C. STILLE.

TELEGRAPHIC PHOTOGRAPHY.

APPLICATION FILED MAR. 4, 1912.

1,116,949.

Patented Nov. 10, 1914.

2 SHEETS—SHEET 1.

Fig. 1.

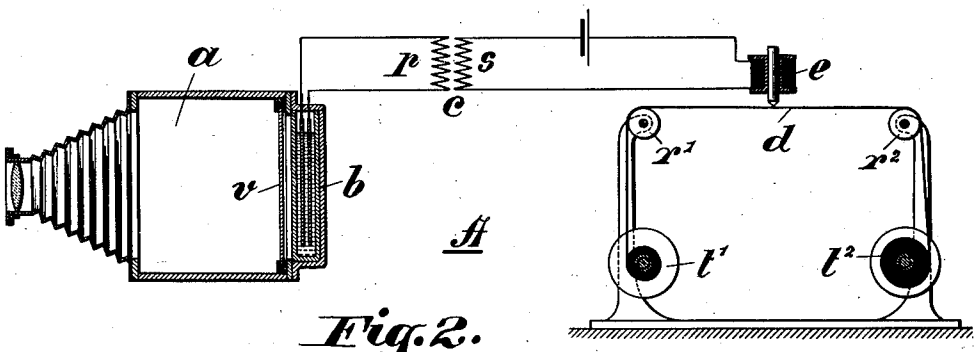


Fig. 2.

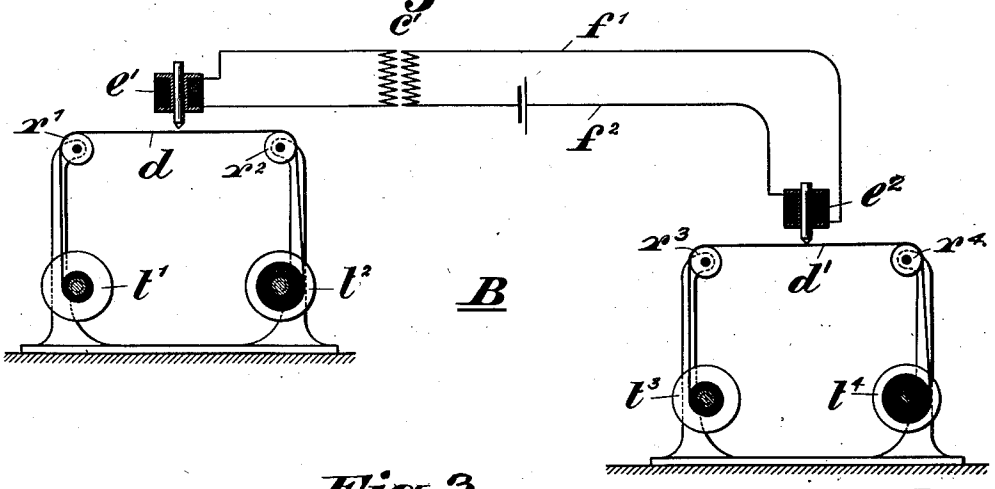
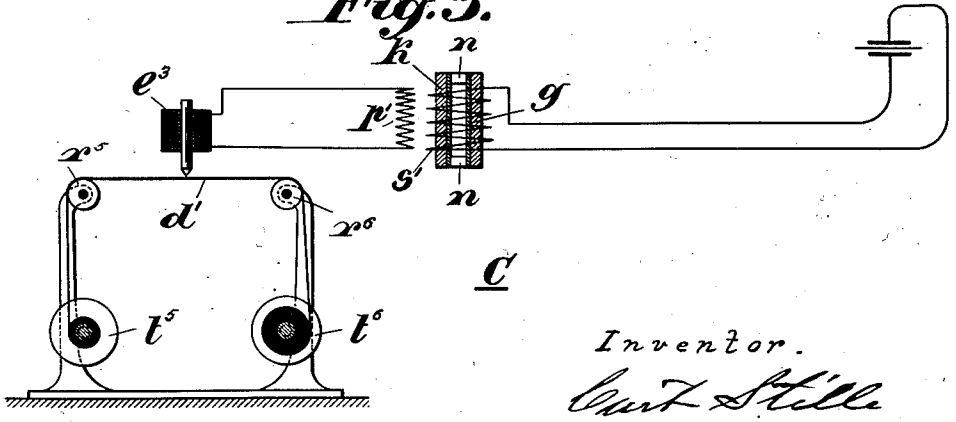


