

Sept. 18, 1923.

1,468,542

M. H. PETERSEN

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Filed June 8, 1921

3 Sheets-Sheet 1

Fig. 1.

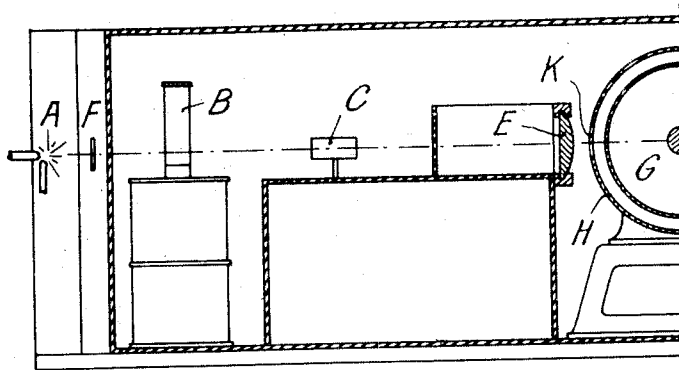
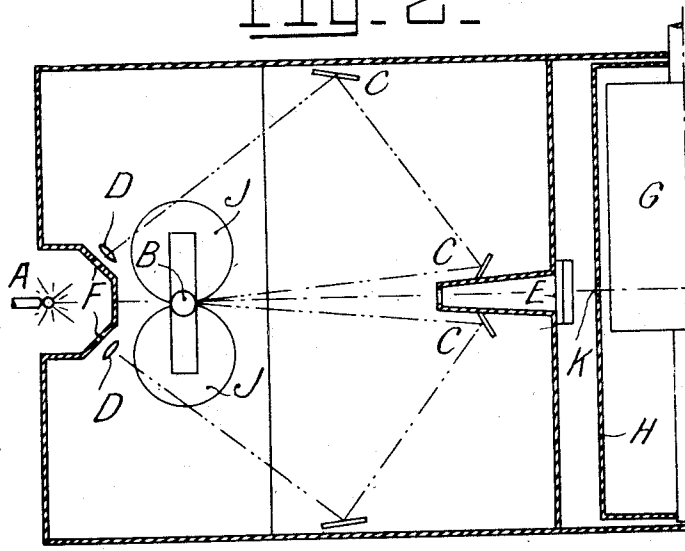


Fig. 2.



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By *[Signature]*  
att.

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Fig. 3.

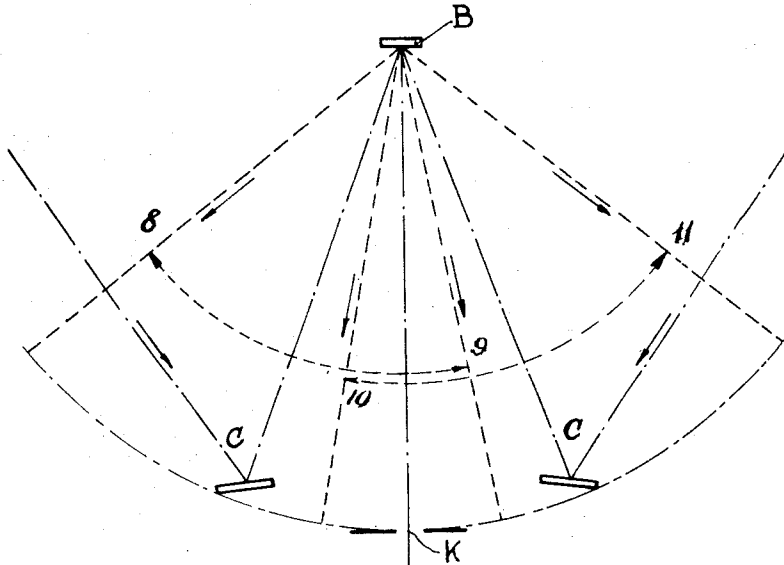
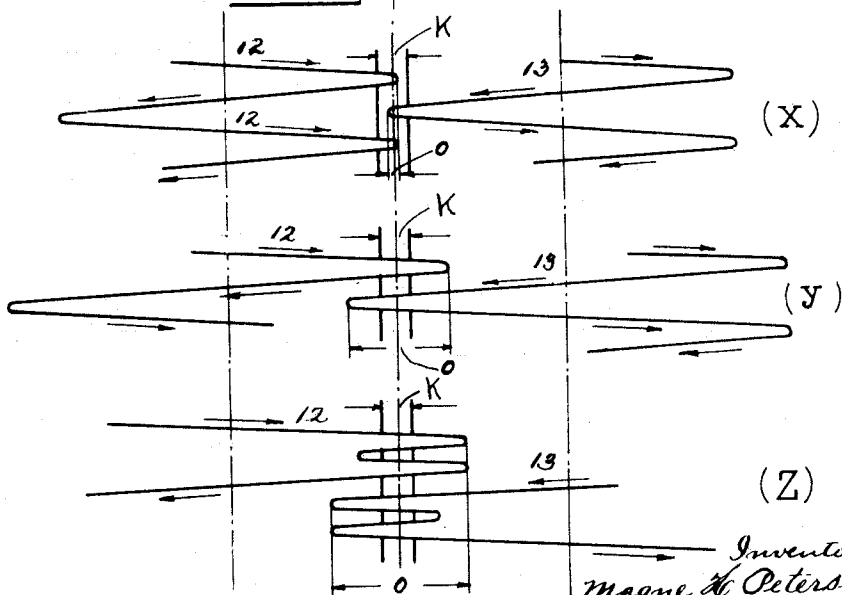


