H. BILLE.

TELEGRAPHIC PERFORATING RECEIVER.

APPLICATION FILED NOV. 3, 1911.

1,076,944.

Patented Oct. 28, 1913.

2 SHEETS—SHEET 1.

Fig 1.

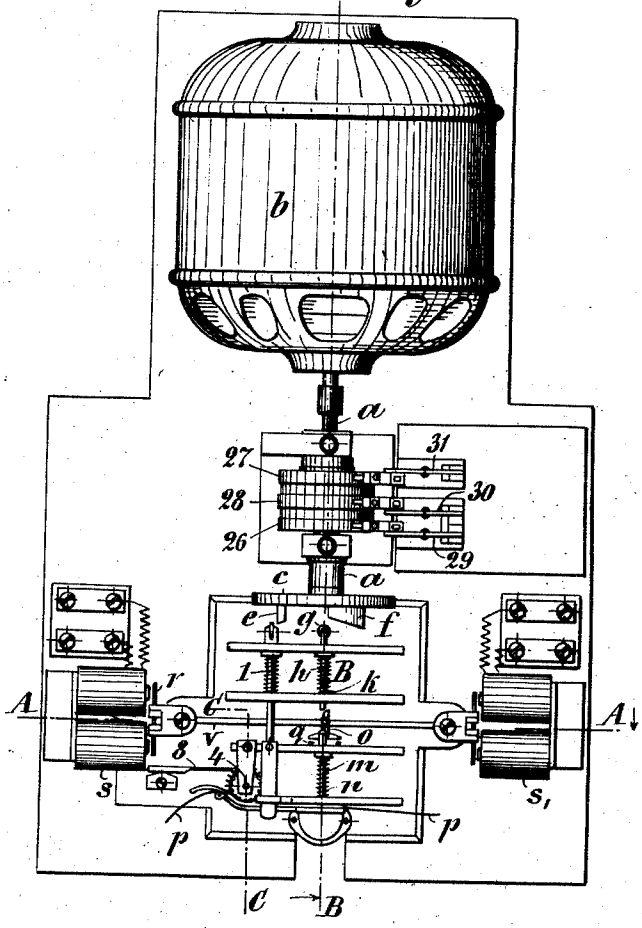


Fig 3.

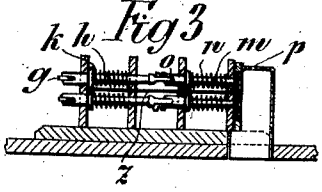


Fig 4.

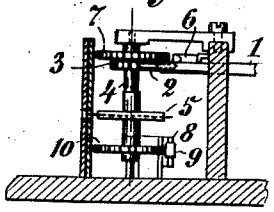


Fig 5.

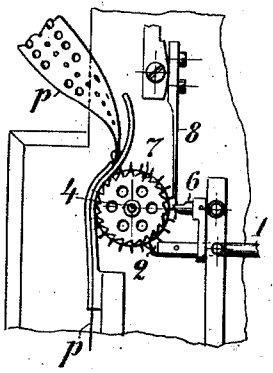


Fig 2.

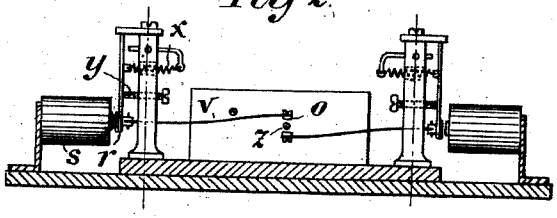
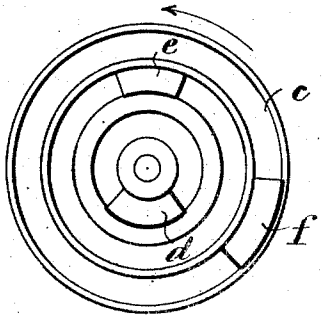


Fig 6.



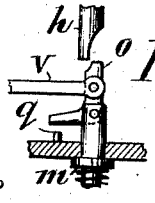


Fig 7.

Witnesses

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TELEGRAPHIC PERFORATING RECEIVER.

