Nov. 26, 1946. G. DEAKIN ET AL 2,411,526

IMPULSE STORING AND REPEATING DEVICE

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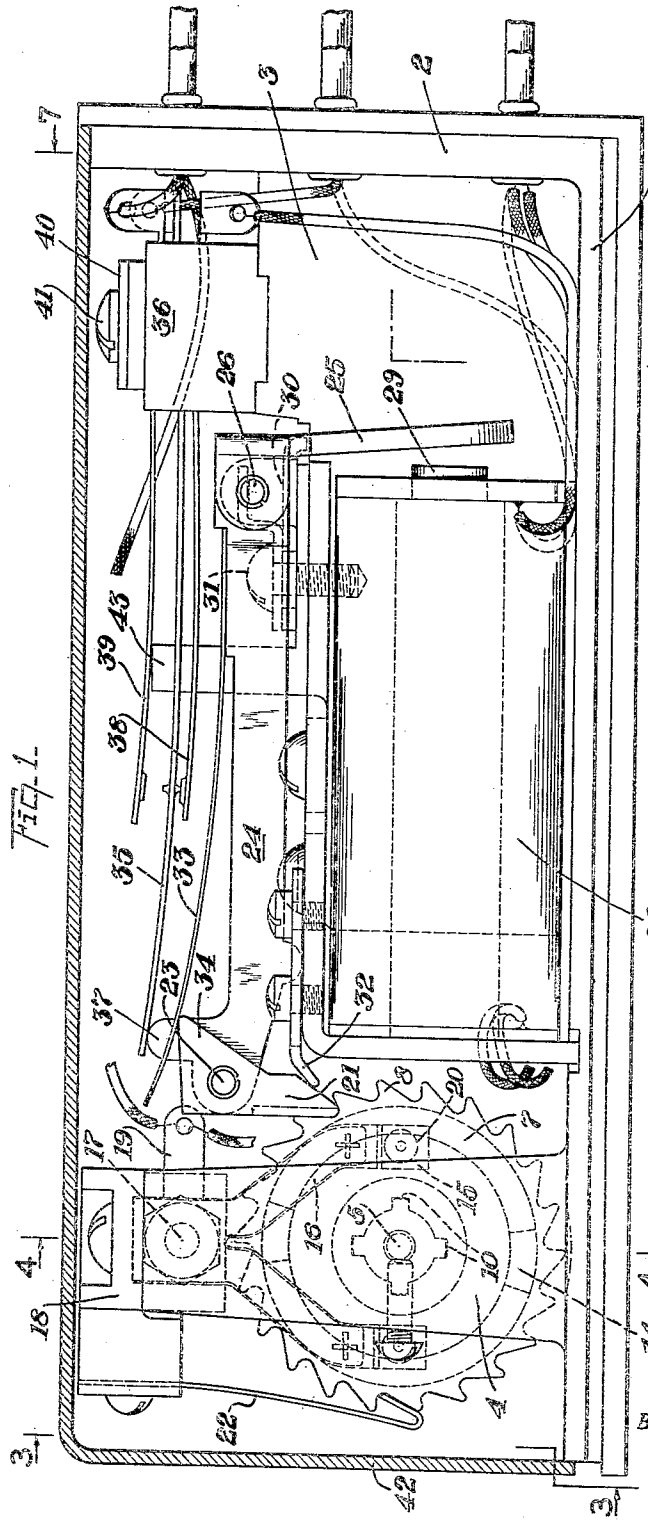

FIG. 1.

