

Nov. 26, 1929.

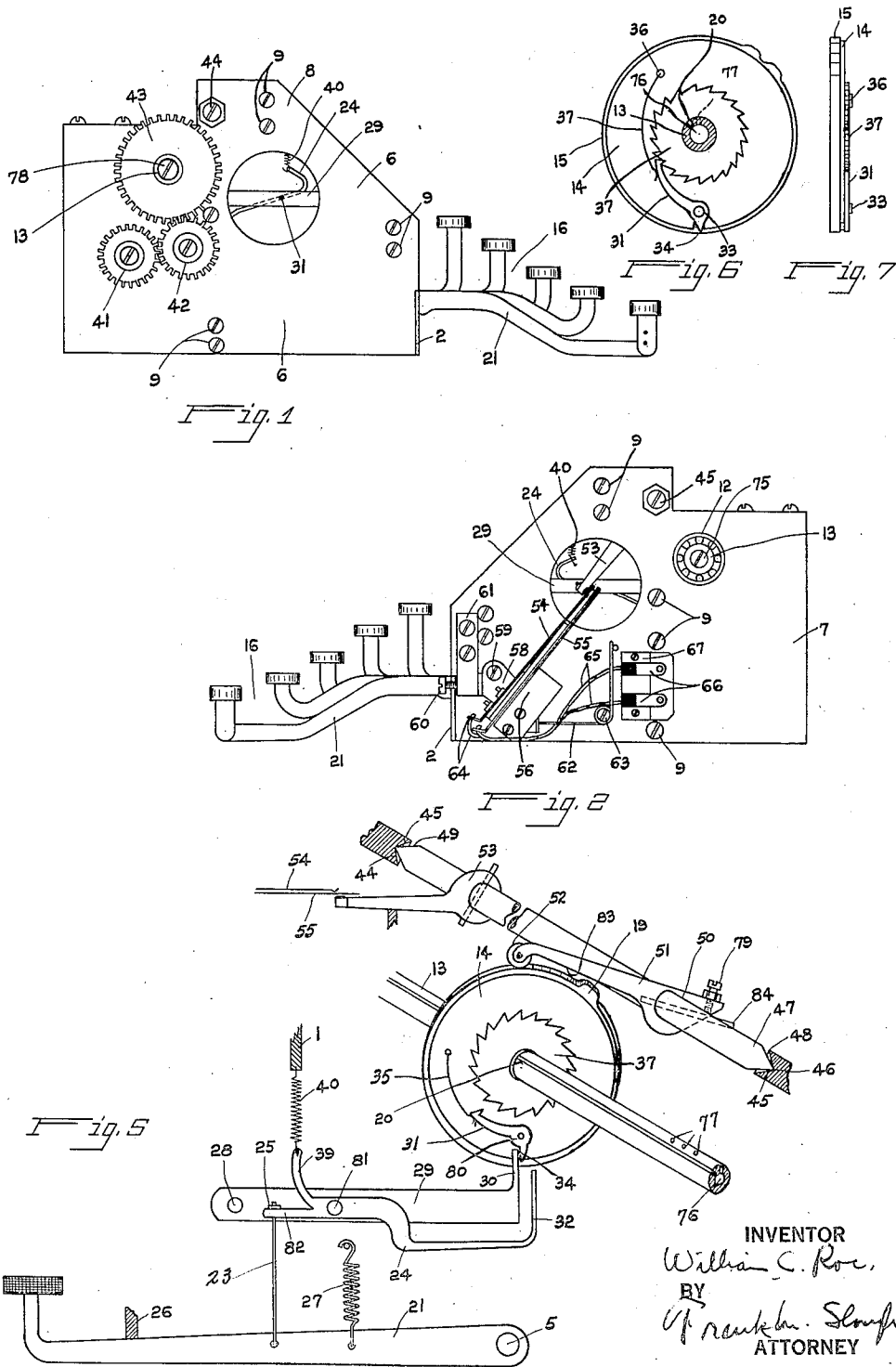
W. C. ROE

1,737,024

ELECTRICAL CODE TRANSMITTER

Filed Sept. 11, 1926

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

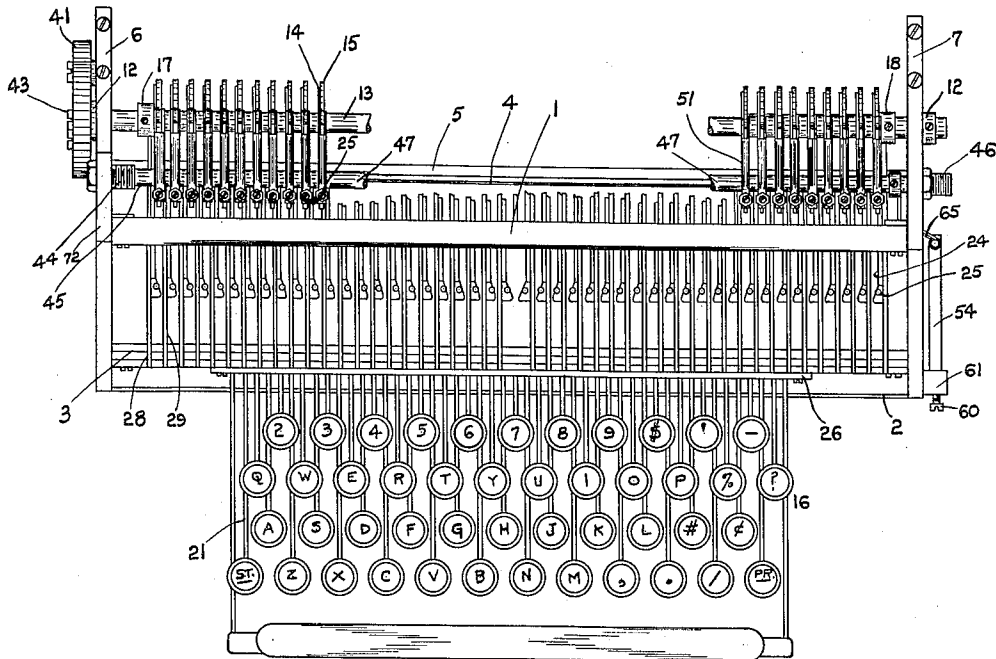


Fig. 3

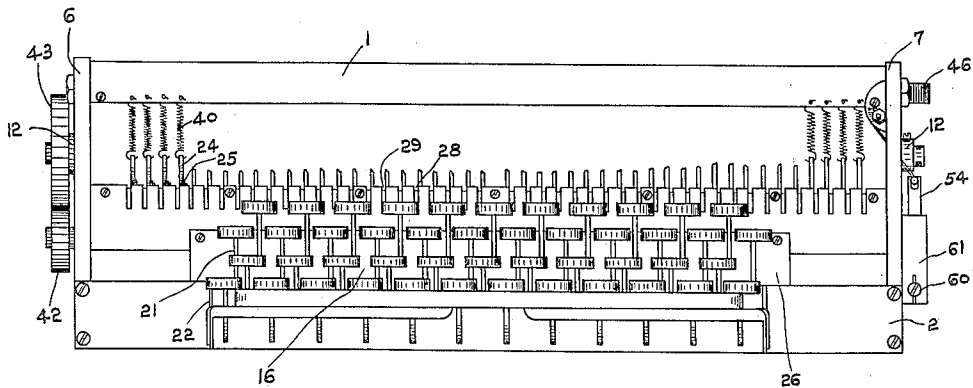


Fig. 4

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ELECTRICAL CODE TRANSMITTER

Application filed September 11, 1926. Serial No. 134,884.

My invention relates to improvements in electrical code instruments and relates more particularly to code instruments of a type adaptable for use in connection with printing telegraph systems.

5 An object of my invention is to provide an improved electrical code transmitter employing a keyboard, comprising keys by the manipulation of which current impulses may be produced in an electrical signaling circuit in a highly efficient manner.

10 Another object of my invention is to accomplish the production of current impulses in an electrical signaling circuit by the operation of highly improved positively operating apparatus.

15 Another object of my invention is to dispense with the multiplicity of contact sets heretofore commonly provided for the purpose of producing current impulses in a signaling circuit, each of their contact sets being associated with one of the plurality of signaling keys provided.

20 Another object of my invention is to provide a mechanism of the above character in which a selected impulse sending element is started in operation by merely depressing a key associated with such element and whereby the element will complete its cycle of operation, regardless of the period of time the key is depressed.

25 Other objects of my invention comprise features of improvement of the mechanism herein described and such and other objects of my invention will become apparent as the following description of an embodiment of my invention progresses, and in which description reference will be had to the accompanying drawings illustrating such embodiment.

