

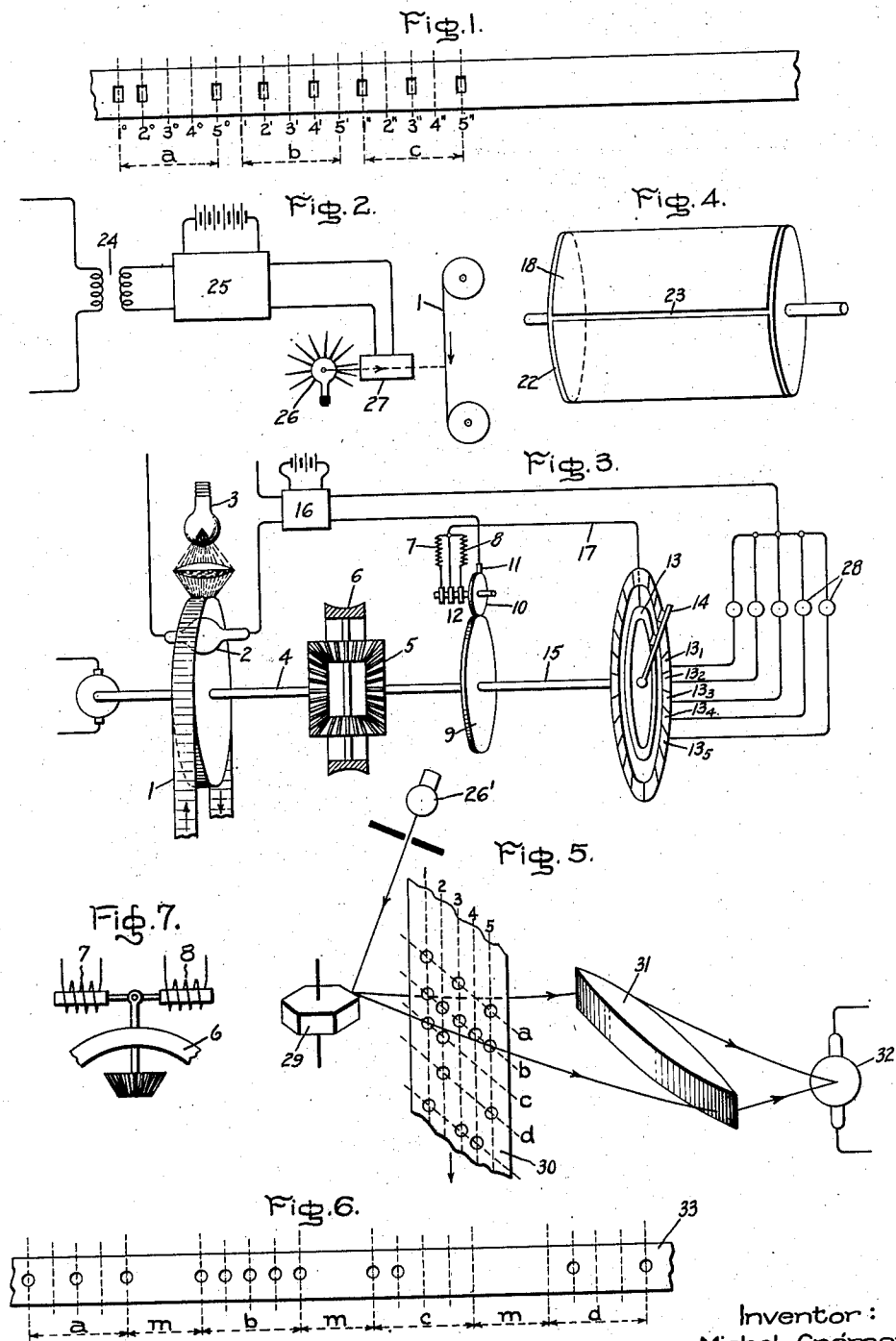
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METHOD OF RAPID TRANSMISSION OF SIGNALS AND MESSAGES

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METHOD OF RAPID TRANSMISSION OF SIGNALS AND MESSAGES

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My invention relates to the transmission of signals or images and has for its principal object the provision of an improved signal transmitting system or apparatus whereby the necessity of maintaining exact synchro-

As is well known, the long-distance transmission of messages or of long-distance control is subject to the limitation that only a relatively small number of signals can be transmitted per time unit.

In the case of a wireless connection, the inertia of the relays constitutes the main limiting factor. Besides, any increase in transmission speed entails difficulties in the synchronization between the apparatus of the transmission and of the receiving station. At very high speeds it is practically impossible to maintain a rigorously synchronous operation.

The purpose of the present invention is to provide an improved apparatus for and method of transmitting messages, signals, long distance control impulses, etc., which will permit of listening to wired or wireless signals having a very high speed and to print the received messages without being handicapped by the inertia of the telegraph relays or by synchronizing troubles.

The present invention relates to a telecommunication apparatus and method, based on the utilization of the methods and apparatus of photo-telegraphy in combination with the methods and apparatus of wired or wireless telegraphy.