Fig. 4.



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Fig. 5.

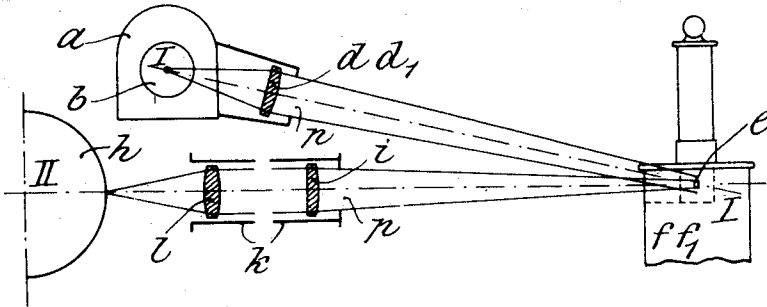


Fig. 6.

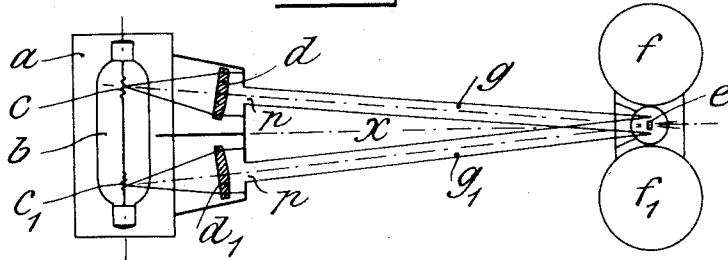
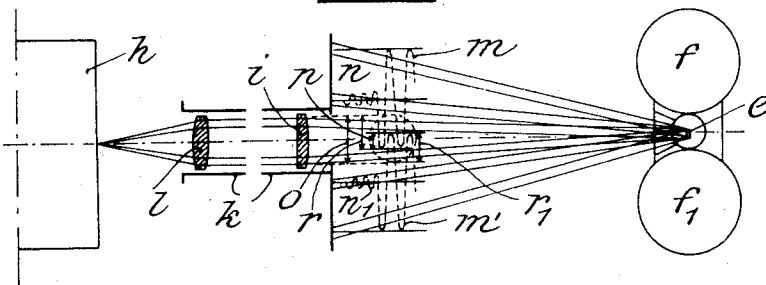


Fig. 7.



Inventor,  
Magnus Hermod Petersen,  
By *[Signature]* att.

# UNITED STATES PATENT OFFICE.

MAGNE HERMOD PETERSEN, OF CHRISTIANIA, NORWAY.

COPYING TELEGRAPH.

Application filed June 8, 1921. Serial No. 476,002.

*To all whom it may concern:*

Be it known that I, MAGNE HERMOD PETERSEN, a subject of the King of Norway, residing at Sorgenfrigate 36, Christiania, Norway, have invented certain new and useful Improvements in Copying 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 or figures of reference marked thereon, which form a part of this specification.

The present invention has for its object a process and apparatus for reproducing writing or pictures by means of electric elementary impulses.

The invention principally consists in the use of an oscillograph at the receiving station actuated by means of electric elementary impulses in combination with one or more optical arrangements for producing overlapping points on a light-sensitive material corresponding to elementary signs which form together a reproduction of the writing or picture to be reproduced.