Referring to the figures of the drawings:

Fig. 1 is a side elevation of the left end of my telegraphic transmitting apparatus;

45 Fig. 2 is a similar view of the right hand end of the apparatus;

Fig. 3 is a top plan view of the apparatus reduced one-half the size of the actual apparatus;

50 Fig. 4 is a front elevation of the same;

Fig. 5 is a schematic view of one of the keys and its associated parts;

Fig. 6 is a side elevation of one of the cam face wheels; and

Fig. 7 is an end elevation of the same.

53 Referring more particularly to the drawings, I have provided a supporting frame for my apparatus preferably comprising a plurality of horizontal bars 1, 2, 3, 4 and 5, arranged parallel to each other on different planes, and rigidly secured in any suitable manner to a pair of vertically disposed side plates 6 and 7. Preferably the frame sections are secured together by means of a series of screws 9 to enable the apparatus to be 60 disassembled with little difficulty.

The horizontal bars 1, 2, 3, 4 and 5, referred to, are adapted for various other functions in this apparatus aside from supporting the vertical side plates 6 and 7, which 70 functions will be more fully described in other portions of the specification.

75 Referring particularly to Fig. 3 of the drawings, I have provided a hollow shaft journaled to rotate in, preferably, ball bearing races 12, mounted in any suitable manner in the side plates 6 and 7. The shaft 13 is hollow to provide a chamber 76 for the reception of a lubricant and will be more fully described in a later portion of the specification. Carried by the hollow shaft 13, and 80 nestled together by fasteners 17 and 18 at each end of the hollow shaft in any suitable manner to prevent lateral displacement, I have provided a plurality of slotted disks 14 85 locked into engagement with the hollow shaft 13 when any one of the keys in the bank of the standard typewriter keyboard 16 is depressed. When a key is depressed the pawl 31 is engaged, by the action of the spring 90 35, with the ratchet wheel 37 keyed to the shaft 13. The lug 20 fitting in the slot 38 in the hollow shaft 13 locks the pawl 31 to the shaft and the slotted disks 14 and the cam wheel 15 are interlocked with the hollow 95 shaft 13 thereby causing rotation of the entire unit.

The hollow shaft 13 is rotated in any suitable manner. One of the preferred forms adopted receives its power preferably from 100

an electric motor, not shown, which drives the intermediate gears 41 and 42 journaled in the side plate 6 of the frame. The intermediate gear 42 is meshed with gear 43, secured to the hollow shaft 13 and imparts rotary motion to the shaft 13 when the electric motor is in operation.

The slotted disks 14 and cam faced wheel 15 are normally disconnected and are connected through the pawl 31 and ratchet wheel 37.

The standard key levers 21 are pivoted to the horizontal cross bar 5 and are guided in vertical slots formed in the horizontal plate 2, to limit the downward movement of the key levers 21 when the same are depressed. A stop plate 26 is disposed above the series of key levers 21 to limit the upward travel of the key levers 21 by the force exerted by the coil spring 27.

Connected to the key levers 21 near their pivots are upwardly extending curved links 23 (Fig. 5). The adjustable links 23 are bent at angles upwardly and to the right and left with respect to each of the levers 21. Adjustment of the links 23 is obtained by screw threading the upper ends. In this way the length of the curved links 23 may vary the pull on the levers 24 to which their upper ends are secured by an adjusting nut 25.

Pivoted to the horizontal bar 3, at 28, are a plurality of horizontal levers 29 supporting an upwardly projecting escapement finger 30 and adapted to pivotally support the locking lever 24, at 81, substantially at their centers. The inner end of the lever 24 is provided with an upwardly extending locking finger 32 which is forced upwardly into the slot 34 of the disk 14 in a manner which will be hereinafter more fully described. The outer end of the levers 24, adjacent to screw 25, carries an upwardly extending lug 39 to which coil springs 40 are secured. The upper ends of the coil springs 40 are anchored in any suitable manner to the horizontal bar 1, of the frame.

Screwed into the side plate 8 is a horizontally adjustable bearing 44 provided on its inner face with a concave wearing surface 45. In a like manner a similar bearing 46 is disposed in the plate 7 in direct alignment with the bearings 45 and having its wearing face turned towards that of the wearing face 45 of bearing 44. Supported in the bearings 44 and 46 is a horizontal shaft 47 having pointed ends 48 and 49 which are inserted into the bearing faces 45 so as to reduce any friction between the bearings 44 and 46 and the shaft 47 as much as possible.

