

March 4, 1947.

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2,416,688

CALL TRANSMITTER

Filed May 10, 1944

3 Sheets-Sheet 1

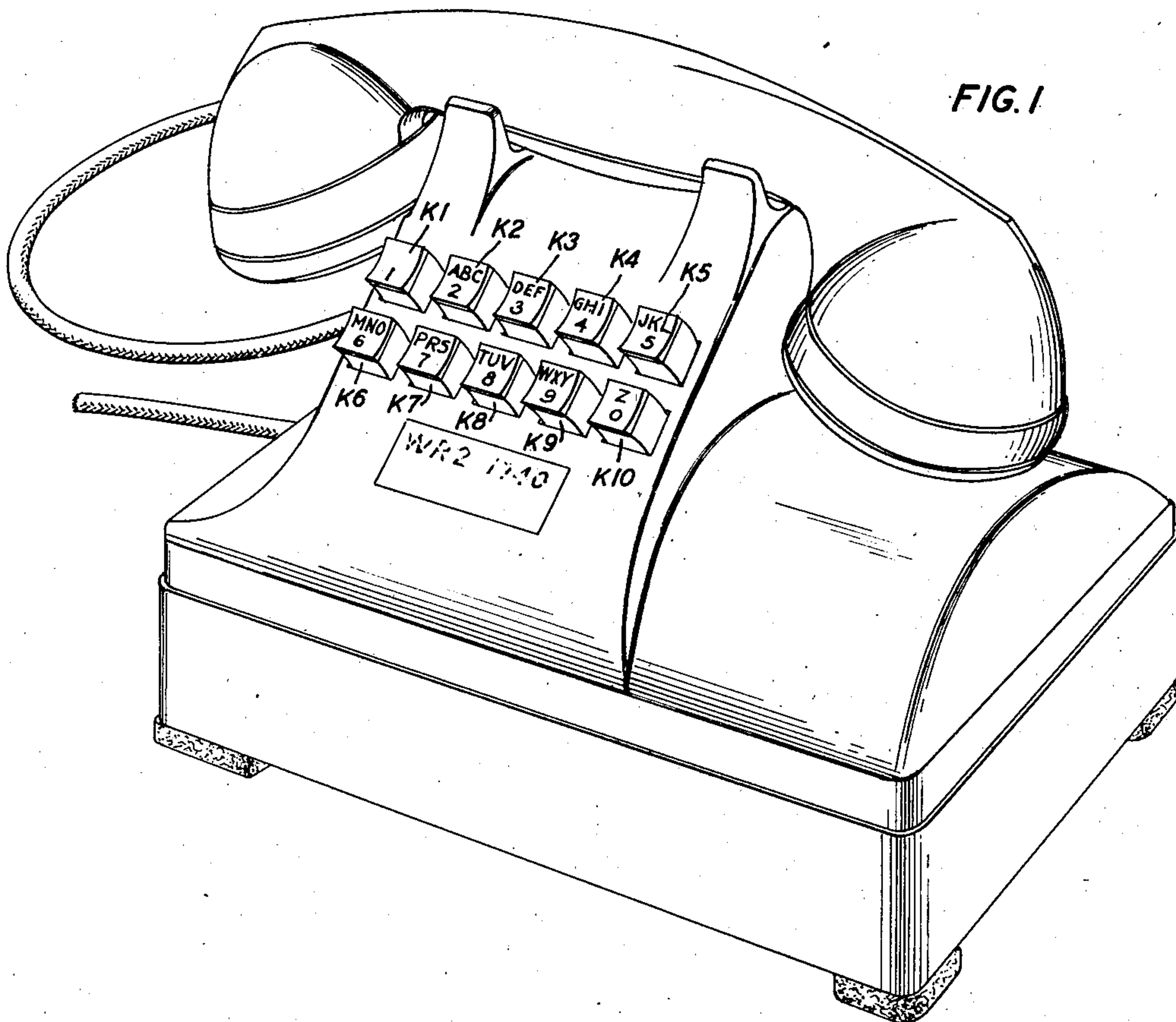
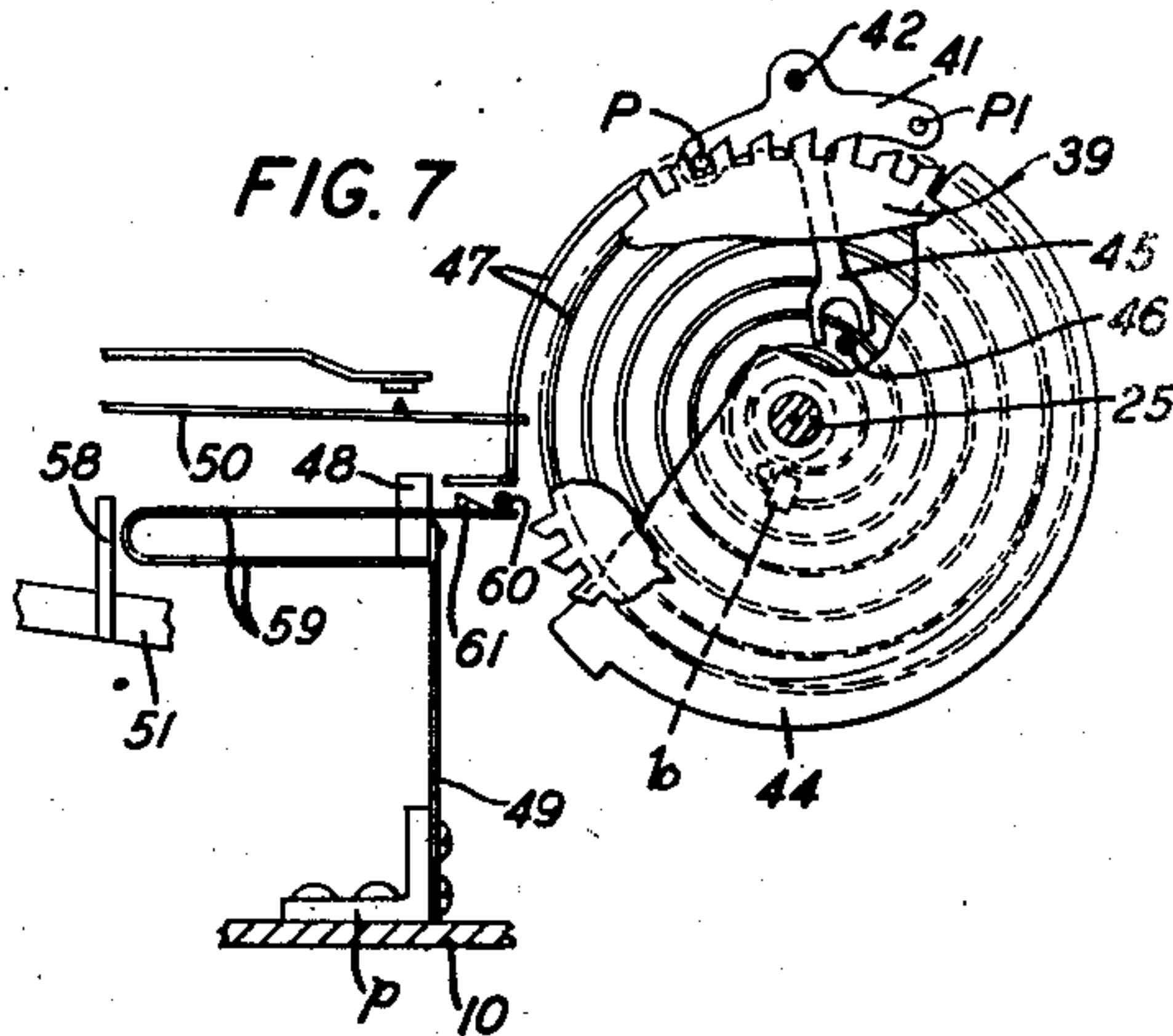
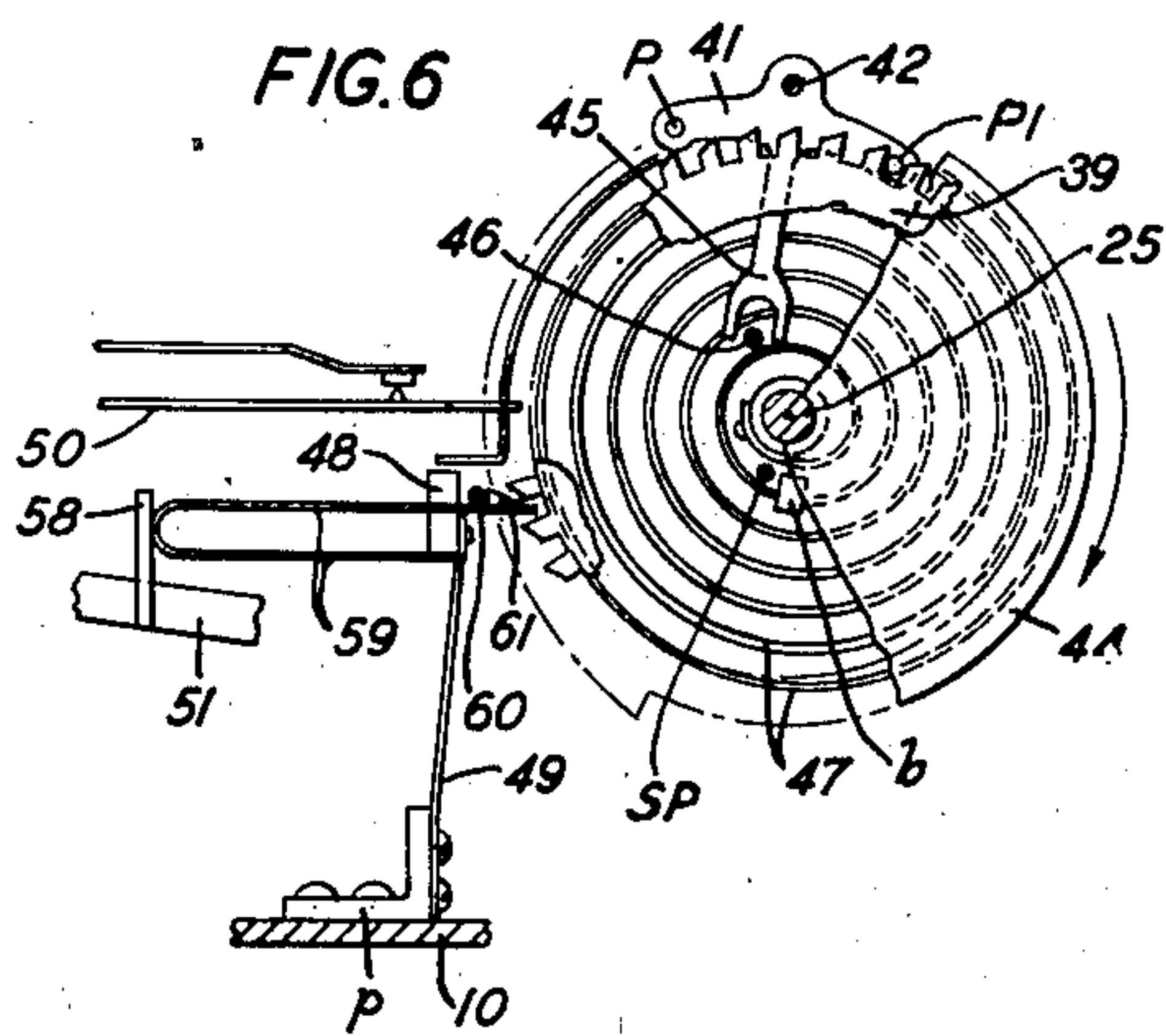