To this end are utilized the conventional signs, such as those of the Morse alphabet, the Baudot code and other codes, or also simplified conventional figures which are so chosen that they will facilitate the transmission and reduce the number of current impulses, which correspond to each signal, to a minimum. In this manner, the number of elements that are to be transmitted is reduced and one can con-

siderably increase the capacity of a connection.

The apparatus by which these methods are effected have the characteristic advantage that transmitting elements such as telegraph relays, which have a considerable inertia and which for this reason limit the transmitting speed, can be entirely omitted. Inasmuch as mechanical inertia is eliminated, the messages may be transmitted at a very high speed by electro-optical procedures and their translation takes place in a local circuit, at a reduced speed at which the translating apparatus, which insure the printing of the text, can operate in a reliable manner.

Another advantage of the improved apparatus lies in the fact that they operate without rigorous synchronism between the apparatus of the two interconnected stations. In fact, the apparatus in the two stations can operate at any speed and the synchronism that is required for the "clear printing" of the message is accomplished only when the messages are translated in a local circuit.

This synchronism is maintained by the regular cadence of the signals that are recorded at the receiver and according to the selected code.

My invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

The attached drawings indicate by way of example and without limiting the scope of the invention, several "physical embodiments" of the invention.

Fig. 1 represents a perforated band which is used for the transmission.

Fig. 2 is a simplified diagram of the receiving station.

Fig. 3 represents schematically the operation of the translator in conformity with the invention.

Fig. 4 relates to the use of drums at the transmitting and at the receiving ends.

Fig. 5 represents a modified form of the transmitter.

Fig. 6 represents the tape at the receiving end.

Fig. 7 represents a detail in the apparatus of Fig. 3.

A physical embodiment which comprises only the partial utilization of the telegraphic methods will first be described.

At the transmitting end, a perforated band is prepared (Fig. 1) preferably on black paper. The sections *a b c* of this band correspond to the successive letters or figures of the message. On each one of these elements a certain number of holes are made which may be of any shape and the arrangement of which corresponds to the selected code, which may be any code, either conventional or new. The perforation in Fig. 1 corresponds to the 5-sign Baudot code. Those of *a* represent a letter, those of *b* another letter, etc.

Along the band there are inscribed at regular intervals the figures 1 to 5 which indicate the various elements of the Baudot code.

When this band is unreeled at high speed between a light source and a photoelectric cell or the equivalent of such a cell, a selenium cell for instance, a series of current impulses are produced which after amplification are transmitted by wire or wireless without synchronism between the two stations.

At the receiving station these impulses act on another photoelectric device which operates without inertia, a Kerr cell for instance, or a sufficiently sensitive galvanometer, such as an oscillograph, etc. which produces on a paper ribbon or on a photograph film, black spots that are arranged as on the transmitting band.

One of the forms of the receiving apparatus is represented schematically in Fig. 2. The current impulses that are received act through transformer 24 and a suitable amplifier 25 on a light control device 27, which intersects the light of lamp 26, a luminous beam of which falls on the photograph film 1 which unreels at constant speed.

If the speeds of the ribbons at the transmitting end and at the receiving end are not quite identical, the lengths *a b c* etc. of the two ribbons will slightly differ and it will be shown in the following that this equality in speed is not indispensable for the writing or translation of the messages.

Such a band at the receiving end can be read without difficulty by a telegraph operator who is accustomed to the code that has been selected, but automatic translation can be accomplished according to the following method which is described by way of example and with reference to Fig. 3.

After its inversion (to obtain the trans-

parent spots on a black background) band 1 (Fig. 3) is caused to travel at a reduced speed between lamp 3 and a photoelectric cell, which receives through the transparent spots the light impulses according to the cadence of the signals received. The shaft 4 which is driven by an electric motor drives through differential 5 the shaft 15 of the conventional distributor 13 and 14, so that when wheel 6 of the differential is fixed in space, the speeds of the two shafts are equal or have a certain determined ratio to each other.

The current impulses which pass through cell 2 are amplified by 16 and applied to a brush 11 which slides on a wheel 10; the periphery of which is provided with three contacts (not shown in Fig. 3). Normally, these impulses must pass through the center contact which is connected to the intermediate ring 12 from which the current passes through wire 17 of the solid ring 13 of the distributor which controls the electromagnets 28 of the printing machine.

If ribbon 1 leads with respect to brushes 14 of the distributor, that is to say, if shaft 15 revolves too slowly, the current from brush 11 does not go any longer through the center contact of wheel 10, but through the contact which lags, through ring 12 on the left, with which this contact may be connected, and through relay 8 which slightly displaces wheel 6 of the differential so as to accelerate shaft 15, a possible arrangement of the connection between the wheel 6 and the relay 8 being illustrated by Fig. 7. If this shaft leads, it is retarded in the same manner by relay 7. Inasmuch as wheel 10 rotates faster than shaft 15, the angular correction can be made only at each impulse.

In order to avoid the loss of synchronism during the intervals between the messages, it is necessary to transmit between the messages the conventional "blank" signals.