Keyed at 50, (Fig. 5) to the shaft 47 are a multiplicity of inwardly projecting contact fingers 51 each provided with a roller 52 journaled therein, and disposed above the cam wheels 15.

Adjacent the pointed end 49 of the shaft 47, a contact lever 53 is secured to the shaft 47

and is adapted to close the spring contact arms 54 and 55. The spring contact arms 54 and 55 are fastened to an insulating plate 56 which is carried by an adjustable plate 58 adapted to be rotated about a pivot 59 on the side plate 7. This plate can be forced to the right by rotating the set screw 60 in the projection 61 on the side plate 7, against the tension of a spring 62 fastened at 63 to the side plate 7. When it is desired to increase the angular adjustment of the spring arms 54 and 55 with respect to the contact lever 53, a set screw 60 may be rotated to swing the plate 58 to the right, on its pivot 59, against the tension of the spring 62, carrying with it spring contact arms 54 and 55.

Referring to Fig. 5 in the drawings, I have shown the hollow shaft 13 provided with a series of small bores 77 on the upper face of the shaft. These bores are disposed in alignment with each one of the slotted disks 14 in such a manner that when the shaft 13 is rotated the lubricant contained in the hollow portion 76 of the shaft 13 may find a passage through the bores 77 and lubricate the sleeve holding cam 15 and slotted disc 14 as lubrication is required. The lubrication chamber 76 is provided with screw caps 75 and 78 at each end so that the lubricant may be replenished as required.

Referring now to the operation of my transmitter, a more comprehensive understanding may be had by reference to the schematic Fig. 5, of the drawings. All the units are similar to the combination shown in this figure with the exception of the indentations on the periphery of the cams. Inasmuch as all the units are alike the operation of one unit will now be described, it being understood that a group of these units is assembled on a common shaft and disposed parallel with each other.

As heretofore described the combination comprising a complete unit comprises a key lever 21, a connecting link 23, a set of escapement fingers 29 and 24, a ratchet wheel 37, a pawl 31, a slotted disk 14, a cam 19, a drive shaft 13, a contact finger 51, a finger shaft 47, a contact arm 53 and a set of contact springs 54 and 55. The shaft 13 is driven in any suitable way, such as by an electric motor, and keyed to the shaft is a ratchet wheel 37, which revolves with the shaft at all times. Closely associated with the ratchet wheel on shaft 13 is a cam 19 slotted disk 14 and a pawl 31 which as shown in Fig. 5 is combined as one unit on a sleeve. This unit is loosely carried on the drive shaft and is held stationary by the escape fingers when the unit is not being operated. The pawl is loosely mounted on the surface of the slotted disk adjoining the ratchet wheel and in such a manner that the hooked end can be engaged with the teeth of the ratchet wheel and, whereby the inside edge of the small right angle tail

projection 80 on the pivot end of the pawl is parallel to, and, adjoining the slot 34 in the disk 14. An angularly disposed end 30 of the escape finger 29 is shaped so as to enter the slot in the disk and hold the pawl clear of the ratchet wheel, and at the same time keep the cam and the disk from rotating. Should the finger 29 be withdrawn from the slot in the disk, the pawl will be brought into engagement with the ratchet wheel by the pawl spring 35 and the cam unit will be carried around with the rotating shaft 13. If now, the finger is released before one revolution of the disk takes place, the end of the finger will come into contact with, and ride on the edge of the disk, until such a time as it reaches the slot in the disk and the pawl thereon. Just before the end of the finger again enters the slot it will engage the angle portion 80 of the pawl, which at this time covers the slot due to its being in engagement with the ratchet wheel and, therefore, tipped at a greater angle, and will carry the same back and parallel with the slot. The pawl is thus disengaged from the ratchet wheel and the finger permitted to re-enter the slot, thereby locking the disk and cam against further rotation. This operation obtains when the finger 29 is released before one revolution of the shaft 13 is completed, since if the finger 29 is held away from the disk for a greater period of time, the cam unit would make more than one revolution which is not desirable. The escapement action of the two fingers 29 and 24 and the pawl 31, provides for automatically insuring correct operation in this respect. The finger 29 is pivoted at 28 at its end, opposite the disk; the finger 24 is pivoted on the finger 29 at about midway of its length. The right hand end of finger 24, adjoining the disk, is angularly so disposed and shaped as is the end of finger 29 so as to permit it to enter the slot in the disk and engage the end of the pawl, under certain conditions when obtained. The opposite end of the finger is bifurcated, one fork thereof, 39, being curved upwardly and at its end is secured an end of a helical restoring spring 40, attached at its other end to a support 1 and disposed to exert an upward effort substantially in a direction at right angles to the main portion of the finger 29. The other fork 82 extends toward the pivot 28. The adjustable link 23 forms the connection between the end of the fork 82 and key lever 21, the connection to 21 occurring at a point midway thereof.