FIG. 1



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FIG. 2

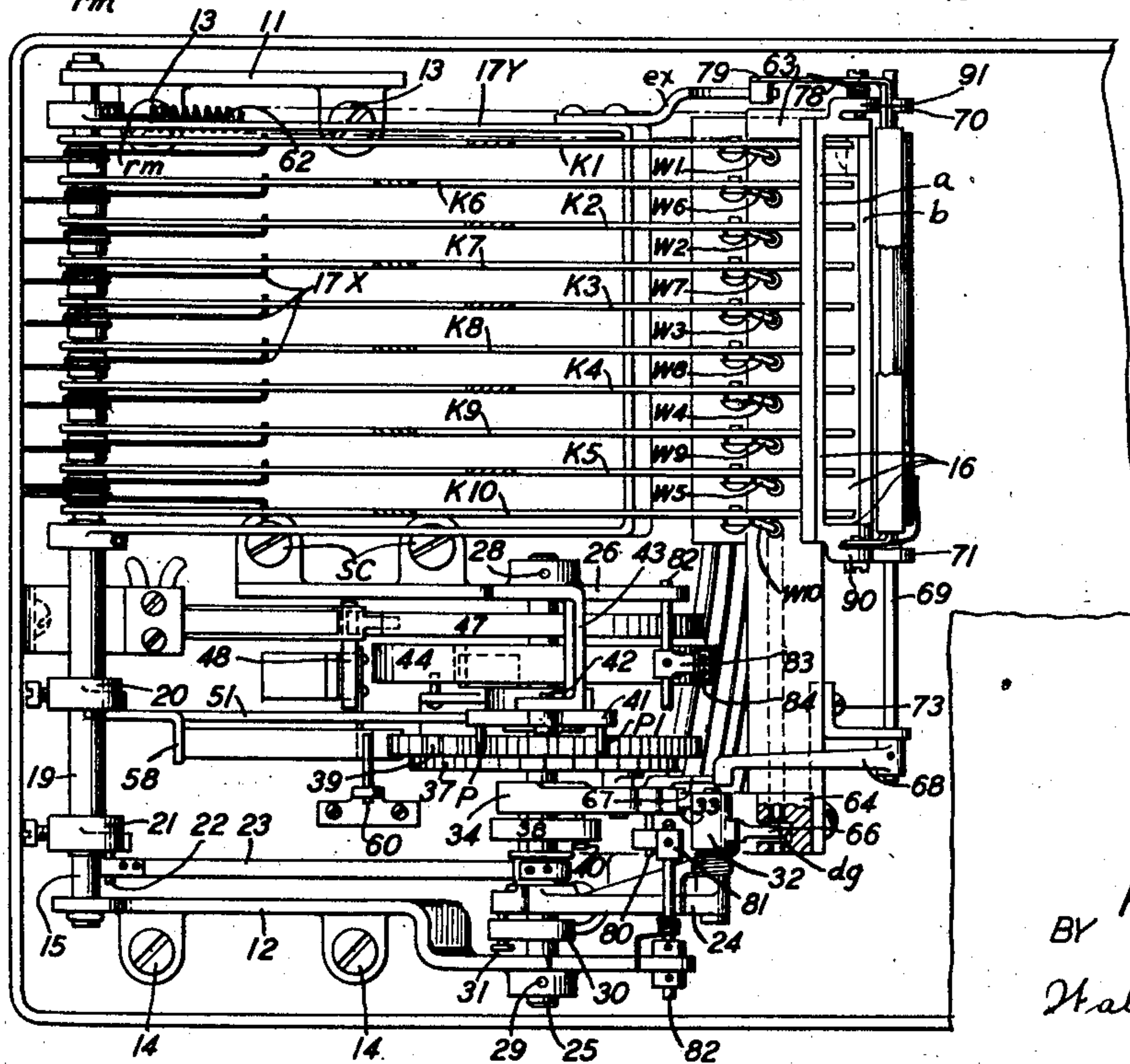
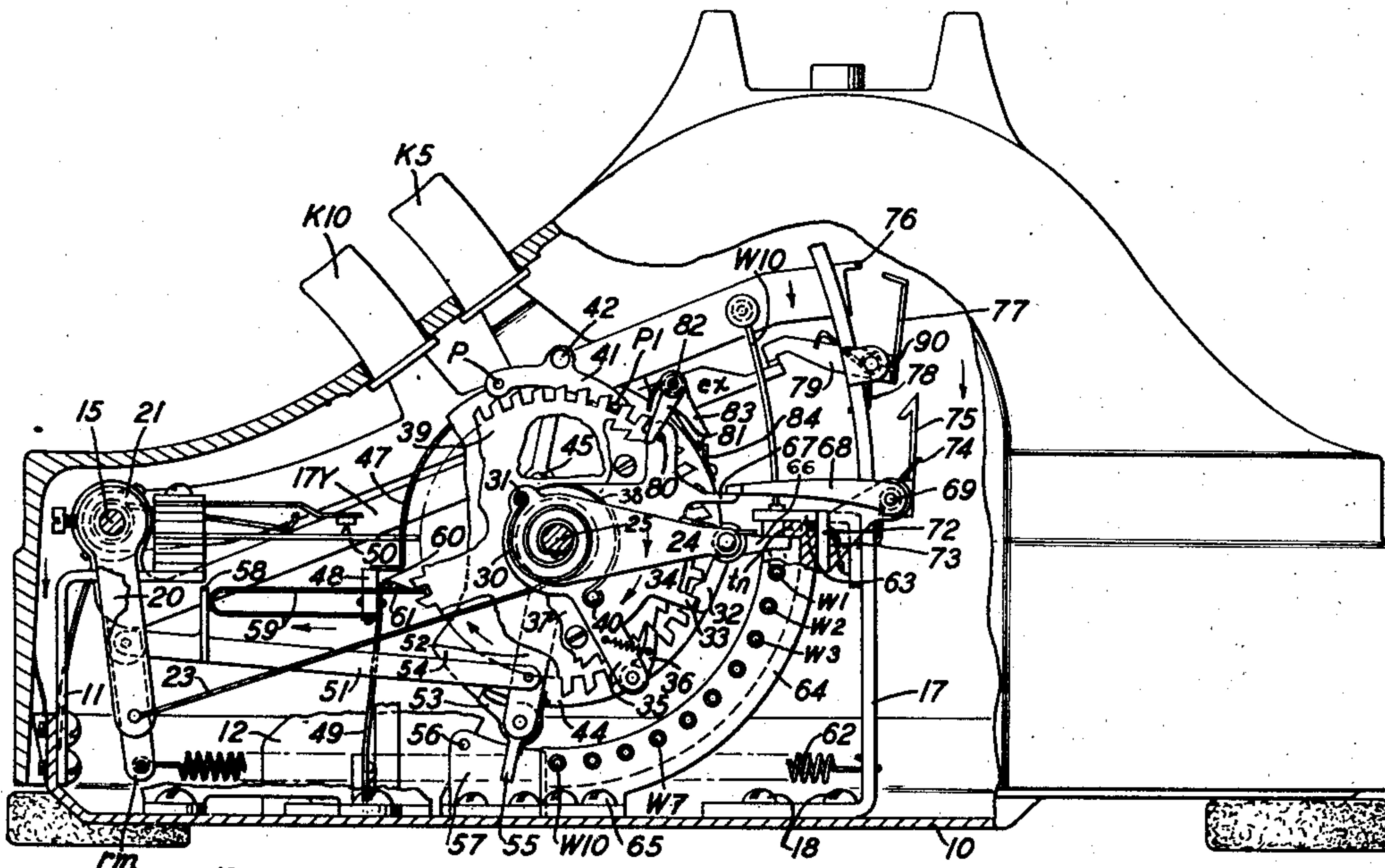