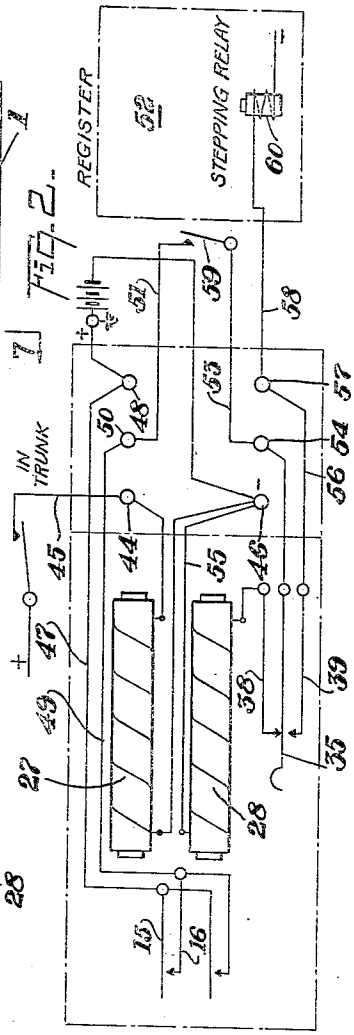

FIG. 2.

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FIG. 3.

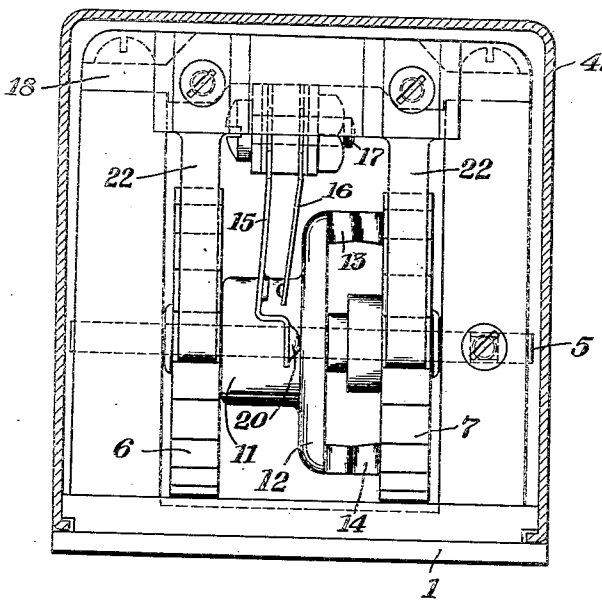

FIG. 6.

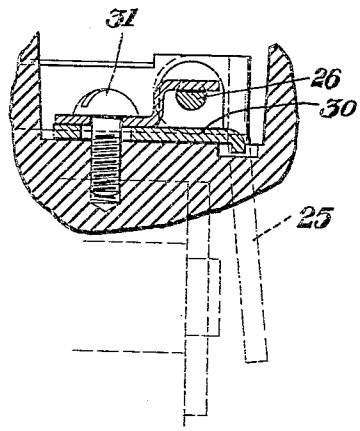

FIG. 5.

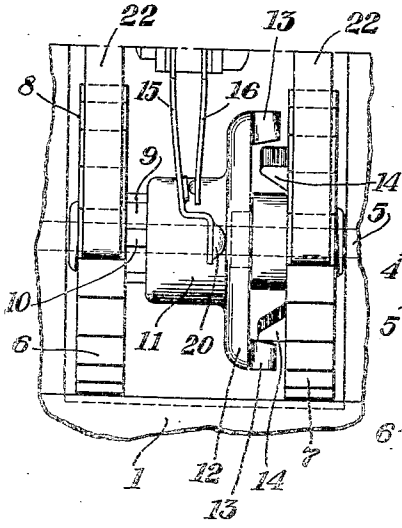

FIG. 4.