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

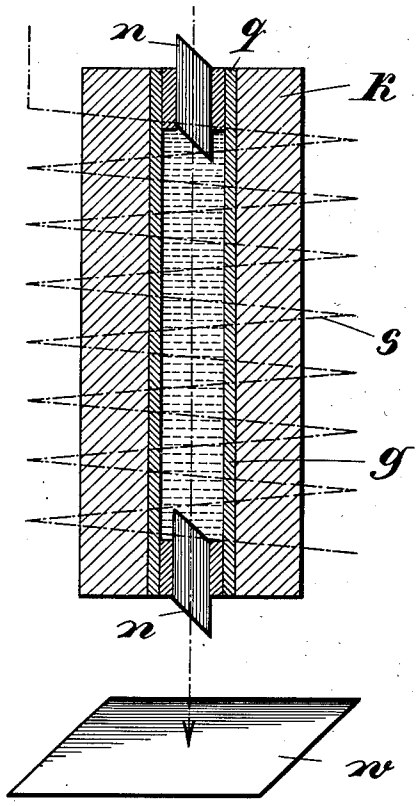
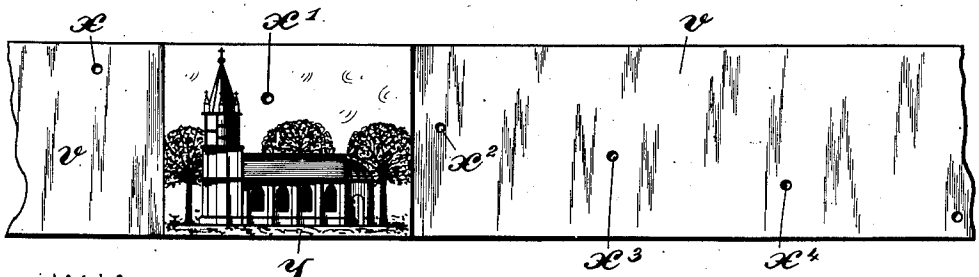


Fig. 5.



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UNITED STATES PATENT OFFICE.

CURT STILLE, OF FRIEDENAU, NEAR BERLIN, GERMANY.

TELEGRAPHIC PHOTOGRAPHY.

1,116,949. Specification of Letters Patent. Patented Nov. 10, 1914.

Application filed March 4, 1912. Serial No. 681,553.

To all whom it may concern:

Be it known that I, CURT STILLE, doctor of philosophy, of Friedenau, near Berlin, a subject of the King of Prussia, German Empire, have invented certain new and useful Improvements in Telegraphic Photography; and I do hereby declare the following to be a full and clear and exact description of the same, reference being had to the accompanying drawings, forming a part of the specification.

My invention relates to telegraphic photography and more particularly to a system by which the electric and the optical operations are done separately in different places.

In the system for telegraphic transmission of photographs it is usual to combine the optical and electrical operations in one apparatus. Evidently this manner of operation has serious draw-backs and disadvantages. The operator must be skilled in the optical as well as in the electrical operations so that an ordinary telegraphist is not able to perform all the operations. Moreover, as usually, the photographic exposure and the electric transmission are combined, the telegraphic line is occupied for a considerable time. This evidently causes expenses which do not allow the practical use of telegraphic photography.

According to my invention the photographic exposure is done separately, and the apparatus used for it is of such a nature that it produces a wire magnetized corresponding to the photograph as will be seen afterward.

This apparatus will be called in the following the optical receiving station. The magnetized wire will then be removed from the optical receiving station and may be brought to the telegraphic transmitting station.

The apparatus used in the electric transmitting station is of a similar nature as the well known apparatus of Poulsen for transmitting speech telephonically, that is to say in this station a wire is made to pass before the poles of an electro-magnet, in which it induces current strength corresponding to the variations of magnetism in the magnetized wire. These currents are transmitted by a line to the third station, viz., the electric receiving station. In this station the induced currents traverse an induction coil with the magnetic core. The magnetism excited in the pole of the core is transmitted to a wire running near the face of the pole. The result is a second magnetized wire whose magnetism corresponds to the magnetism of the first wire, each variation being exactly reproduced. Now the magnetized wire may be removed from the third station, that is to say from the electric receiving station, and brought to the optical transforming station which transforms the variations of magnetism into variations of light by any of the known methods as will be afterward described.

It is evident that by the new system two advantages are arrived at—viz: 1. The optical operations are absolutely separated from the electrical ones so that in the telegraphic station the ordinary telegraphist will be able to accomplish the service. 2. The second advantage is that the magnetized wire can be made to run before the poles of the electro-magnets with a speed which is independent of the optical operations. It may run at a very high speed with the effect that the electric station and the electric line are occupied for a relatively very small time.

After having given the outlines of the new invention and after having pointed out its special advantages, the invention shall be described in the following with reference to the drawings of which—

Figure 1 is a diagram of the general arrangement and electrical connections. Fig. 2 is a diagram of a transmitting station and a reproducing station. Fig. 3 is a diagram of the optical transmitting station and optical transforming station. Fig. 4 is a transformer used in the electrical receiving station. Fig. 5 shows a device used for the optical and photographical exposure.

With reference to Fig. 1 A means the optical and photographical receiving station. A photographic camera *a* is used instead of the ordinary screen of mat glass. A photo-electric cell *b* is arranged at the rear end of the camera. Before the photographic cell a flat band is arranged which is able to run before the cell. This band *v*, which is illustrated in Fig. 2, has a series of holes arranged in certain distances corresponding to the breadth of the photo-electric cell. The holes are arranged in different heights, the length of the heights being chosen according to the conditions of the case. The band is opaque with the exception of the holes.