FIG. 3

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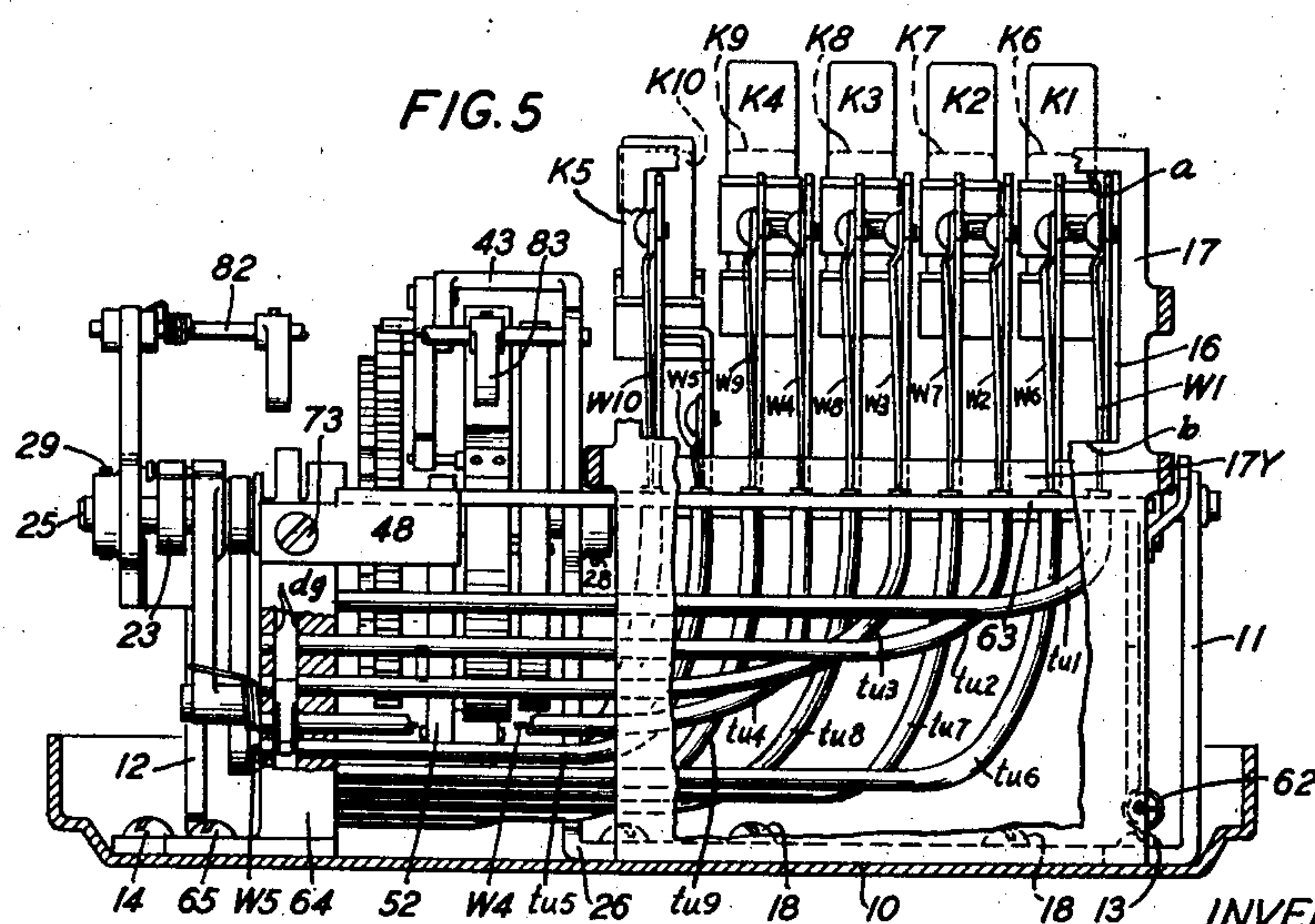