If now, the key lever 21 is depressed, the link 23 will exert a downward pull on the extension 82 of finger 24 and the restoring spring 40. As the opposite end of the finger 24 does not touch the edge of disk 14 it will be raised up against the disk by virtue of rotating on its pivot 81 on finger 29.

During this movement of the finger 24, finger 29 will remain in its normal position, due to the relative positioning of the parts, the upward pull of the spring 40 being exerted on a three point suspension,—namely, the pivot rod 28 at one end, the disk at the opposite end and the pivot of finger 24 at its center. If, after the end of the finger 24 comes into contact with the disk, the link 23 is moved farther downward by depression of the key lever 21, the pivot point of finger 24 will be moved downward also, the end of the finger in contact with the disk acting as a pivot. As the finger 24 is pivoted on finger 29, this operation will cause finger 29 to be drawn down and rotated on its pivot rod 28 in the left-hand end. This movement of finger 29 will effect the withdrawal of its end 30 out of the slot 34 in the disk and free the disk 14. At the moment the finger is withdrawn from the slot 34, the pawl will be spring pressed into engagement with the ratchet wheel, and thus the cam unit will be rotated by the drive shaft. When one revolution thereof is nearly completed and the finger 24 is held against the disk by the pressure on the key lever, the end 32 of the finger 20 will enter the slot 34 and effect the disengagement of the pawl from the ratchet wheel, thus locking the cam unit as mentioned before. Now, the pressure on the key 21 being removed and the key returned to its normal position, the spring 40 will raise finger 29 into contact with the disk, after which with a continued upward movement finger 24 will be withdrawn from the slot 34 and through the operation of the pawl and ratchet wheel the cam unit will be advanced until finger 29 enters the slot 34 and again releases the pawl and locks the cam unit. The arrangement of the escapement as a whole is such that the cam unit will make but one revolution for each complete operation of the key lever, regardless of the length of time that the key lever is held in a downward position. The action of the two fingers on the disk and pawl is to always bring the idle finger into operative position before the withdrawal of the locking finger from the slot in the cam unit, the idle finger causing the release of the locking finger by the movement of the fulcrum points along the length of the fingers. The key lever used may be of the type common to all typewriters and requires no explanation. The cam section of the unit just referred to has a toothed edge, the teeth being so disposed thereon as to operate the contacts 54 and 55 according to the impulse code to be transmitted by that particular cam. In contact with and operated by the toothed cam is one end of a contact finger 51, this end of which holds a roller 52 for the reduction of friction between the finger and the cam. As shown in Fig. 5, the finger is constructed with a hole through the opposite end through which passes a

finger shaft 47. An adjusting screw 79 is preferably provided in the end projecting beyond the shaft 47. The finger has a slot 83 throughout its length receiving the roller 52 at its one end and a pin 84 rests within the slot at the other end of the finger. The finger is loosely mounted upon the shaft 47 and directly in line with the slot, a hole being cut through the shaft at right angles thereto, into which is secured the pin 84. The slot 83 is of such depth that the pin does not come into contact with the bottom of the slot 83, but at same time positions fingers on shaft 47. It can be seen that an upward movement of the finger by the cam will cause the shaft 47 to be rotated, and also that the shaft could be rotated in a clockwise direction, as seen from the right, without imparting any movement to the finger. Each time that the cam is rotated the irregular surface of the cam will cause the finger to be intermittently raised to impart movement to the shaft through the screw and pin 84, but in the case where two or more like cam units are mounted upon the same shaft, the operation of one cam and finger unit will not affect the others, as the shaft 47 can be rotated in a clockwise direction by any one unit and through the non-functioning of the screws and pins, the others will remain stationary.

Thus, a series of impulses are communicated to the contacts 54 and 55 through contact arm 53 from one of a number of cam units without interference. The contact arm 53 secured on shaft 47 causes the contacts 54 and 55 to be operated responsive to movements of any selected finger riding on the irregular surface of a cam. This construction makes it possible to use but one set of electrical contacts for an indefinite number of characters, resulting in a comparatively simple but positive impulse transmitter.