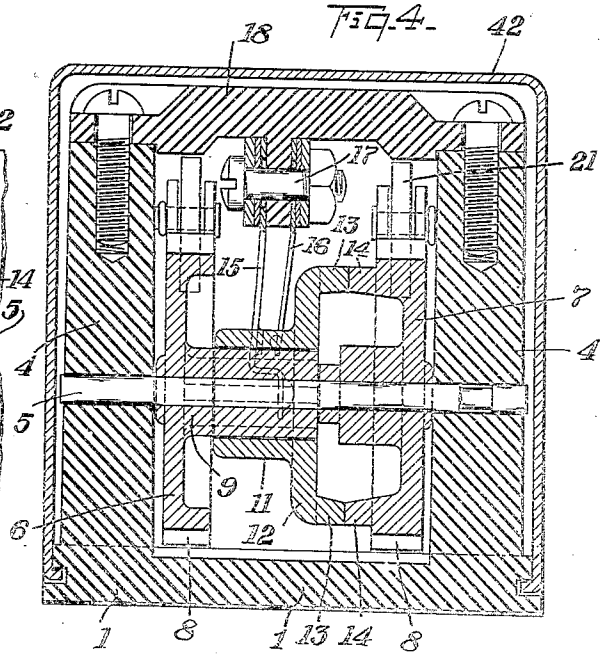

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Fig. 7.

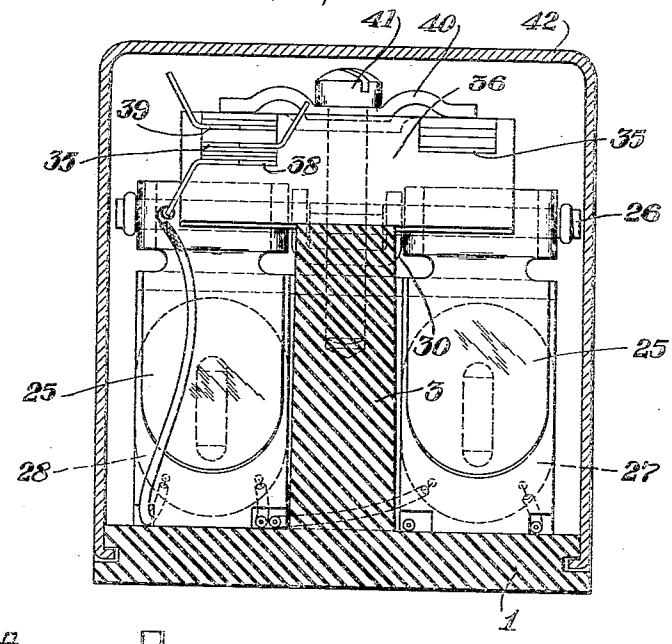
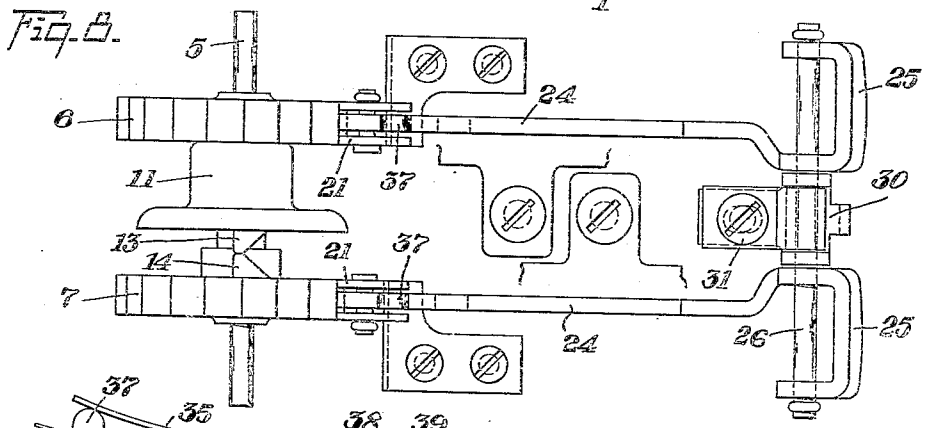


Fig. 8.



