March 29, 1938. E. ROSSBERG ET AL 2,112,306

PRINTING TELEGRAPHY

Filed March 27, 1935

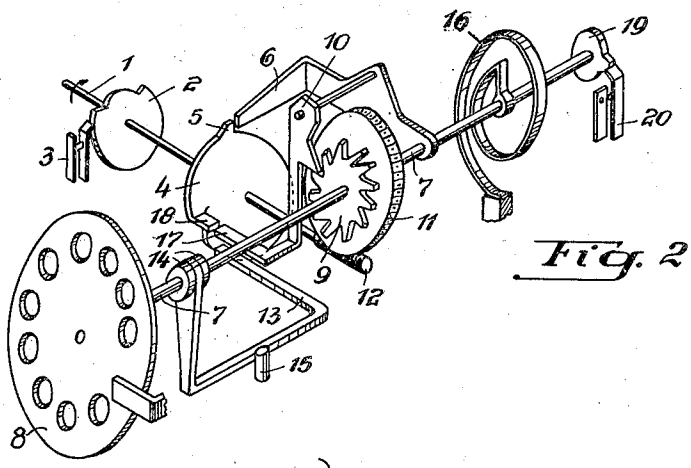

Fig. 2

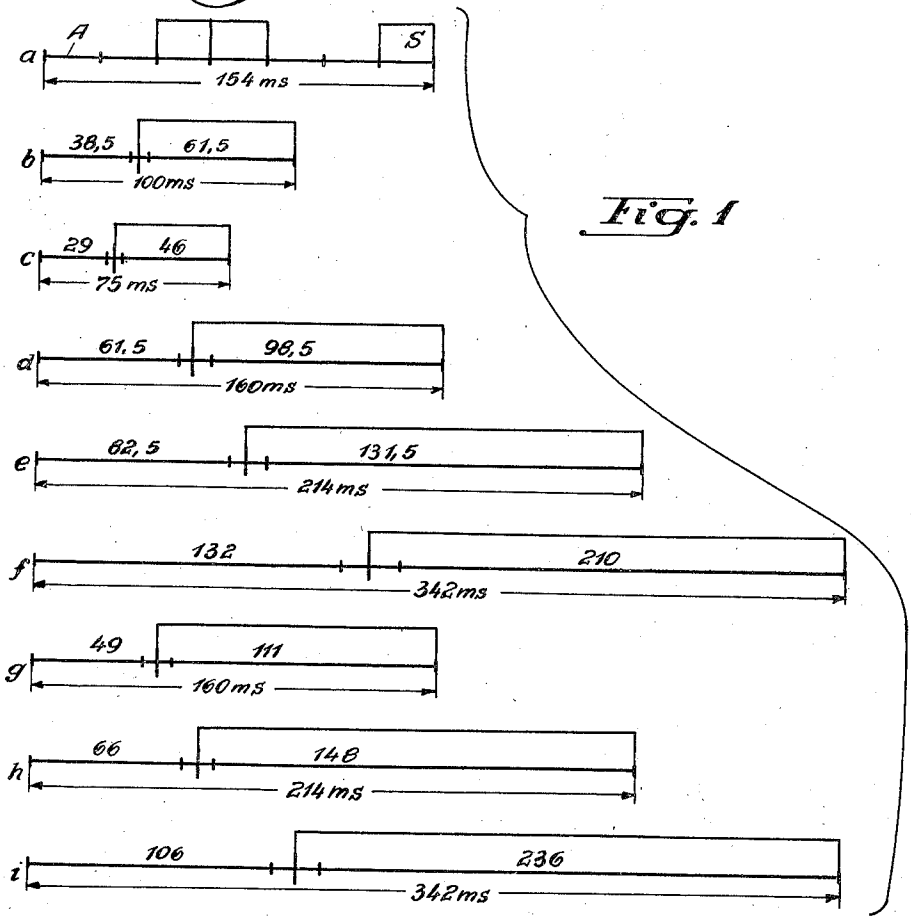

Fig. 1

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Patented Mar. 29, 1938 2,112,306

UNITED STATES PATENT OFFICE

2,112,306

PRINTING TELEGRAPHY

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Application March 27, 1935, Serial No. 13,296
In Germany March 27, 1934

13 Claims. (Cl. 178—75)

Our invention relates to printing telegraphy, and more particularly to an arrangement for dialling in printing telegraph exchange systems.

In printing telegraph exchange systems, in which regenerative repeaters are employed, the transmission of the dialling impulses presents difficulties, since the dial switch transmits a train of impulses differing from that of the printing telegraph, so that a mutilation of the dialling impulses occurs when transmitting the dialling impulses through a regenerative repeater.