In operating the transmitter, the depression of any key will cause the cam associated with that key to make one revolution. Each cam, having a different series of teeth on its edge, will cause its associated contact finger to oscillate the finger shaft, which in turn will close and open the set of contacts 54 and 55 in unison therewith. In this way the desired series of impulses, corresponding with any character, can be transmitted over a wire.

It will be understood from the foregoing that the depression of one of the keys of the keyboard and its associated levers and cam wheel will cause this one cam wheel to be locked to the hollow supporting shaft and rotated thereon. The adjacent finger will be vibrated and oscillated on the finger shaft independently of the other fingers to close the contact at 53 and 54 by virtue of the fine individual adjusting pin and screw carried by each finger.

Having thus described my invention in a

specific embodiment, I am aware that numerous and extensive departures may be made from the invention herein illustrated and described but without departing from the spirit of my invention.

I claim—

1. In an electrical impulse sending mechanism, the combination with a set of electrical contacts, of a plurality of means for operating said contact set, said means comprising a rod, a plurality of lever arms extending laterally from the rod and secured thereto, a rotatable shaft disposed parallel with the rod, a plurality of impulse wheels on the shaft, a clutch for each impulse wheel, said clutch comprising a clutch element keyed to the shaft and rotatable therewith, a second clutch element adapted to cooperate with the first clutch element to effect driving engagement between the shaft and its associated impulse wheel, a key for each set of clutch elements adapted to initiate the clutching operation thereof, and means responsive independently of the continued operation of said key adapted upon a predetermined rotative movement of an impulse wheel to disable its associated clutch, one of said lever arms extending from the rod to the said contact set to communicate operative movements thereto, the other said lever arms each extending to one of the said impulse wheels and having a portion contacting therewith to receive rocking movements therefrom as the wheel is rotated responsive to operation of its associated clutch, rocking movements imparted to any of said lever arms imparting similar rocking movements to said first lever arm to operate the contact set.

2. In an electrical impulse sending mechanism, the combination with a set of electrical contacts, of a plurality of means for operating said contact set, said means comprising a rod, a plurality of lever arms extending laterally from the rod and secured thereto, a rotatable shaft disposed parallel with the rod, a plurality of impulse wheels on the shaft, a clutch for each impulse wheel, said clutch comprising a clutch element keyed to the shaft and rotatable therewith, a second clutch element adapted to cooperate with the first clutch element to effect driving engagement between the shaft and its associated impulse wheel, a key for each set of clutch elements adapted to initiate the clutching operation thereof, and means responsive independently of the continued operation of said key adapted upon a predetermined rotative movement of an impulse wheel to disable its associated clutch, one of said lever arms extending from the rod to the said contact set to communicate operative movements thereto, the other said lever arms each extending to one of the said impulse wheels and having a portion contacting therewith to receive rocking movements therefrom as the wheel is rotated responsive

to operation of its associated clutch, rocking movements imparted to any of said lever arms imparting similar rocking movements to said first lever arm to operate the contact set, means associated with each said key adapted to lock its associated impulse wheel in a given rotative position, said means being responsive to an operative movement of said key to disable said locking means.

3. In an electrical impulse sending mechanism, the combination with a set of electrical contacts, of a plurality of means for operating said contact set, said means comprising a rod, a plurality of lever arms extending laterally from the rod and secured thereto, a rotatable shaft disposed parallel with the rod, a plurality of impulse wheels on the shaft, a clutch for each impulse wheel, said clutch comprising a clutch element keyed to the shaft and rotatable therewith, a second clutch element adapted to cooperate with the first clutch element to effect driving engagement between the shaft and its associated impulse wheel, a key for each set of clutch elements adapted to initiate the clutching operation thereof, and means responsive independently of the continued operation of said key adapted upon a predetermined rotative movement of an impulse wheel to disable its associated clutch, one of said lever arms extending from the rod to the said contact set to communicate operative movements thereto, the other said lever arms each extending to one of the said impulse wheels and having a portion contacting therewith to receive rocking movements therefrom as the wheel is rotated responsive to operation of its associated clutch, rocking movements imparted to any of said lever arms imparting similar rocking movements to said first lever arm to operate the contact set, means associated with each said key adapted to lock its associated impulse wheel in a given rotative position, said means being responsive to an operative movement of said key to disable said locking means, a second impulse wheel locking means conditioned to lock the wheel responsive to the operation of the key to effect rotation of the wheel, and means carried by the wheel adapted to cooperate with said second locking means therefor to effect the locking of the wheel after a given predetermined rotation thereof.