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2 SHEETS—SHEET 2.

Fig 8.

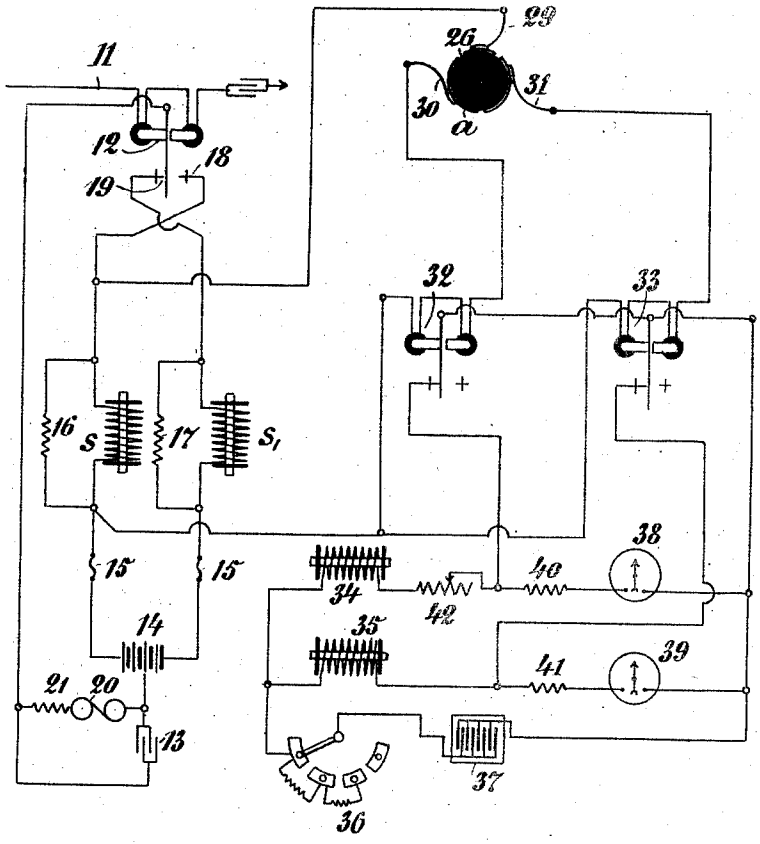


Fig 9.

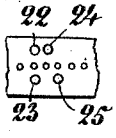
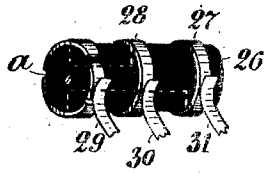


Fig 10.



Witnesses

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TELEGRAPHIC PERFORATING-RECEIVER.

1,076,944. Specification of Letters Patent. Patented Oct. 28, 1913.

Application filed November 3, 1911. Serial No. 658,319.

To all whom it may concern:

Be it known that I, HARALD BILLE, engineer, a subject of the King of Denmark, residing at Copenhagen, Denmark, have invented certain new and useful Improvements in Telegraphic Perforating-Receivers, of which the following is a full, clear, and exact description.

The invention relates to a telegraphic receiving apparatus of that kind in which the signal currents transmitted to the line cause the perforation of a paper tape, which is a true copy of a tape used at the transmitting end, this result being made possible by the present invention because of a certain relation existing between the situation of the holes in the paper tape by means of which it is fed in a step by step manner during the perforating, and the holes which are formed under control of the signal currents. Such a tape is, for instance, that used in the so-called Wheatstone system, in which for each signal two holes are required which are normally situated one on each side of a middle row of holes used for the feeding, and the above named relation between the situation of the signal holes and the feed holes is generally simply that each signal hole is found directly opposite to a feed hole, the feed holes being equally spaced apart. According to the ordinary Wheatstone system two current impulses are required, for instance a positive and a subsequent negative one or vice versa, for the formation of a signal; but the invention can be used not only in connection with the Wheatstone system in a narrow sense, but also in connection with other systems using signal currents which are transmitted at intervals of time having a certain constant value or a multiple thereof.