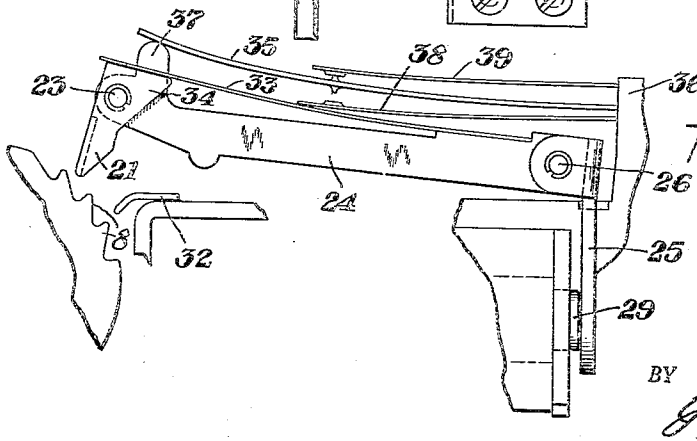


Fig. 9.

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IMPULSE STORING AND REPEATING DEVICE

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Application March 31, 1945, Serial No. 586,005

9 Claims. (Cl. 179—16)

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This invention relates to dial impulse storing and repeating devices designed for employment in telecommunications systems such as in automatic or semi-automatic telephone exchange systems and the like. An object of the present invention is to make provision for receiving electrical impulses, to store the impulses received and, dependent on circuit conditions, to later or simultaneously therewith, retransmit or repeat the received impulses in properly timed relation to receiving apparatus such as the register of an automatic exchange.

As illustrative of a typical use of the present apparatus it may be employed in association with an incoming trunk to a register of an automatic exchange of the multi-potential selection type from a Strowger office not provided with a register or other means of storing the call pending the picking up of the register. An example of such use is disclosed in co-pending application Serial No. 484,184, filed April 23, 1943, now Patent No. 2,380,950, dated Aug. 7, 1945. In a straight Strowger exchange, as is well understood, no means is provided for storing of the digit impulses for the short interval of time required to pick up the trunk register. Moreover, in the transmission of the dialling impulses from the Strowger office, particularly when working under maximum traffic conditions, the dialling of a low digit, such as 1, may occur in such rapid succession as to be short of the time requirement for the selection at the receiving exchange such as when all but the last few trunks in the selected level of a group selector are busy. Under the first-mentioned conditions wherein there is no adequate time interval available for register selection it is necessary that the first digit trunked into an automatic office from a Strowger office be stored in the trunk itself and further that a full inter-digital time period be provided for register selection. The device of the present invention is designed for the storing and the repeating of the impulses under the prescribed conditions in a manner to effect the proper operation of the related receiving device or register. The improved device, to be so operative, consists of two driven parts, one of which advances in position with relation to the other responsive to the number of impulses received and wherein the other of the driven parts is caused to have a following movement during which the impulses are repeated until it reaches the advanced position of the first part by inter-engagement therebetween.

The foregoing and other features and advantages of the present improvements will be more

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fully understood by reference to the accompanying drawings wherein like reference characters are applied to the corresponding parts in the several views.

In the drawings,

Fig. 1 is a view of the improved impulse storing and repeating device showing same in side elevation with the cover shown in section;

Fig. 2 is a schematic view showing the circuit arrangement;

Fig. 3 is an end elevation taken from the left of Fig. 1 with the cover member shown in section;

Fig. 4 is a vertical cross sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is a partial view in end elevation corresponding to Fig. 3 with the parts thereof in changed or "leading" position;

Fig. 6 is a detailed vertical longitudinal sectional view of the armature mounting;

Fig. 7 is a vertical cross sectional view taken on line 7—7 of Fig. 1;

Fig. 8 is a skeletonized plan view of the moving parts of the mechanism; and

Fig. 9 is a partial view in side elevation of the follower magnet armature and associated ratchet feed and contact under the condition of magnet energization.

The improved apparatus and associated circuit arrangement of the invention, designed for the storing and repeating of received impulses, employs in its operation a stepping mechanism employing two driven parts which by inter-engagement open and close contacts for preparing an impulse repeating or re-transmitting circuit. One of the driven parts is stepped or advanced by a magnet responsive to the incoming or received impulses. The other of the driven members is stepped by a magnet under the control of interrupter contacts after the preparation of its energizing circuit by the leading or advanced relation of the first driven member with relation to that of the second and cooperating driven member.