4. In an electrical impulse sending mechanism, the combination with a set of electrical contacts, of a plurality of means for operating said contact set, said means comprising a rod, a plurality of lever arms extending laterally from the rod and secured thereto, a rotatable shaft disposed parallel with the rod, a plurality of impulse wheels on the shaft, a clutch for each impulse wheel, said clutch comprising a clutch element keyed to the shaft and rotatable therewith, a second clutch element adapted to cooperate with the first

clutch element to effect driving engagement between the shaft and its associated impulse wheel, a key for each set of clutch elements adapted to initiate the clutching operation thereof, and means responsive independently of the continued operation of said key adapted upon a predetermined rotative movement of an impulse wheel to disable its associated clutch, one of said lever arms extending from the rod to the said contact set to communicate operative movements thereto, the other said lever arms each extending to one of the said impulse wheels and having a portion contacting therewith to receive rocking movements therefrom as the wheel is rotated responsive to operation of its associated clutch, rocking movements imparted to any of said lever arms imparting similar rocking movements to said first lever arm to operate the contact set, said key means comprising a pair of levers, both of said levers having contact portions projected into the path of the rotatable wheel associated with said key, one of said levers pivoted at an intermediate point on the other lever, the other lever being pivoted at a point thereon disposed at an opposite side of the pivot point for the first lever from its contact portion, and retractile means adapted normally to hold the contact portion of the first lever out of engagement with the wheel and to hold said other lever contact portion in engagement with the said wheel.

5. In an electrical impulse sending mechanism, the combination with a set of electrical contacts, of a plurality of means for operating said contact set, said means comprising a rod, a plurality of lever arms extending laterally from the rod and secured thereto, a rotatable shaft disposed parallel with the rod, a plurality of impulse wheels on the shaft, a clutch for each impulse wheel, said clutch comprising a clutch element keyed to the shaft and rotatable therewith, a second clutch element adapted to cooperate with the first clutch element to effect driving engagement between the shaft and its associated impulse wheel, a key for each set of clutch elements adapted to initiate the clutching operation thereof, and means responsive independently of the continued operation of said key adapted upon a predetermined rotative movement of an impulse wheel to disable its associated clutch, one of said lever arms extending from the rod to the said contact set to communicate operative movements thereto, the other said lever arms each extending to one of the said impulse wheels and having a portion contacting therewith to receive rocking movements therefrom as the wheel is rotated responsive to operation of its associated clutch, rocking movements imparted to any of said lever arms imparting similar rocking movements to said first lever arm to operate the contact set, said key means comprising a pair of levers,

both of said levers having contact portions projected into the path of the rotatable wheel associated with said key, one of said levers pivoted at an intermediate point on the other lever, the other lever being pivoted at a point thereon disposed at an opposite side of the pivot point for the first lever from its contact portion, and retractile means adapted normally to hold the contact portion of the first lever out of engagement with the wheel and to hold said other lever contact portion in engagement with the said wheel, said key means comprising a key portion adapted to transmit a manually applied key operating impulse to the said first lever to move it into engagement with the said wheel, said other lever being responsive to the engagement of the first lever with the wheel upon continued pressure being applied to the key means to withdraw its contact portion from engagement with the wheel.

6. In an impulse sending mechanism, the combination with a plurality of impulse wheels, a plurality of manually operable keys of the typewriter type, each of said keys associated with a different one of said wheels, of a common set of electrical contacts for all said wheels, and means responsive to the depressing of one of said keys to rotate a selected wheel to actuate said contacts in accordance with the form of the wheel associated with said key, and means operable independently of the continued manual operation of said key, adapted to render said first named means inoperative after a single series of impulses, characteristic of the said wheel, is communicated to the contact set.

7. In an impulse sending mechanism, the combination with a plurality of impulse wheels, a plurality of manually operable keys of the typewriter type each of said keys associated with a different one of said wheels, of a common set of electrical contacts for all said wheels, and means responsive to the depressing of one of said keys to rotate a selected wheel to actuate said contacts in accordance with the form of the wheel associated with said key, and means operable independently of the continued manual operation of said key, adapted to render said first named means inoperative after a single series of impulses, characteristic of the said wheel, is communicated to the contact set, said impulse wheels being normally stationary, and means to communicate rotative motion to a single selected one of said wheels effective on operation of its associated key, and means responsive to a predetermined rotative movement of the wheel to lock it against rotation.