To eliminate the above difficulties it has already been proposed to provide by-pass devices for the regenerative repeaters that are effective during the transmission of the dialling impulses and transmit directly the dialling impulses by bypassing the regenerative repeater. For the control of these by-pass devices in accordance with the establishing of connections, particular switching means are, however, necessary which cannot be employed in all cases or which at least unnecessarily complicate the exchange equipment.

The present invention has for its object to provide an arrangement for dialling in printing telegraph exchange systems whereby the above-mentioned difficulties are eliminated and is based on the fact hitherto unknown that it is more convenient to retain the regenerative repeater unaltered in the lines or circuits and to effect in this case the dialling in such a manner as to attain a satisfactory transmission of the dialling impulses beyond the regenerative repeater and, under circumstances, even a correction of the dialling impulses by means of the repeaters. This may be accomplished according to the invention by adapting the speed of the dial switch to the speed of rotation of a printing telegraph transmitter.

This inventive idea may be realized in various ways. By the use of an independent dial switch, i. e., of a dial switch which is as usual independent of the printing telegraph, it is possible to reduce the speed of running down of the dial switch to such an extent that the period of the dialling impulses produced is substantially equal to the length of a complete code impulse combination. If the limiting values of the speed which depend upon the manufacturing tolerances of the dial switches are taken at the same time into consideration it is necessary that the period of the dialling impulses in the case of the highest permissible speed should last at least as long as a complete code impulse combination.

Another possibility of realizing the invention consists in the fact that the speed of the dial switch is controlled by the printing telegraph apparatus, the control being effected by the electrical or mechanical method as the case may be. For instance, the running down of the dial switch may be retarded by an escapement which may be released by the impulses produced by an electromagnet controlled by the printing telegraph apparatus. Such an escapement may, however, be made conditional by the mechanical method upon parts of the printing telegraph apparatus moved in rhythm with the normal telegraph signals. This may be accomplished in a particularly convenient manner by causing the dial switch to be operated by the motor of the printing telegraph. To this end, a control member may, for instance, be provided on the transmitter shaft or on a shaft coupled with the transmitter shaft. The control member then operates the dialling impulse contact and its number of revolutions is limited by correspondingly adjusted devices in accordance with the angular position of the dial switch pulled round.

Further details of the invention will be apparent from the following description taken in connection with the drawing. Fig. 1 shows various graphic representations of impulses for illustrating the variation of the impulse periods of a standard dial switch as is required according to the invention, whereas Fig. 2 shows an embodiment of a dial switch controlled mechanically by the printing telegraph.

The upper portion *a* of Fig. 1 illustrates in diagrammatic form the signal units of a normal five-unit combination together with the starting impulse A and the stop impulse S. The five characteristic impulse units which have normally a length of 22 ms. each lie between the starting and the stop impulse which also have the same length, so that the duration of a complete code impulse combination amounts to 154 ms.

The dial switch developed for use in connection with telephony and which is also employed in the same form in automatic printing telegraph exchange systems has upon an average a running down period of one second per ten dialling impulses. The prescribed value of a period consisting of a current break and make consequently amounts to 100 ms., see portion *b* of Fig. 1. In this case the impulse ratio is chosen in such a manner that the current is off during 38.5 ms. and the current is on during 61.5 ms. This off-to-on ratio is indicated in portion *b* by the long cross line. The tolerances for the departure from this normal off-to-on ratio amount in this case to ± 10% as is shown by the short cross lines drawn close to the long cross line.

The dial switch has, however, very considerable speed tolerances owing to the manufacture and cheapness thereof. The value of 100 ms. for each period of the current impulses indicated in portion *b* represents only a mean value. The period in the case of the greatest running down speed permissible in accordance with the tolerance may actually amount to 75 ms. (portion *c*), whereas the complete running down of the dial switch with the lowest speed permissible according to the tolerance lasts 1.6 sec., i. e., the current impulse period amounts to 160 ms. (portion *d*). Accordingly, the shortest duration of a current-off period amounts to 29 ms. (portion *c*) and the longest duration of such period or break amounts to 61.5 ms. (portion *d*).

If these impulse periods according to the portions *b*, *c*, and *d* are compared with the length of a complete code impulse combination according to portion *a* it will be apparent that a normal dial switch cannot cooperate in a perfect manner with a printing telegraph apparatus or with a regenerative repeater, for in the case of a rapid dial switch according to portion *c* a rotation of the regenerative repeater (154 ms.) would correspond approximately to two periods (150 ms.) and in the case of a slow dial switch according to portion *d* not even to a complete period (160 ms.). In this case, however, it must be above all considered that owing to the nature of the regenerative repeater additional variations of the dialling impulses may occur, i. e., shortenings or lengthenings by at most 22 ms., so that the current break might be suppressed, for instance, in the case of a rapid dial switch according to portion *c*.