In the preferred structural embodiment of the device illustrated in the drawings the impulse storing and repeating mechanism includes driven members in the form of similar rotatably supported ratchets rotated by magnet-controlled pivoted armatures carrying feed pawls engaging with the ratchet teeth to effect step-by-step rotation thereof. The mechanism as shown is supported upon a base or standard 1 having integrally formed therewith, a rear wall 2, a centrally positioned vertical supporting wall 3 and forwardly and op-

positely positioned brackets 4. Within apertures in the brackets 4 a transverse bearing shaft 5 is journaled upon which are freely rotatably mounted two ratchet wheels 6 and 7, of corresponding diameter and provided with similar ratchet teeth 8. The ratchet wheel 6, which is the received impulse operated or lead ratchet, is provided with a hub 9 formed with axially extending keys or splines 10 upon which is slidably mounted a switch actuating collar 11 having a radial flange 12 provided on one face with diametrically positioned laterally extending cam lugs 13. These lugs 13 project toward and cooperatively engage with coacting cam lugs 14—14 carried upon a face of the ratchet wheel 7. Relative rotation of the ratchet and inter-engagement of the lugs will accordingly effect shifting of the collar 11, thereby effecting the opening of contacts in the impulse repeating circuit, as will now be described. These contacts 15 and 16 are carried upon flat spring elements, supported by bolt 17 upon a bridge 18 in insulated relation, and each is provided with a terminal extension 19 as shown in Fig. 1. As shown in Fig. 5, when the cam lugs 13 and the coacting cam lugs 14 are disengaged whereby the collar 11 is shifted toward the ratchet wheel 7, the contacts 15—16 engage for closed circuit as the spring element 15 presses at its lower end against the flange 12 of the actuating collar 11. Engagement of the cams 13—14 causes axial shifting of the collar 11 to open the contacts as shown in Fig. 3. In the structural embodiment as shown (dotted lines in Fig. 1) each of the spring elements carrying the contacts 15 and 16 is forked to provide legs straddling the collar 11, and the extremities of these elements are formed as shown by laterally bending same toward the flange to provide offset engaging portions 20, each having a rounded surface pressing against the flange 12 to cause axial shifting of the collar 11 as above stated.

A uni-directional step-by-step rotation of each of the ratchets 6 and 7 is provided by similar magnetically operated feed pawls 21 coacting with the ratchet teeth. The customarily employed cooperating retaining springs 22 engaging with the ratchet teeth, are supported upon the bridge member 18 and retain the ratchets in the successive positions, opposing reverse movement thereof. The feed pawls 21, pivotally supported at 23 upon extensions 24 of armatures 25, are independently operable by means comprising a magnet structure including the coils 27 and 28 having the usual cores 29. The armatures 25 are pivoted at 26 upon brackets 30 which, as is best shown in Fig. 6, are secured in position by screw 31 to permit armature-magnet air gap. The magnetic ratchet rotating mechanism above-described will be understood to be of corresponding construction for each of the ratchets 6 and 7 and each further includes adjustable stops 32, engaging the under sides of the feed pawls to limit the downward movement thereof, flat springs 33, supported upon the arms 24 and engaging rearward extensions 34 of the pawls, resiliently to urge the latter into contact with the ratchet teeth and return or feed springs 35, supported upon a bridge 36 and engaging lugs 37 of the armature extensions 24 to effect downward or feed movement of the pawls and rotation of the ratchet wheels upon each release of the armature. Insofar as now described, the two magnetic ratchet feed devices operated by the two magnets are similar structures but in the case of the magnet element including coil 28

associated with the follower ratchet 7 the mechanism further includes switch elements operated by the return spring 35, which is insulatingly supported and carries contact element engaging contact elements carried by coacting resilient and insulatingly supported springs 38 and 39. It will be understood that spring 35, in its normal position as shown in Fig. 1, causes engagement of the contact element carried thereon with the coacting contact element carried on the leaf spring 39, thus a circuit including the springs 35 and 38 is normally completed and a circuit including springs 35 and 39 is normally incompleted. Spring 39, it will be noted in Fig. 1, is retained in fixed position by a stop 43. As shown in Fig. 7, the return spring 35, contact springs 38 and 39 and associated insulating washers are supported in position upon the bridge 36 by a yoke 40 secured by a single screw stud 41. A cover 42 is provided as shown for the protection of the operating mechanism.