8. In an impulse sending mechanism, the combination with a plurality of impulse wheels, a plurality of manually operable keys of the typewriter type, each of said keys associated with a different one of said wheels,

of a common set of electrical contacts for all said wheels, and means responsive to the depressing of one of said keys to rotate a selected wheel to actuate said contacts in accordance with the form of the wheel associated with said key, and means operable independently of the continued manual operation of said key, adapted to render said first named means inoperative after a single series of impulses, characteristic of the said wheel, is communicated to the contact set, said impulse wheels being normally stationary, and means to communicate rotative motion to a single selected one of said wheels effective on operation of its associated key, and means responsive to a predetermined rotative movement of the wheel to lock it against rotation, said last named means being adapted to be disabled by said key upon a discontinuance of pressure applied to its key, and spring pressed means adapted thereupon to restrain said wheel from operation independently of said locking means.

9. In an impulse sender, the combination of a rotatable shaft, a plurality of impulse wheels loosely carried on said shaft, a clutch for each wheel adapted to clutch it to the shaft to effect its rotation, a set of key contacts a linkage adapted to communicate motion from a rotating one of said wheels to said contact set, and manually operable key means to operate a selected one of said clutches, said key means comprising a pair of levers for each wheel, one of said levers normally in locking engagement with said wheel, the other of said levers normally out of engagement with said wheel, said key means adapted to discontinue the locking engagement of said first lever with said wheel and to condition the second lever for locking engagement therewith, and means operative only after a predetermined rotative movement of the wheel to permit locking engagement of the second lever with the wheel, and means responsive to the withdrawal of the first lever from locking position to operate said clutch.

10. In an impulse sender, the combination of a rotatable shaft, a plurality of impulse wheels loosely carried on said shaft, a clutch for each wheel adapted to clutch it to the shaft to effect its rotation, a set of key contacts, a linkage adapted to communicate motion from a rotating one of said wheels to said contact set, and manually operable key means to operate a selected one of said clutches, said key means comprising a pair of levers for each wheel, one of said levers normally in locking engagement with said wheel, the other of said levers normally out of engagement with said wheel, said key means adapted to discontinue the locking engagement of said first lever with said wheel and to condition the second lever for locking engagement therewith, and means operative

only after a predetermined rotative movement of the wheel to permit locking engagement of the second lever with the wheel, and means responsive to the withdrawal of the first lever from locking position to operate said clutch, and means to render said clutch-operating means disabled upon the locking engagement of said second lever with the wheel.

11. In an impulse sender, the combination of a rotatable shaft, a plurality of impulse wheels loosely carried on said shaft, a clutch for each wheel adapted to clutch it to the shaft to effect its rotation, a set of key contacts a linkage adapted to communicate motion from a rotating one of said wheels to said contact set, and manually operable key means to operate a selected one of said clutches, said key means comprising a pair of levers for each wheel, one of said levers normally in locking engagement with said wheel, the other of said levers normally out of engagement with said wheel, said key means adapted to discontinue the locking engagement of said first lever with said wheel and to condition the second lever for locking engagement therewith, and means operative only after a predetermined rotative movement of the wheel to permit locking engagement of the second lever with the wheel, and means responsive to the withdrawal of the first lever from locking position to operate said clutch, and means to render said clutch-operating means disabled upon the locking engagement of said second lever with the wheel, said second lever pivoted at a portion intermediate the pivot and locking portion of said first lever.

12. In an impulse sending mechanism, the combination with a plurality of impulse wheels, of a rotatable shaft carrying the said wheels, said wheels being normally loosely mounted on the shaft, clutching means to clutch a selected one of said wheels to the shaft to effect rotation of the selected wheel of a contact set responsive to a selection of a wheel to make and break an electrical circuit, in accordance with the particular wheel selected, said shaft having a longitudinal bore and ducts extending laterally from said bore to the exterior of the shaft adjacent each wheel, and closures for the bore at its ends, said bore adapted to contain a supply of lubricant for the wheels.

In testimony whereof I hereunto affix my signature this 27th day of February, 1926.
WILLIAM C. ROE.