ring of the commutator A, whereby the current is conducted in turn to each of the selenium cells. The gear-wheels *r r* are so proportioned that the wheel K turns through one-third of a millimeter while the arm *k* makes one complete revolution and brush *g* in its circular path touches the entire series of the contact-pieces, so that the current passes successively through each of the entire series of cells. Each of the conducting-wires extending from the contact-pieces 1' 2' 3' leads to a corresponding selenium cell 1 2 3, from which conducting-wires again extend, which unite together at *i* to form the conductor *v*. This conductor *v* leads as a line-wire to the receiving-station Rc. It will be seen that in effect the despatch or writing is divided by close parallel cross-lines and each such line is subdivided into a succession of dots or points and that each dot or point is caused to vary the illumination of one cell, the electrical resistance of which is thereby affected, and this variance causes a corresponding variance of the electrical current passing through each cell and along the common conductor *v* to the receiving-station. The variations of this current are utilized by my invention to reproduce the original despatch in its exact form, and I will now describe the apparatus for effecting this result, which is shown to the right in Figs. 1 and 2.

The current from the transmitting-station is led to the receiving apparatus preferably through a single conductor *v* and is caused to control the passage of a ray or rays of light onto a sensitized film in such manner that for each dot or point of the despatch a corresponding dot will be made upon such film. It is obvious that a succession of such dots will form a line corresponding with a line of the despatch. The current from the selenium cells 1 2 3 is passed to the telephone-like apparatus *a'* by means of the conductor *v*, and the diaphragm *b'* of the said telephone is set in vibrations corresponding to the differing strengths of the current. To the diaphragm *b'* of the telephone is secured one end of a rod *c'*, while to the other end thereof is secured a reflector *d'* in such manner that it can swing

in a vertical plane. An arm e' is secured at one end to the reflector and at the other end to the shell of the telephone and both axes of rotation are parallel to the axis of oscillation of the reflector. In Figs. 3, 4, and 5 is shown in detail the construction of the telephone-like apparatus. Upon the frame a^2 of the diaphragm b' of the telephone is secured a transverse support b^2, having two pointed screws c^2, carrying between them a shaft e'. Said shaft is provided with a fork-shaped projection e^2, embracing a rod c' and connected with it by means of a pin f^2. The other end of the rod c' is connected with the diaphragm b' of the telephone. If now the membrane is vibrated, as indicated by arrows, its movements are transferred to the shaft e' in such manner that it is turned alternately in the one and the other direction, and as the reflector d' is secured to the shaft it partakes of the vibrations of the diaphragm and deflects correspondingly the ray of light falling upon it. On the reflector is now projected, by means of a source of light L^2 and a screen, the image of a point or, preferably, of a three-cornered aperture, (shown in Fig. 6,) which is reflected from the reflector in a vertical plane in a direction corresponding to the position thereof for the time being.

In order that the ray or pencil of rays reflected from the reflector d' may be given a horizontal movement to bring it along the whole length of a slit in a dark chamber R', to be described, it is subjected before it reaches said dark chamber to a further reflection by means of a polygonal mirror h'. This polygonal mirror moves synchronously with the brush g of the commutator A in such a manner that while the mirror h' makes one revolution on its axis the brush of the commutator makes as many revolutions as said mirror has sides. The images of the variations in current strength during one revolution of the commutator-brush—that is to say, the combined points of a section of the original picture or of the despatch—are therefore each reflected by one side of the mirror in such a manner that by reason of the rotation of said mirror the pencil of rays reflected on the slit of the dark chamber is led along the whole length thereof while the arm K of the commutator makes one revolution. At the beginning of the next revolution of the commutator-arm, however, the next following side of the polygonal mirror begins to reflect and again throws the pencil of rays along the slit. The reflected pencil of light-rays falls on the dark chamber R' in such a manner that the point thereof, which, as before stated, preferably has a three-cornered transverse section, enters into the slit z of said chamber (which in this construction is one-third of a millimeter wide) either not at all or only partially or entirely, according to the oscillations of the reflector d', and produces in this manner an image of the point or of the three-cornered aperture on the sensitized film H, moving behind the slit of said dark chamber. The movements of the point of light which are reflected through the slit z on the sensitized film correspond with the strength of the current passing through the telephone. In this manner an image of the corresponding point or points of the despatch arranged on the wheel K at the transmitting-station is produced, and as the film moves forward one-third of a millimeter the next row of points is registered, and so on until the entire despatch is reproduced. The message may be written upon transparent paper with opaque lines or upon opaque paper with transparent lines. In this former case with the construction of apparatus shown the cells are normally light, the reflector is normally held attracted by its magnet, and the beam of light may be led across the chamber R' below the slit z. Hence when a dark cell is in circuit the reflector is less strongly attracted and accordingly moves to raise the beam into the slit. When the message is written upon opaque paper, the cells are normally dark, and the beam of light may be led along the chamber R' above the slit until a light cell comes in circuit, when the stronger attraction of the magnet will depress the reflector, causing the light to enter the slit. If the brush of the commutator is sufficiently wide to bridge the contacts 1' 2' 3', the line normally described by the beam of light when moving below or above the slit will be approximately straight, being varied to enter the slit whenever a point is to be reproduced. If the circuit is made and broken at every contact, however, such line will be wavy, but only such curves as are caused by the current through the cells affected by the message will have sufficient amplitude to enter the slit. After the film H has been exposed it passes downward into the receptacles H', H^2, and H^3, which contain the fluids successively used for developing, fixing, and washing photographic pictures. It may then be removed and delivered to the addressee.