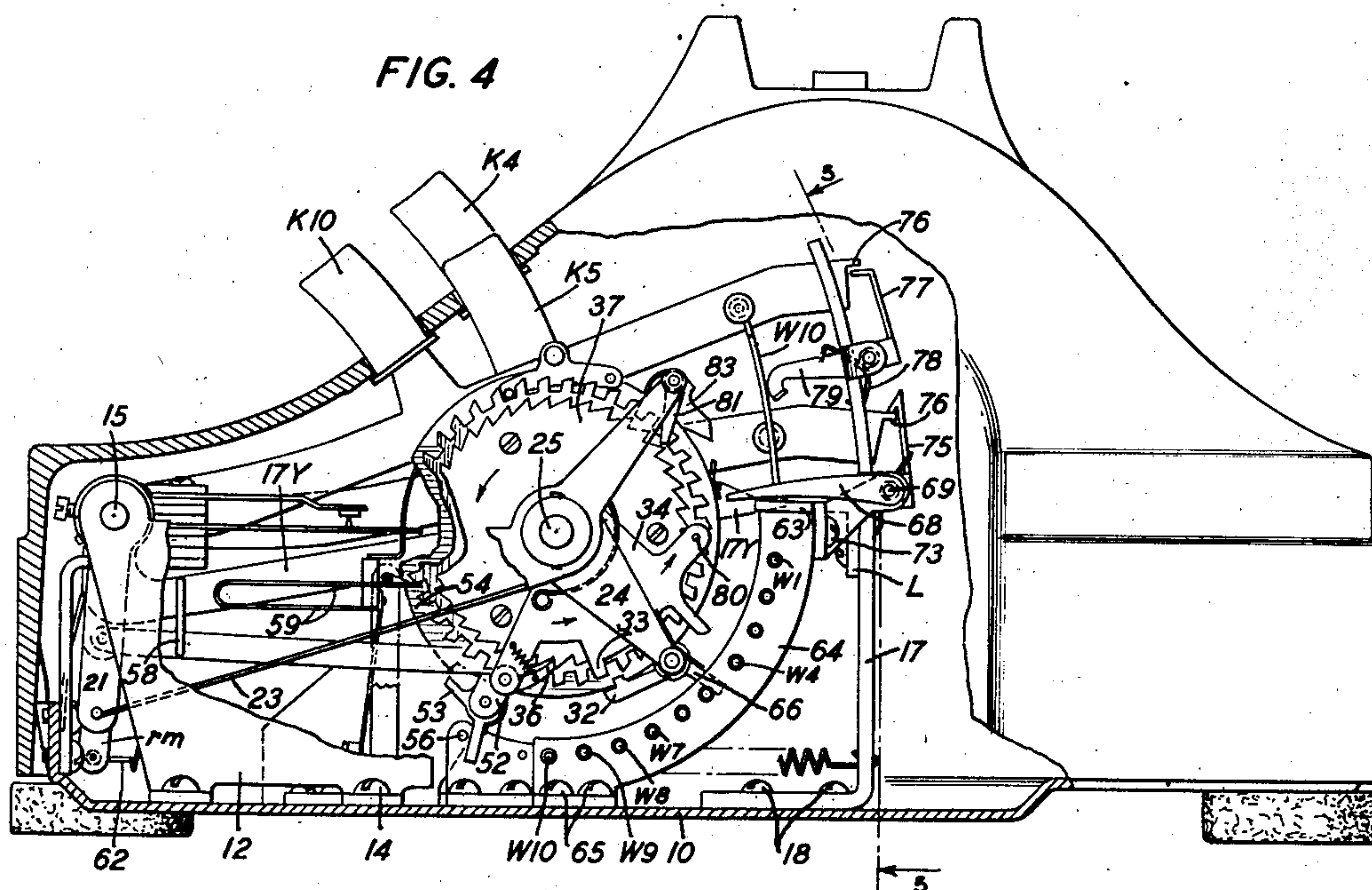
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3 Sheets-Sheet 3