An operating circuit including the hereinabove described device is shown diagrammatically by way of example in Fig. 2 wherein the coil 27 of the lead ratchet operating magnet is connected through terminal 44 to trunk 45 of a Strowger exchange and to the negative battery terminal 46. The lead ratchet wheel 6 is accordingly rotated stepwise in response to the impulses received from this independent circuit. The follower ratchet operating magnet 28 for creating impulses in the repeating circuit is controlled by the switch elements 15—16 and additionally by a switch 59 which will be understood to be closed in any known manner as soon as the register is connected. The circuit for magnet 28 extends over lead 47 from the positive battery terminal 48, the switch elements 15 and 16, lead 49, terminal 50, lead 51, switch 59, terminal 54, the leaf spring switch elements 35, 38, magnet 28, lead 55 to the negative terminal 46. The impulse repeating circuit extends over a stepping relay 60 in the register, lead 58, terminal 57, the leaf spring switch elements 39, 35, terminal 54, switch elements 59, 16, 15 to the positive battery terminal. Accordingly, the operation of the follower ratchet controlling magnet 28 is dependent first upon the closing of the control switch elements 15—16 and on completion of the circuit over the switch 59, and it continues to step until the switch elements 15—16 are opened by engagement of a lug 14 on the ratchet 7 with a lug 13 of the flange 12 rotated by the ratchet 6.

The operation of the device above-described is as follows: the cam lugs 13 and 14 are in engaged relationship accordingly switch elements 15 and 16 are not in contact and accordingly no current flows from the battery through magnet coil 28. As impulses are transmitted in the trunk lines, circuit normally is completed from the trunk with the register and switch 59 is accordingly closed, but should circuit not be completed from the trunk with the register, switch 59 is moved to open circuit position. The impulses from the trunk, meanwhile, have caused stepwise rotation of the lead ratchet 6 by energization of the magnet coil 27 which is connected across the trunk terminals 44 and 46, and as this ratchet is rotated the engaging lugs 13 and 14 are disengaged thereby permitting the spring pressing member 15 to shift the collar 11 axially causing closing of the switch elements 15—16. When this occurs and if circuit is completed between the trunk and the register, the magnet coil 28 is then connected through closed switch

59 in closed circuit with the battery, thereby receiving an impulse which results in stepwise rotation of the follower ratchet 7, engagement of the cam lugs 13—14 and opening of the switch elements 15—16. Each impulse thus received by the magnet coil 28, as it causes operation of the corresponding armature results in momentary contact between the contact elements carried on the leaf springs 35 and 39 whereby corresponding impulse currents are transmitted to the stepping relay of the register causing it to select the corresponding line. If however, the trunk has not been connected to the register, switch 59 is in open circuit position, hence the transmission of digit selecting operating impulses to the stepping relay is postponed until such connection is established, but when this occurs magnet coil 28 is energized and the mechanism transmits the impulses as above-described.

What is claimed is:

1. An impulse storing and repeating device comprising lead and follower driven members supported and formed for inter-engagement to establish a coacting position, a first magnet to advance the lead member responsive to received impulses, a second magnet to advance the follower member, an energizing circuit for the second magnet including a control switch adapted to be opened in the engaging position of the driven members and closed when the lead member is in advanced relation with respect to the follower member and interrupter contacts arranged to be actuated by said second magnet.

2. An impulse storing and repeating device comprising lead and follower driven members supported and formed for inter-engagement to establish a coacting position, a first magnet to advance the lead member responsive to received impulses, a second magnet to advance the follower member, a control switch adapted to be opened in the engaging position of the driven members and closed when the lead member is in advanced relation with respect to the follower member, and interrupter contacts arranged to be actuated by said second magnet.