In the apparatus forming the subject of the invention perforating punches which are controlled by the signal currents are used, and it is necessary that the shaft effecting the feeding of the tape on the receiver and the actuating of the punches shall run synchronously with the corresponding shaft of the transmitter, and in the present apparatus it is a necessity owing to the kind of the signal currents that the synchronizing shall be effected and maintained by means of all or some of the signal currents themselves, the line not being available at certain times for special current impulses for causing or maintaining the synchronizing as is the case in other apparatuses of known kind. The signal currents proper have also previously been used for mechanically controlling the feeding of such a tape without effecting a proper synchronizing of shafts; but this arrangement suffers from the drawback that it demands rather great power and consequently causes considerable wear of the parts on which depends the exactitude of the control.

The accompanying drawings illustrate the invention.

Figure 1 represents a top view of the receiving apparatus; Fig. 2 represents a sectional view according to the line A—A, Fig. 1; Fig. 3 is a sectional view of the punching mechanism according to the line B—B, Fig. 1; Fig. 4 illustrates a section through the feeding mechanism according to the line C—C, Fig. 1; Fig. 5 is a top view of said mechanism on an enlarged scale; Fig. 6 is a front view of the cam disk; Fig. 7 is a detail on an enlarged scale; Fig. 8 is a diagram illustrating the working according to Wheatstone's system; Fig. 9 shows a part of a paper slip, and Fig. 10 is a detail showing the electrical connections between segments and rings on a synchronizing device.

A shaft *a* is rotated by an electromotor *b* or other mechanism so as to run synchronously with the crank shaft of the rocking beam of the transmitter and said shaft *a* carries a drum or a plane disk *c* having three cams *d*, *e* and *f*, Figs. 1 and 6, for acting upon the three punches and the paper feeding device. In the path of the cam *d* is found the roll *g* on the rod *h*, Figs. 1 and 3, which by means of a spring *k* is pressed in the direction of the disk. In alinement of the rod *h* is found the punch *m*, which in a similar manner is acted upon by a spring *n*. The punch *m* carries a small turntable angle piece *o* (Figs. 1 and 7), by means of which the rod can press the punch *m* through the paper slip *p*, when the parts assume the position shown. When the punch *m* has perforated the paper slip a further slight movement of the rod *h* will cause the sideward pointing small arm of the angle piece to strike against the fixed stop *q*, so that the angle piece is turned and slides away from the rod *h*, so that the punch *m* can be carried back by its spring (and at the same time the armature *r* of the magnet *s* is withdrawn, see below). The position of the angle piece *o* is determined by an elec-

tromagnet s with the armature r of which it is connected by a rod v. When the magnet is not energized the armature r is by a spring x held against a stop y, Fig. 2, and in this position of the parts the angle piece o is turned in such a manner that the rod h does not hit the same and thus does not actuate the punch m. Under the rod m and the other parts are found corresponding elements for the other row of holes in the paper; but out of regard to space, the electromagnet and related parts are arranged to the right as shown. Between the two punches is found a long thin punch z, Fig. 3, producing the middle row of holes serving for the feeding. This punch being connected with the rod h produces a hole for each revolution of the shaft a notwithstanding whether the other punches are perforating or not.

Figs. 1, 4 and 5 show the feeding device consisting of a rod 1 actuated by the cam f, which rod by means of a pawl 2 actuates a ratchet wheel 3 on a shaft 4, which shaft carries the feeding wheel 5. Care has been taken that the wheel, for instance by arranging of a stopping device 6 engaging a wheel 7, can only be turned one tooth each time. A spring 8 carrying a roll 9 coacting with a wheel 10 secures the stopping of the feed wheel in the correct position in well known manner.

Fig. 6 shows a front view of the disk c carrying the three cams, arranged in such a mutual position that the cams d and e actuating the punches are mutually displaced 180 degrees, while the cam f is arranged in such a manner that the paper is fed shortly after the acting of the cam e. The cam d actuates its punch in the position of the disk c, shown in Fig. 6, whereas the cam e only becomes active after half a revolution of the disk which takes place in the direction of the arrow.