According to the invention the running down speed of the dial switch should, therefore, be adapted to the length of the code impulse combination, for instance to 154 ms. in the example illustrated by portion *a* of Fig. 1. The most favorable adaptation may be attained if the current impulse period of the dial switch for the highest running down speed permissible according to the tolerance is at least equal to the length of a complete code impulse combination (assumed above as 154 ms.). In the case of the percentages so far considered for the tolerance of the running down speed a current impulse period of 214 ms. with a break duration of 82.5 and a make duration of 131.5 ms. results as mean value, provided that the usual break-to-make ratio is taken as a basis (portion *e*). The dialling of the most rapid dial switch coincides in this case with the dialling of the normally dimensioned slowest dial switch (portion *d*). The impulse period of the slowest dial switch dimensioned according to the invention amounts to 342 ms. with a break (current-off) period of 132 ms. and a make (current-on) period of 210 ms. (portion *f*).

If this normal break-to-make ratio is taken into consideration a further difficulty, however, results as will be apparent in comparing the graphic representation *f* with the one at *a*. In this case the break may be so long that it falls within the stop impulse S of the code impulse combination, so that it may happen that the shaft of the regenerative repeater is not stopped at all, thus causing a wrong transmission of the dialling impulse.

In order to eliminate this fault the break-to-make ratio must, therefore, be also chosen quite otherwise than is the case with the dial switches hitherto known, that is to say, the longest possible break during the running down of the dial switch inclusive of a certain allowance for safety should not be greater than 132 ms. (duration of a code impulse combination without stop impulse). The portions *e*, *h* and *i* of Fig. 1 show a break-to-make ratio which may be considered suitable in view of the above-mentioned conditions. The portion *h* represents in this case again the mean value with a current impulse period of 214 ms. and with a break-to-make ratio of 66 ms. for the current break and 148 ms. for the current make. For the most rapid dial switch the break-to-make ratio amounts to 49:111 ms. for a period of 160 ms. (portion *g*), whereas for the slowest permissible dial switch the impulse period is equal to 342 ms. with a break-to-make ratio of 106:326 ms. (portion *i*). Naturally, these figures represent only approximative values which may be varied depending upon the particular requirements.

The above-mentioned variation of the normal running down speed of a dial switch may be attained in some cases by another adjustment of the standard dial switches. If this is not possible it will be, as a rule, sufficient to effect a simple change in the dimensions, for instance an increase in the flywheel weight of the regulator or a change in the force of tension of the spring acting on the flywheel weight in order to obtain the desired dialling.

Fig. 2 shows an embodiment of a dial switch which is not driven independently of the printing telegraph as the dial switches so far described, but is controlled by the printing telegraph itself.

It is assumed that the drive of the dial switch is effected by the transmitter shaft of the printing telegraph. To this end, the transmitter shaft is provided with a slip coupling (not shown) and is associated with the shaft **1** of the dial switch by means of the slip coupling. The shaft **1** carries a cam disc **2** as control member for actuating the impulse contact **3**. When the motor of the printing telegraph is running the shaft **1** is, therefore, continuously under the effect of the revolving transmitter shaft, the shaft **1** being, however, held at rest when the lug **5** of the disc **4** mounted on the shaft **1** faces, as disclosed in Fig. 2, the end of the lock lever **6**. The lock lever **6** is rigidly mounted on the shaft **7**, to the front end of which the dial switch **8** is secured. The escapement wheel **9** cooperating with the pawl **10** and a worm wheel **11** firmly secured to the escapement wheel **9** are loosely mounted on the shaft **7**. The worm wheel **11** meshes with the worm **12** mounted on the shaft **1**.

If the dial switch is pulled round in the usual manner by hand the lock lever **6** rotates and the pawl **10** slides over a number of teeth of the escapement wheel **9** corresponding to the dialled number. Upon the rotation of the lock lever **6** the lug **5** is released therefrom so that the shaft **1** begins to rotate. After the shaft **1** has rotated a given angle the lug **18** is, however, firmly held again by the lever **13** which is coupled with the shaft **7** of the dial switch **8** by means of a weak friction coupling **14** and which moves away from its stop **15** when the dial switch is pulled round. The shaft **1** makes, therefore, only a preparatory movement when the dial switch is pulled round which movement, however, does not yet bring about an actuation of the contact **3**.

Only when the dial switch is released the shaft **7** begins to rotate in the opposite direction under the action of the spring **16** and the lever **13** is brought back to its normal position so that the lug **18** is also brought out of engagement with the

lever 13 and the shaft 1 is again free to rotate. Upon every complete revolution of the shaft the impulse contact 3 opens for a given time corresponding to the recess of the disc 2 so that a number of impulses are produced corresponding to the number of the possible revolutions of the shaft 1. The shaft 1 comes to rest as soon as the lock lever 6 together with the dial switch 8 reaches its normal position in which the lug 5 is again locked.