Two or more sets of optical arrangements may be used which are so disposed that the light rays which are reflected from a mirror actuated by or mounted on an oscillograph overlap each other with regard to the narrow slot, whereby there is caused the formation of a number of points or elementary signs on the light-sensitive material.

Two forms of the invention are illustrated on the drawing.

Figs. 1 and 2 represent front view and plan partly in section of the apparatus according to one form of the invention.

Fig. 3 is a diagram showing a particular arrangement for increasing the number of elementary signs.

Fig. 4 is a diagrammatical illustration of three different arrangements of the overlapping oscillations.

Fig. 5 is a front view of a modified construction.

Fig. 6 is a sectional plan of the same on the line I—I Fig. 5 and

Fig. 7 is a sectional plan on the line II—II Fig. 5.

The main feature of the invention consists therein that the elementary impulses

caused by means of the transmitted writing or picture are conducted into the loop of an oscillograph, whereby a mirror actuated by the same is caused to perform corresponding oscillations, thereby reflecting a ray of light so as to throw points of light on a light-sensitive material so that elementary signs are formed thereon, which form together a reproduction of the original writing or picture.

The apparatus comprises the following parts (Figs. 1 and 2):

A stationary source of light A throwing an intense light, two slots F on the loop mirror of the oscillograph, which again reflects the rays of light on to the light-sensitive paper.

A measuring loop with a loop mirror B mounted thereon is placed in the field of an electromagnet J. The measuring loop itself is coupled in the circuit of the driving current necessary for taking up the picture and by any alteration of this current is caused to oscillate corresponding to the current impulses in the circuit.

A mirror arrangement C throws two rays of light on the loop mirror from each side of the same.

An optical arrangement D collects the rays of light from the source of light and concentrates them before they reach the loop mirror.

An optical arrangement E concentrates the ray of light reflected from the loop mirror on the light-sensitive paper.

The necessary blenders F regulate the ray of light and the exposition of the paper.

The apparatus G serves to mount and guide the light-sensitive paper.

The operation of the device is as follows:

A light-sensitive material (paper, film or the like) is placed on the device or drum H to which is imparted by means of a suitable driving mechanism a rotary and progressive movement. The whole of the apparatus is placed in a light-tight case I of which the side turned against the loop mirror is provided with a narrow vertical slot K.

Owing to the oscillations of the current conducted to the measuring loop, corresponding oscillations are imparted to the mirror which is thereby caused to reflect two or more rays of light (in the present case two) in the direction of the light-sensitive

paper, said rays of light oscillating horizontally across the narrow vertical slot K in front of the paper.

The original which is to be reproduced is directly or indirectly connected in the same circuit as the measuring loop and causes the electrical oscillation in the circuit by means of a particular interrupting and closing arrangement.

As the ray of light, concentrated by means of a lens arrangement E, passes slot K the light-sensitive paper is momentarily exposed, whereby a point is produced corresponding to an elementary sign of the picture or writing. The opening or slot K or the form of lens E determines the size and form of the elementary sign.

The reproduction of pictures or writing thus takes place by production in the receiving apparatus of the necessary number of elementary signs corresponding to the original.

In order to obtain the largest possible number of elementary signs the illustrated form of the oscillograph receiver is provided with a double mirror and lens arrangement. The oscillation angle 8—9 and 10—11 (Fig. 3) on the loop mirror is so adjusted that the top of the curve for both light rays passes the slot in front of the paper through the collecting lens placed at this point, whereby one, two or more elementary signs are produced on the paper for each alteration or half period. The oscillating movement of the light rays reflected from the mirrors C thus overlap each other with regard to the slot.

On Fig. 4 it is seen that it is possible by different modes of overlapping to obtain one point for each half period ( $x$ ), two points for half period ( $y$ ) or four points for half period ( $z$ ) etc.

In all three cases 12 and 13 illustrate the crests of the alternating curves or elementary impulses described by the two pencils of light rays moving with respect to the slot K and through which the rays are admitted to the moving actinic surface. First one pencil of light is reflected from one mirror C or one source of light  $c$  by the oscillograph  $e$  either partly or wholly across the slot K and then the other pencil of light is similarly reflected.

The paths described by the pencils of light are approximately sin-curves, and as indicated at  $x$  the crests do not extend entirely across the illuminating slot K but they overlap within the opening by a small amount  $o$ . As shown at  $y$  the overlap of the crests is greater than the width of the slot K, so that instead of making only a single actinic impression as in  $x$  through the slot K, each crest makes two impressions on the moving actinic surface.