Fig. 8 shows the diagram according to which the apparatus works. 11 designates the line through which arrive the telegraphic currents to the relay 12, which is polarized. The relay tongue is connected with one plate of a condenser 13, the other plate of which is connected with the middle of the double battery 14. The other two poles of the battery are through the safety fuses 15 connected to the electromagnets s and s' shown in Fig. 1. To each of the two electromagnets s and s' is shunted a resistance 16 and 17. Each of the windings of the electromagnets s and s' are at their other ends connected to one of the two contacts 18 and 19 respectively of the relay 12. On the receiving apparatus 20, which has a reducing rheostat 21, is obtained a copy of the telegram. When a current arrives through the line 11, which current turns the tongue of the relay 12 from the contact 18 to the contact 19, the right half of the battery 14 will charge the condenser 13 through the windings of the electromagnet s' whereby the armature of the same is attracted. Hereby the angle piece belonging to the undermost of the punches is brought into the position upon which perforation is contingent, which takes place when the cam e subsequent to this is carried over the corresponding roll. If now the direction of the current through the relay 13 is changed, the tongue of the same is led against the contact 18, whereby the left half of the battery 14 charges the condenser 13 to the opposite polarity through the winding of the electromagnet s, and hereby the system according to Fig. 1 is set into activity, the armature r being attracted and the punch m effecting perforation when the roll g is struck by the cam d.

By way of example it will now be stated what takes place when the letter A consisting of a dot and a dash is transmitted and received. The paper slip has the aspect shown in Fig. 9. Each signal (dot or dash) ending with a negative current the tongue of the relay 12 will immediately before arrival of the letter A rest against the contact 19. The current impulse first arriving is thus a positive one and carries the tongue of the relay against the contact 19, whereby the armature of the electromagnet s brings the angle piece o, Fig. 1, into its active position, so that the cam d when thereupon striking against the roll g, forms the hole 22, Fig. 9. Subsequent to this the negative impulse arrives and the armature of the electromagnet s' causes the other punch to act when the cam e strikes its corresponding roll, and the hole 23, Fig. 9, is formed. Immediately thereafter the feeding of the paper slip takes place by means of the cam f, Fig. 6, and the subsequent positive current impulse then causes the formation of the hole 24, Fig. 9. When the cam e thereupon passes its roll, no perforation takes place, but feeding of the paper is effected by means of the cam f, and thereafter the cam d likewise passes its roll without causing perforation. On arrival of the negative impulse belonging to the dash the armature of the electromagnet s' is attracted and the hole 25 is formed.

The working in the right manner of the apparatus as above set forth is contingent on that the cams d and e actuate their corresponding punches for a suitably short time after the arrival of the impulses which are to effect perforation by means of the corresponding cams. This is attained when the shaft a and the crank-shafts of the transmitter are running synchronously and with a distinct difference of phase depending upon the retardation of the line. An important feature in the invention is the

fact that the current impulses proper, which cause the perforation, are used for the controlling and maintaining of the synchronism. According to the diagram shown in Fig. 8 this can be obtained in the following manner. On the shaft *a*, Figs. 1, 8 and 10, carrying the disk *c* is arranged an ebonite cylinder 26, carrying two metallic rings 27 and 28, Fig. 10, and further a ring cut up so as to form two long and one short insulated segments (see Fig. 8). The brush 29 rubs on these segments, and the brushes 30 and 31 each on one of the rings 28 and 27 as shown in Fig. 10. They are, as indicated by dotted lines, connected each with one of the two longer segments, with which the brushes 30 and 31 are thus constantly electrically connected. 32 and 33 are two polarized relays each having one contact and one stop, and through suitable unsymmetrical adjustment of the armature between the pole shoes of the magnet of the relay provisions have been made for the relay tongue, when the relay is not acted upon by currents, constantly resting against the contact. The field coils of the shunt electromotor *b* directly coupled to the shaft *a* are designated by 34, the armature coil by 35. 36 is a starting resistance, and 37 the current source for the motor. 38 and 39 are two small current indicators (milliampere-meters or tantalum lamps), 40, 41 and 42 are resistances, the last one of which can be varied by hand. If everything is working all right, the spring 29 will touch the insulated short segment at the moment when a positive current impulse arrives and has laid the tongue of the relay 12 against the contact 18. It is evident that the cam *d* at this moment must not yet have hit its roll, as the adjustment of the piece *o* would then not be possible; on the contrary the cam will have to actuate its roll after the piece *o* has been brought into its action position. As it cannot be relied upon that the transmitter works absolutely regularly, neither that the motor of the receiver runs at an absolutely constant speed, the greatest security for the right adjustment of the piece *o* before arrival of the cam is obtained, when the latter is backwardly displaced half a revolution, *i. e.* when the disk *c* is placed in such a manner on the shaft of the motor that, for allowing the acting of the cam *d*, it will have to perform half a revolution after the above named moment of arrival of the positive current impulse. Of course then the cams *e* and *f* are displaced in a corresponding manner. In practice a motor of about $\frac{1}{7}$ H. P. is used.