The cells herein described as "selenium" cells may, as before stated, be of any substance whose electrical resistance is altered or varied by its illumination, any such substance being an equivalent of selenium.

What I claim is—

1. A facsimile-telegraph comprising a plurality of selenium cells, means for projecting an image on such cells, thereby varying their degree of illumination and electrical resistance, a conductor in circuit with said cells, means for sending current impulses over said conductor through said cells successively, and a receiving instrument comprising means for causing said current impulses to affect a ray of light, and means for recording variations in such ray corresponding to the variations in electrical resistance of such cells.

2. A facsimile-telegraph comprising a plurality of selenium cells, means for projecting an image on said cells, thereby varying their degree of illumination and electrical resist-

ance; a conductor in circuit with each of said cells and the receiving-station, means for sending current impulses over said conductor through said cells successively, an electromagnet at the receiving-station adapted to be energized by such impulses, a reflector vibrated by said magnet, by means of which the direction of a ray of light is varied, and means for recording such variations.

3. The combination with means for varying a beam of light, a sensitive sheet, and means for advancing the sheet, of means for directing said beam across the sheet continuously in one direction so as to generate successive disconnected lines.

4. In receiving apparatus for facsimile-telegraphing, a source of light, means controlled by the transmitted current, for reflecting a ray of light vertically and means independent of the current for reflecting said ray horizontally.

5. In receiving apparatus for facsimile-telegraphing, a source of light, an electromagnet, a reflector vibrated by said magnet, and a rotating mirror, said reflector and mirror adapted to vary the direction of a ray of light vertically and horizontally.

6. In receiving apparatus for facsimile-telegraphing, a source of light, a box having a narrow opening, and carrying a sensitized film, a mirror reflecting a pencil of light in horizontal direction along said opening, a reflector vibrated by current impulses from the transmitting-station, and reflecting said pencil in vertical direction, whereby said beam enters said opening and strikes said film at intervals varying with the said current impulses.

7. In facsimile-telegraphs, a transmitting apparatus comprising a moving despatch-carrier, a plurality of selenium cells, and a commutator having contact-pieces in connection with the respective cells, in combination with a receiving apparatus comprising a sensitized film moving in synchronism with said despatch-carrier, a mirror moving in synchronism with said commutator, an electromagnet energized by the current from said transmitting-apparatus, and a reflector vibrated by said magnet, adapted to reflect a ray of light on said mirror, which in turn reflects said ray upon and off said strip, as said mirror is vibrated.

8. In facsimile-telegraphs, a transmitting apparatus comprising a moving despatch-carrier, a plurality of selenium cells, a line conductor, a commutator having contact-pieces each of which is in connection with one of said cells, and which acts to direct current impulses through said cells in succession, in combination with a receiving instrument, comprising means for moving a sensitive strip, a mirror moving in synchronism with said commutator, an electromagnet energized by said impulses, and a reflector vibrated by said magnet which throws a ray of light on said mirror, said mirror and reflector being adapted to vary the direction of said ray of light vertically and horizontally, whereby said ray of light is directed on said strip during vibration of said reflector, and when so directed it strikes said sensitive strip, whereby upon continuous movement of the apparatus the successive dots will produce on said strip a tracing in exact accordance with the despatch carried by said carrier.

9 A transmitting instrument for a facsimile-telegraph, comprising a series of parallel elongated selenium cells, a source of light, means for moving the matter to be transmitted between said source of light and said cells, and an interposed cylinder-lens arranged to concentrate the light upon said cells in the form of elongated lines of light extending parallel with the cells.

10. In facsimile-telegraphs, a transmitting apparatus comprising a moving despatch-carrier, a plurality of selenium cells, a line conductor, and means for directing current impulses through said cells in succession.

11. In facsimile-telegraphs, a transmitting apparatus comprising a moving despatch-carrier, a plurality of selenium cells, a line conductor, and a commutator having contact-pieces each of which is in connection with one of said cells, and which acts to direct current impulses through said cells in succession.

12. A transmitting instrument for a facsimile-telegraph comprising a series of parallel elongated selenium cells, a line conductor connected to each of said cells, a source of light, means for moving the matter to be transmitted between said source of light and said cells, and means for directing current impulses through said cells in succession.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ANTON POLLAK.

Witnesses:

SIGMUND BERNAUERT,

EDMUND GERSTER.