At  $z$  each wave has a saddle back crest

whose amplitude is sufficient to traverse the slot K and leave four impressions on the actinic surface for each half period, the overlap  $o$  being greater than the width of slot K.

According to the form of the apparatus illustrated on Figs. 5—7 an incandescent lamp  $b$  is mounted in a lamp-housing,  $a$ , said lamp being provided with two filaments  $c$ ,  $c'$ . The lamp-housing also serves as holder for a double lens-arrangement with  $d$ ,  $d'$  so placed that a picture of the source of light is formed on the small oscillograph mirror  $e$  placed in the magnetic field of magnets  $f$ ,  $f'$ .  $g$  and  $g'$  are the two rays of light, which are thrown on the oscillograph mirror  $e$  from the two filaments  $c$ ,  $c'$  to different sides thereof at a suitable angle. When the mirror is in its position of rest the light ray from  $g$  is reflected in the direction  $g'$  and the light ray from  $g'$  in the direction  $g$ .

When the loop to which the mirror  $e$  is fastened is supplied with alternating current it begins to oscillate and by a suitable supply of current to the loop the oscillation may be so adjusted that the two rays of light from opposite sides pass the centerline of the apparatus. In the centerline is placed the optical projection apparatus which is characteristic for the present invention. For constructive reasons the lamp-housing is placed on one plane (I—I) and the projection arrangements in another plane (II—II). The projection arrangement comprises the collecting lens  $i$  in the focus of which the oscillograph mirror  $e$  is placed. The rays sent from mirror  $e$  into lens  $i$  will therefore be parallelized by the lens. At a certain distance from the lens  $i$  suitable for the construction of the apparatus is placed another collecting lens  $l$  in such a manner that the focus of the same falls on the light-sensitive paper  $h$ , which on the drawing is shown as mounted on a cylinder.

The operation of this construction is as follows:

When the oscillograph is actuated by means of signal current from the sending apparatus, the mirror  $e$  is oscillated and the rays of light reflected from the mirror will oscillate as indicated on Fig. 7, where  $m$  and  $m'$  show the amplitudes when the mirror performs full oscillations. When the mirror is not actuated by signal current, it will either be completely at rest when the light rays are reflected outside the lens, or if a weak current always passes through the line the light rays will oscillate as indicated at  $n$ ,  $n'$ , whereby they will also be outside the lens  $i$ . As it appears from the drawing both amplitudes of the signal current are utilized in this manner, and the light rays are utilized during the whole of their

passage across lens *i*. It is of no consequence whether the rays strike the edge or the center of lens *i*, as they are nevertheless collected in the focus of lens *l* on the light-sensitive paper. By this arrangement is thus obtained a far more intense exposition of the light-sensitive paper than in the case where the ray of light is just let in through a slot as according to the form of the invention first specified. The source of light by this last arrangement accordingly needs not be so strong as according to the first form of the invention.

It is obvious that two lamps may be used instead of a lamp with two filaments or a single lamp with a single filament may be used, whereby the rays are divided by means of mirrors.

Further the distance between the lens *i* and *l* may be varied at will as the rays of light are parallel and accordingly the light rays may also be deflected by means of mirrors, if so desired.

Claims:

1. In a copying telegraph, an oscillograph including a mirror, means to supply a ray of light thereto, an actinic surface arranged to receive light reflected by said mirror and means to direct a light beam from said mirror and means to permit a plurality of exposures of said surface for each period of the alternating current supplied to said oscillograph.

2. In a copying telegraph, an oscillograph including a mirror, means to supply a plurality of light beams to said mirror from different directions, a moving actinic surface arranged to receive light reflected from said mirror, and means to permit a plurality of exposures of said surface for each half period of oscillation of said mirror.

3. In a copying telegraph, an oscillograph including a mirror, means to supply a plurality of beams of light to said mirror from different directions, an actinic surface, an exposure slot arranged between said surface and mirror, the angles of incidence of said beams being arranged to reflect from the mirror in overlapping crests onto said surface through said slot.

4. In a copying telegraph, an oscillograph, an actinic surface, a collecting and a condensing lens combination focussed on said surface, said combination arranged to direct crest portions of a light beam reflected from said mirror through said combination, the crest portions of one half period overlapping those of the other half period of swing of the mirror.

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

MAGNE HERMOD PETERSEN.

Witnesses:

MORGUN BUGGE,  
GUNDSE FENSAFT LARSON.