When now the synchronism is disturbed this will have the effect that the brush 29 at the moment of arrival of a positive impulse is electrically connected either with the brush 30 or with the brush 31, depending on the motor running too slow or too fast. Suppose the motor has been running a little too slow, the local positive impulse from the battery 14 leaving the condenser 13 will partly go through the brushes 29 and 30 and the relay 32. Hereby the tongue of the same will momentarily be removed from its contact, and the short circuiting caused by the relay of the resistance 40 and the current indicator 38 will cease, which again will incur a short augmentation of the speed of the motor, the resistance 40 being arranged in series with the shunt. If, however, the motor has been running too fast, the brush 29 will be electrically connected with the brush 31 at the moment of arrival of a positive impulse, and now the relay 33 acts in a similar manner, which incurs a temporary ceasing of the short circuiting of the resistance 41 and the current indicator 39, whereby resistance is inserted in the armature circuit of the motor. It can always be seen on the current indicators 38 and 39 whether the motor is inclosed to run too slow or too fast, dependent on whether one or the other indicator most frequently shows passage of current, and a regulation of the motor can then be effected by alteration of the resistance 42, which is either, as shown, permanently inserted in the shunt or in the armature circuit. From this it will be seen that it is exclusively the local currents controlled by the signal currents on the line which maintain the synchronism. Finally it is clear that a quite similar system can be used with the so-called reversal system, in which for instance a positive current impulse produces a dot, a negative current a dash. Moreover of course the invention can be used for systems with a plurality of rows of holes above each other in the paper slip.

Having described my invention, I claim:

1. A telegraphic receiving apparatus comprising a tape perforator, and a constantly rotating motor and signal controlled devices acting together to actuate the tape perforator, and means whereby the signal currents will control the speed of the motor substantially as described.

2. In a telegraphic receiving apparatus, the combination of a tape perforator, a constantly rotating motor, a signal-controlled means for throwing the tape perforator into and out of operative mechanical connection with the motor, and means whereby the signal currents will cause the motor to run in synchronism with the transmitter.

3. In a telegraphic receiving apparatus, the combination of an electric motor, a continuously rotating cam disk, a plurality of punches actuated by said disk, electromagnets operated by signal currents and adapted to select the punches for actuation and a paper strip-feed operated step by step by said motor, substantially as described.

4. In a telegraphic receiving apparatus, the combination of an electric motor, a continuously rotating cam disk, a plurality of punches actuated by said disk, electromagnets operated by signal currents and adapted to select the punches for actuation, a paper strip feed operated step by step by said motor, and means whereby the signal currents will automatically control the speed of the motor.

5. In a telegraphic receiving apparatus, a motor in combination with a synchronizing mechanism therefor comprising a switch driven by the motor, means for directing the signal currents through the switch, two relays into one or the other of which the signal currents may be directed by said switch, local circuits controlled by the respective relays for increasing and decreasing respectively the speed of the motor and means whereby during the normal speed of the motor said relays will not be actuated, substantially as described.

In witness whereof, I have subscribed my signature, in the presence of two witnesses.

HARALD BILLE.

Witnesses:
VIGGO BLOM,
H. STUB.