Now if we assume the band to run from the right to the left the light will penetrate through the holes x, x', x^2, x^3, x^4, &c. The image which is assumed in the drawing to be a church will cause in every instance a small spot of light which corresponds to a spot of the image.

In the drawing the hole x has passed the picture, in the hole x' it being near to the tower of the church. Evidently the light received in every moment by the photo-electric cell will correspond to the instantaneous intensity of brightness of the image, and the whole image will be divided into strips, the number of which is equal to the number of the holes.

The photo-electric cell is a galvanic element inclosed in a vessel of glass and having as electrodes two plates of silver which dip into an aqueous sulfuric acid. The plate which is opposite to the interior of the camera is covered with halogen salt of silver (chlorin, iodin, bromin). The cell of the plate which is opposite to the camera is ground plain to avoid any disturbances for the passing image. The photo-electric cell is, as stated, inclosed in a vessel of glass and the walls of this vessel must be two parallel planes, in order to avoid any disturbing influence of refraction, as would be the case with the walls of the ordinary glass vessel.

Experiments have shown that a surface of 2.2 inches is sufficient for the electrodes of the cell to produce satisfying differences of light.

By the action of light an electromotive force is generated, which is proportional to the intensity of light. The two poles of the photo-electric cell are connected to the primary coil p of a telephonic relay c having the secondary coil s.

In the circuit of the secondary s a battery and an electro-magnet e are connected. The object of the relay is to magnify the intensity of the currents which would be too weak to be used directly. The currents induce magnetism in the core of the electro-magnetic coil e, which as it will be seen is such that the instantaneous intensity of magnetism corresponds exactly to the instantaneous intensity of the light of the illuminated spot in the camera.

Underneath the core runs a wire of steel d suitably arranged. On a frame are two drums t' t^2 which may be driven mechanically, so that the wire is wound on one of the drums and unwound from the other running over the rollers r' r^2.

Experiments have shown that a speed of 2 to 3 yards per second will give satisfactory results.

After the wire is magnetized its magnetism corresponding, as having been said, to the variation of the intensity of light in the image it may be removed from the drums and brought to the transmitting station forming a part of the electric station B. The wire is made to pass before the pole of the electro-magnet e' (on the left side of the figure running from drum t') over the rollers r' r^2 to drum t^2. Now the magnetism will produce in the core a new magnetism corresponding exactly to the magnetism of the wire. The magnetism of the core in the coil e' will induce currents which are transmitted to the relay c' and from thence to the line f' f^2. In the circuit of this line is connected an electromagnet coil e^2 of similar nature as described, and before the pole of its core runs a wire d' to be magnetized in analogous manner to the wire already magnetized. This wire may now be removed from the electric receiving station and brought to the optical transmitting station. In this station a similar reproduction will be effected. The wire runs from drum t^5 over the rollers r^5 r^6 to drum t^6, before the pole of the electromagnet e^3 and produces variation of currents in the primary coil p' of the transformer whose object is to transform the electric variations into optical ones.

The transformer is shown in Fig. 4. Its core is a tube of glass q being sealed at the top and at the bottom by two Nicol prisms, the tube being filled with carbonic disulfite or similarly acting liquids. Around the tube is a layer k of finely divided iron, for instance iron chemically deposited. For increasing a magnetic action in the circuit of the secondary s' a battery may be connected. Now by well known laws a beam of light passing through the Nicol prism and the solution of carbonic disulfite will be polarized so that its intensity of light is proportional to the current which traverses the coil. The beam may be used to act on a moving photographic plate, the movement corresponding to the movement of the band v of Fig. 1, *i. e.* the picture moving in such a manner that a series of strips of light are produced on the plate w. Instead of the optical transmission as described any other of the well known methods to convert an electric current whose intensity corresponds to the intensity of a spot of a picture may be used. One of those systems is known under the name of Korn.

I do not limit myself to the details of the specification as the means used may be changed, but I consider as new and essential for my invention the division of the electric optical station in a broad sense.

What I do claim as my invention and desire to secure by Letters Patent of the United States, is—

1. A method of photo-electric telegraphy consisting in converting the variations of intensity of light into variations of intensity of electric current and recording such variations of current as variations in the strength

of magnetism, reproducing the magnetism in electric currents and the electrical currents in variations of magnetism and converting the variations of magnetism into variations of intensity of light.

2. A method of photo-electric telegraphy consisting in converting the variations of intensity of light into variations of intensity of electric current and recording such variations of current as variations in the strength of magnetism, reproducing the magnetism in electric currents and the electrical currents in variations of magnetism and converting the variations of magnetism into variations in intensity of electric current and converting the variation in intensity of said last mentioned electric current into a variation of light.

3. A method of photo-electric telegraphy consisting in converting the variations of intensity of light into variations of intensity of electric current and recording such variations of current as variations in the strength of magnetism, reproducing the magnetism in electric currents and the electrical currents in variations of magnetism and converting the variations of magnetism into variations in intensity of electrical current and causing the variations of the last mentioned electrical current to magnetically act on a body having magnetical optical rotary power.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CURT STILLE.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.