3. An impulse storing and repeating device comprising lead and follower driven members supported and formed for inter-engagement to establish a coacting position, a first magnet connected to advance the lead member responsive to received impulses, a second magnet arranged to advance the follower member, an energizing circuit for the second magnet including a control switch adapted to be opened in the engaging position of the driven members and closed when the lead member is in advanced relation with respect to the follower and repeating contacts closed responsive to each actuation of said second magnet.

4. An impulse storing and repeating device comprising lead and follower ratchet driven members rotatably journalled and formed for inter-engagement to establish a coacting position, a first magnet for stopping the lead member responsive to received impulses, a second magnet for stepping the follower member, an energizing circuit for said second magnet including a control switch adapted to be opened in the engaged position of the driven members and closed when the lead member is in advanced relation with respect to the follower member, self-interrupter contacts for said second magnet and impulsing contacts for actuation each time said second magnet is operated.

5. An impulse storing and repeating device

comprising lead and follower ratchet driven members rotatably journalled and formed and supported for shifting engagement to establish a coacting position, a first magnet having a spring pressed armature provided with a feed pawl positioned to advance the lead member responsive to received impulses, a second magnet positioned to advance the follower member, an energizing circuit for the second magnet including a control switch adapted to be opened in the engaged position of the driven members and closed when the lead member is in advanced relation with respect to the follower member, and an impulse repeating circuit connected to be closed over said control switch and over further contacts controlled by said second magnet.

6. An impulse storing and repeating device comprising lead and follower ratchet members rotatably supported, one of said ratchets having a shiftable collar and formed with a lug for inter-engagement with a lug on the other ratchet to establish a coacting position by shifting of the collar, a control switch having a movable contact engaged by the collar, a first magnet operative to advance the lead ratchet step by step responsive to received impulses, a second magnet operative to advance the follower ratchet, an energizing circuit for the second magnet including the control switch adapted to be opened in the engaged position of the ratchet members and closed on advanced positioning of the lead ratchet, means for intermittently energizing said second magnet, impulse repeating contacts controlled by said second magnet and an impulse repeating circuit connected to be closed responsive to each energization of said second magnet.

7. An impulse storing and repeating device comprising lead and follower ratchet members supported for relative rotation and provided with means for inter-engagement to establish a coacting position, a first magnet having a movable armature operative to advance the lead ratchet step by step responsive to received impulses, a second magnet having a movable armature operative to advance the follower ratchet, a contact group comprising front and back contacts actuated by the armature of the second magnet, an energizing circuit for the second magnet connected to said front contacts and including a control switch connected to be opened in the engaged position of the driven members and closed on advanced positioning of the lead member, and an impulse repeating circuit connected to said back contacts.

8. An impulse storing and repeating device comprising lead and follower ratchet members rotatably supported in axial alignment, a collar provided with a lateral cam slidably fitted to one ratchet, the other ratchet having a coacting cam for inter-engagement to establish a co-related position, a first magnet operative to advance the lead ratchet member step by step responsive to received impulses, a second magnet operative to advance the follower ratchet member, an energizing circuit for the latter magnet including a control switch having a movable contact engaged by the collar to be opened on the co-related positioning of the driven ratchets and closed on advanced positioning of the lead ratchet, means for intermittently energizing said second magnet and an impulse repeating circuit connected to be closed responsive to deenergizing of said second magnet.

9. An impulse storing and repeating device comprising lead and follower driven members ro-

tatably supported and formed for inter-engagement to establish a coacting position, a first magnet operative to advance the load member step by step responsive to received impulses, a second magnet operative to advance the follower member, an energizing circuit for the latter magnet including a control switch adapted to be opened in the coacting positioning of the driven members and closed on advanced positioning of the lead member, means for intermittently energizing said second magnet, an impulse repeating circuit and contacts for closing the repeating circuit responsive to opening of said energizing circuit.

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