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CALL TRANSMITTER

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10 Claims. (Cl. 177—380)

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This invention relates to key-operated contact breaking devices for use, for example, for controlling the operation of selector and connector switches at a telephone exchange for establishing talking connections.

The object of this invention is the provision of a switching device of the type above referred to, which will be simple in construction, convenient for use, positive and accurate in operation.

A feature of the invention is the provision of a time mechanism actuated by a motor the tension of which is effected by the operation of manually operated keys under comparatively light pressure.

A feature of the invention is the provision of means in the form of a common pivoted bar actuated by any key in a set of keys representing symbols, for simultaneously actuating elements of ratchet mechanisms for tensioning a motor spring, the function of which is to actuate a ratchet wheel and an escapement wheel forming parts of a time mechanism.

Another feature is the provision of means in the form of an anchor member in the time mechanism for imparting oscillatory movements to a balance wheel in response to the operation of the escapement wheel by the motor spring, the operation of the balance wheel successively tensioning a spiral spring having one of its end portions disposed for engagement with the operable element of a pulsing contact for actuating the latter once for each complete oscillation of the balance wheel.

Another feature is the provision of stop elements movable by the operation of the keys for controlling the operation of one element in the ratchet mechanisms for determining the number of oscillations of the balance wheel in the time mechanism and thereby the operation of the pulsing contact.