In order to prevent undesirable controls of the printing telegraph exchange devices it has been found necessary to lock the dial switch as long as the circuit closing key is not pressed, i. e., as long as the driving motor of the printing telegraph is not running. This locking is brought about in the arrangement shown in Fig. 2 by the fact that the end of an extension 17 of the pawl 10 faces in the position of rest a lug 18 arranged on the disc 4. If the dial switch is to be pulled round the pawl 10 must at first pass over the teeth of the escapement wheel 9, i. e., the extension 17 must move towards the disc 4. This movement is, however, not possible if the motor and, consequently, also the disc 4 are at rest, for in this case the lug 18 prevents a rotation of the pawl 10.

A further measure of safety consists in the provision of the cam disc 19 and the contact 20. It may happen that the dial switch in the case of an unexpected disconnection of the motor—for instance by means of an engaged signal coming from the exchange—comes to rest in another than in the position of rest. This may be avoided in such a manner that the contact 20 is opened owing to the design of the cam disc 19 only in the normal position of the dial switch, otherwise the contact 20 is closed. This contact maintains, for instance, the motor cut-in relay in a local circuit in an energized state or bridges the contacts of the motor cut-in relay.

In the above-described arrangement it is presupposed, as will be apparent from the drawing, that the break time of the impulse transmitting contact 3 is shorter than the make time, and accordingly the recess of the cam disc 2 takes up less than the half of the periphery thereof. It is, of course, possible to adjust other impulse ratios with longer break duration, if a smaller portion of the rotation is interposed between the limiting points of the levers 6 and 13 by a corresponding modification of the construction. Instead of the above-mentioned friction coupling it is, of course, possible to use a claw coupling which must be then engaged and disengaged by the levers 6 and 13. The adjustment is then to be effected in such a manner that when pulling round the dial switch there is no position in which both levers release the disc 4.

The impulse transmitter shown in Fig. 2 is designed in such a manner that it is possible to combine the impulse transmitter with a printing telegraph to form a unit. This arrangement has the advantage that the case for the dial switch, which is, as a rule, arranged at one side of the usual printing telegraph, may be dispensed with.

We claim as our invention:—

1. In a printing telegraph, the combination of a number impulse-producer provided with a rotary member having a connection for operating such member by a member of the printing telegraph proper, said impulse-producer further including switch means actuated by said rotary member, the latter being constructed to adapt the impulse ratio of the current impulses to the length of a telegraphic code combination of the printing telegraph transmitter, in such a manner that the period of the stop impulse of a telegraphic code combination will occur during an interruption of the number current, and means controlling the rotary member to adapt its rotary speed to the telegraphing speed of the transmitter.

2. A device according to claim 1, in which the parts are so proportioned that the length of the impulses produced by the impulse-producer will be approximately equal to the length of a telegraphic code combination.

3. A device according to claim 1, in which the parts are so proportioned that at the highest permissible rotary speed the period of the number impulses produced will be at least equal to the length of a complete telegraphic code combination.

4. A device according to claim 1, in which the parts are so proportioned that the longest permissible interruption of the current controlled by said impulse producer will be at the most equal to the length of a telegraphic code combination exclusively of the stop impulse.

5. A device according to claim 1, in which the parts are so proportioned that the longest permissible current impulse controlled by said impulse-producer will be at the most equal to the length of a telegraphic code combination exclusively of the stop impulse.

6. In a printing telegraph, the combination of a telegraph transmitter, a number impulse-producer, means for operating said number impulse-producer by a member of said telegraph transmitter, and adjustable control means for controlling the extent of operation of said means for operating said number impulse-producer.

7. In a printing telegraph, the combination of a rotary member having a connection for operating such member by a member of the printing telegraph proper, switch means co-operating with said rotary member to produce signal impulses, a dialling member, and means controlled by such dialling member for permitting or arresting the operation of said rotary member.

8. A device according to claim 7, in which the dialling member controls two pawls arranged to arrest the rotary member at two different points of its motion.

9. A device according to claim 7, in which there is provided, in conjunction with the dialling member, means for releasing said rotary member for a number of revolutions corresponding to the dialled number.

10. A device according to claim 7, provided with means for blocking the operation of the dialling member in the event that the said member of the printing telegraph proper is not operating.

11. A device according to claim 7, provided with means for permitting the drive of the telegraphic transmitter to be interrupted only when the dialling member is in its initial position.

12. A device according to claim 7, provided with a switch and means operatively connected with the dialling member for opening said switch only when said member is in its initial position.

13. A device according to claim 7, provided with a switch which when closed causes the operation of the telegraph transmitter, and means operatively connected with the dialling member for closing said switch whenever the dialling member is out of its initial position.

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