The system described in the preceding permits thus to realize the necessary synchronism between the passage of the signals that are recorded on band 1 on the one hand, and the passage of the distributor brushes on the contacts, on the other hand. But besides this agreement in speeds, there must also be an agreement of the phases, that is to say, the coincidence between the different distributor contacts which correspond to these elements.

In order to accomplish this regulation the messages may be preceded by the transmission of a certain stipulated letter, for instance letter *a* which is repeated several times. When this letter, which is recorded on tape 1 of Fig. 2, passes through the translating apparatus, a different letter will be printed as long as the phases do not agree. In order to have the phases agree, it is only necessary to move the wheel of the differential, manually or by any other means, until the printer gives the letter *a*. From that moment on,

the apparatus is regulated and its synchronism is obtained automatically by relays 7 and 8. It is evident that this regulation may take place in a different manner and that the above described method is only by way of example.

It will be seen that in this system synchronism is used only for the translation, that is to say, in a local circuit. This can be done without difficulty, and without complicated apparatus. On the other hand, the transmission itself takes place without synchronism since each apparatus operates at its optimum speed which needs only remain somewhat constant.

By using in a somewhat more complete manner the method of phototelegraphy, it is possible to realize the transmission of messages according to the invention by proceeding as follows:

At the transmitting station a sheet of opaque paper is prepared (18 in Fig. 4), on which the signals that are to be transmitted are perforated so that they follow the pattern representing helical segments when the sheet is arranged around a drum of suitable dimensions. This sheet represents an "image" of the message that is to be transmitted. By placing it on a transparent drum or cylinder 22, in Fig. 4, its diameter may be selected so as to obtain the narrow slit 23 which, at the receiver serves as a marker for the reading of the signals.

A smaller drum which rotates at constant speed at the receiving end records, through a photographic procedure, the received signals.

The operator may proceed in the manner which is generally utilized for the transmission of pictures by observing complete synchronism between the two drums. But this condition, which is indispensable in order to avoid the deformation of the pictures and drawings, is not obligatory for the transmission of the simplified pictures that are constituted by the spots which are arranged according to a telegraph code, such as the Baudot code. It suffices that the speeds be approximately constant at the transmitting and at the receiving stations.

In order to have such constant speed, each one of the drums must be driven by a synchronous motor or by a device, the speed of which is maintained constant by means of a tuning fork, or the like apparatus, but without introducing the ordinary correction of the synchronism. Inasmuch as these devices are known and are commonly used in telegraphy, they will not be described in the present application. The automatic translation of the recorded message on the drawing can take place by means of a device which is similar to that of Fig. 3.

Finally, there may be used, for the transmission, tapes which have transversal per-

forations such as shown in Fig. 5. Tape 30, which consists of an opaque material and which comprises a certain number of rows of holes 1, 2, 3, which form horizontal rows, corresponding to the signs *a b c d* moves at a high speed in front of a revolving mirror so that each horizontal row is scanned by one face of the revolving mirror 29, which mirror is lighted by lamp 26'. The light beams which pass through the holes are concentrated by the cylindrical lens 31 on the photoelectric cell of the transmitting station.

At the receiving end, the message is received by a drum which is shown schematically in Fig. 2 and there is obtained on tape 33 at the receiving end a series of signals as shown in Fig. 6. The number of surfaces of the mirror 29 and its distance from tape 30 may be so chosen that the desired distance "*m*" between successive signs *a b c* may be obtained. If the message is read at sight without translation, this distance may have any value, but if the tape must pass through a translator, it is preferable that "*m*" be equal to a multiple of the normal distance between the different elements of the code, as indicated in Fig. 1.

It goes without saying that the physical embodiments which have been described in the preceding by way of example, may be modified without going beyond the scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A signal transmitting system including movable means for producing electrical impulses dependent on the signals, movable means for recording said signals, a differential mechanism interposed between said movable means, and means responsive to the phase relation of said signals and said recording means for varying said differential mechanism.

2. A signal transmitting system including movable means for producing electrical impulses dependent on the signals, movable means for recording said signals, a differential mechanism interposed between said movable means, and a plurality of relays arranged to respond to said signals for moving a member of said differential mechanism and maintaining synchronism between said recording means and the speed of said signals.

3. In a signal transmitting system, a rotatable member arranged to support a signal band, a plurality of printing devices, a controlling distributor therefor, means for rotating said member and distributor, connecting means between the member and the distributor for varying the angular relation therebetween, and means responsive to the signals received from said band for controlling said connecting means.

4. In a signal transmitting system, a rotatable member arranged to support a band

having signal marks thereon, a plurality of
printing devices, a controlling distributor
therefor, a motor connected to rotate said
member and distributor, a differential mecha-
5 nism connecting said member and distributor
having a control member, electro-magnetic
means for shifting said control member to
vary the phase relation between the rotatable
member and the distributor, and relay devices
10 responsive to the phase relation of the signals
received from said band and the position of
the distributor for controlling said electro-
magnetic means.

In witness whereof, I have hereunto set
15 my hand this 25th day of November, 1929.

MICHEL CRÉMER.

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