Another feature is the provision of means defining a movable stop normally positioned for preventing the operation of the operable element of the pulsing contact during the tensioning of the spiral spring by a ratchet element actuated by the movement of a common bar, the operation of such means causing the operation of a latching mechanism by the movement of the escapement wheel for permitting the operation of the contact upon the continued operation of the escapement wheel by the motor spring and the consequent continued oscillations of the balance wheel.

Another feature is the provision of means actuated by the return movement of one of the

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ratchet elements in the form of a sector-shaped plate to normal non-operated position for actuating means for stopping the movement of the balance wheel simultaneously with the release of the operated key and the consequent reengagement of the stop means with the spiral spring for controlling the operation of the contact in relation to the symbol represented by the depressed key.

Another feature is the provision of means whereby the operation of any one of the key members is effective to cause the automatic operation of a latching bar to lock the non-operated key in that position while means is provided for latching the depressed key in the operated position following the movement of the plate from normal to operated position.

Another feature of the invention is the provision of means in the form of a pivoted arm actuated by the return movement of the depressed key to normal non-operated position for engaging means carried by the balance wheel preparatory to the operation of the succeeding key for starting the operation of the balance wheel.

Other novel features of the invention and advantages will appear from the following description and by the claims appended thereto, reference being had to the accompanying drawings in which:

Fig. 1 is an elevation view shown in perspective, the keys being shown in normal non-operated position;

Fig. 2 is a right side elevation view shown with a number of operating parts in sectors, the keys and the operating mechanism being shown in normal non-operated position;

Fig. 3 is a top view of Fig. 2 shown with the casing housing the mechanism removed and with the base with portions broken away.

Fig. 4 is a right side elevation view showing one of the keys and the operating mechanism in the operated position;

Fig. 5 is a rear elevation view shown partially in section taken on line 5—5 of Fig. 4; and

Figs. 6 and 7 are detail views showing the contact and elements of the time mechanism in different operated positions.

In the switching device of this invention sometimes referred to as a call transmitter, a base 10 is provided for mounting the upright supports 11 and 12 which are secured at their lower ends to the base as by a number of screws 13 and 14 best seen in Fig. 3 and on the supports 11 and 12 is journaled a shaft 15 serving for pivotally mount-

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ing a set of key members at K1, K2, K3, K4, K5, K6, K7, K8, K9 and K10 having their free end portions extending through a common rectangularly-shaped opening 16 in an upright extending plate 17 secured at its lower end to the base 10 as by a plurality of screws 18. The parallel portions *a* and *b*, Figs. 3 and 5 of plate 17 forming the sides of the opening 16 serve to limit the movement of the keys K1, K2, etc., from normal to operated position while retractile springs 17X serve to return the keys K1, K2, K3, etc., to normal non-operated position, following each digit transmitting operation as will be hereinafter described in detail.

On shaft 15 is pivotally mounted a U-shaped bar 17Y shown in Figs. 2, 3, 4 and 5 held in operative relation with the key members K1, K2, K3, etc., by the tension of a retractile spring 62, having one end hooked to an arm *rm* formed with the bar 17Y and its other end to the upright plate 17. The operation of bar 17Y is effective to rotate a sleeve 19 having one of its ends secured to one arm of U bar 17Y and on this sleeve are keyed the downwardly extending arms 20 and 21, the latter arm being provided at its free end with a pin 22 serving for hooking one end of a metallic belt 23, the other end of which is secured and wound around the hub of a lever member 24 mounted for free rotation on a shaft 25 supported by the upright support 12 and support 26 secured to the base 10 by screws *sc* and is held against rotation on these supports by pins 28 and 29 as shown in Figs. 3 and 5. According to this construction the operation of any one of the key members K1, K2, K3, etc., and consequently that of the U-shaped bar 17Y is effective to impart a corresponding angular movement to the sleeve 19 and to the arms 20 and 21 carried thereby for actuating the arm 24 through the metallic belt 23 and thereby winding a spiral retractile spring 30 having its inner convolution secured to shaft 25 and its outer convolution hooked to a pin 31 carried by a projection formed with the arm 24.

The arm 24 is provided at its free end portion with a spring pressed pawl 32 normally engaging with a tooth or projection 33 formed at the periphery of a sector-shaped plate 34 best seen in Figs. 2, 3 and 4 pivoted on shaft 25. This plate is provided with a projection 35 for mounting a spring-pressed pawl 36 engaging a ratchet wheel 37 mounted for free rotation on the shaft 25 and actuated by the movement of sector plate 34 under the tension of a retractile spiral spring 38 having one of its ends secured to shaft 25 and its other end hooked to a pin 40 carried by the sector plate 34 so as to be tensioned by the angular movement of this plate as effected by arm 24 and pawl 32.

An escapement wheel 39 similar to that used in ordinary clock mechanisms is mounted on shaft 25 for free rotation as a unit with the ratchet wheel 37 under control of an anchor member 41. This anchor member is pivoted on a stud 42 extending laterally from a projection 43 formed integrally with the upright support 26. The anchor member 41 is provided with the usual laterally extending pins P and P1 for engaging with the teeth of escapement wheel 39 and the forked arm 45 of the anchor member 41 best seen in Figs. 2, 6 and 7 engages a pin 46 carried by the balance wheel 44 mounted for free rotation on shaft 25. A spiral spring 47 has the end of its inner convolution secured to the hub of balance wheel 44 and the end of its outer convolution ex-

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tends in engageable relation with an operable stop in the form of a block 48 mounted at the free end of a ribbon spring 49, the lower end of which is secured to an angle piece P in turn secured to the base 10.

The spiral spring 47 as shown in Fig. 6 at a point adjacent the end of its outer convolution is provided with a rectangularly-shaped slot through which the free end of an operable contact spring 50 extends for operation by the successive tensioning of spiral spring 47 as effected by the oscillation of the balance wheel 44 in a manner which will be hereinafter described in detail.

To the spiral spring 47 is secured a block piece *b* engaging a stationary pin SP upon the rotation of the balance wheel in the direction indicated by the arrow so that a faster build-up of the tension of the spiral spring is obtained during the closing period of the pulsing contact.

To the free end portion of arm 20 keyed on sleeve 19 is pivoted one end of a link bar 51, the opposite end of which connects with an arm 52 best seen in Figs. 2 and 4 pivoted on shaft 25. This arm is provided at its free end with a spring-pressed pawl 53 normally engaging with a ratchet tooth 54 formed at the periphery of balance wheel 44. This pawl is formed with an arm 55 disposed in engageable relation with a pin 56 laterally extending from an upright support 57 secured to the base 10, pin 56 serving to disengage the pawl 53 from the balance wheel 44 following the operation of the latter by the operation of arm 20 and link bar 51 as effected by the movement of U-shaped bar 17Y under control of any one of the keys K1, K2, K3, etc.

The link bar 51 is formed with a projection 58 normally engaging a hairpin-shaped spring member 59 having one of its ends secured to the underside of block 48 and the other end extending when spring 49 is flexed in engageable relation with one of the teeth of anchor wheel 39 as shown in Figs. 2 and 3 where it is normally held by a pin 60 engaged by a ratchet-shaped tooth projection 61 carried by the spring 59, the flexing of the spring 49 as shown in Fig. 2 being effected under the tension of retractile spring 62 connecting with the U-shaped bar 17Y.

To the key members K1, K2, K3, etc. are attached one end of piano wires as W1, W2, W3, W4, W5, W6, W7, W8, W9 and W10 which are fitted for sliding movement in guiding members in the form of tubing *tu1*, *tu2*, *tu3*, *tu4*, *tu5*, *tu6*, *tu7*, *tu8*, *tu9*, and *tu10* having one of their ends secured to a supporting bar 63 formed at one end with a lug L, Fig. 4, bent at right angles thereto and secured to the upright extending plate 17, while the opposite end of the bar 63 is secured to the top disposed end of an arcuated-shaped member 64 as by a screw 73, the support in turn being secured to the base 10 as by a plurality of screws 65.

Sector-shaped member 64 is provided with a plurality of equally spaced holes for receiving the opposite end of tubings *tu1*, *tu2*, *tu3*, etc., and an internally disposed curved groove *dg* into which a projection 66 formed with the pawl 32 extends for engagement with any one of the piano wires W1, W2, W3, etc., which may be moved across the groove *dg* by the depressed key, such engagement causing to move the pawl 32 out of engagement from the tooth 33 of pivoted sector plate 34 for permitting the return movement of the latter by the tension of spring 38 simultaneously with the initial movement of

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balance wheel 44 as effected by the arm 52, pawl 53, link 51 and the arm 30 movable with the U bar 17Y, the pawl 32 reengaging the tooth 33 of pivoted sector plate 34 upon the return of the depressed key to normal non-operated position as will be hereinafter described in detail.

The sector-shaped plate 34 is provided with a projection 67 disposed in engageable relation with an arm 68 keyed on a shaft 69 journaled in lugs 70 and 71 formed with the upright extending plate 17 and in a bracket 72 best seen in Figs. 2 and 3 secured to the arcuated member 64 as by a screw 73.

The angular movement of shaft 69 as imparted by the tension of a retractile spring 74 following the movement of sector plate 34 in the direction indicated by the arrow in Fig. 2 is effective to move the pawl-shaped plate 75 secured to shaft 69 in the path of similar lugs 76 formed with the key members K1, K2, K3, etc., for engaging and holding the depressed key in the operated position as shown in Fig. 4 while another pawl-shaped plate 77 pivoted on studs laterally extending from lugs 90 and 91 formed with the upright extending plate 17 is permitted to move by the tension of a retractile spring 78 in engagement with the underside of lugs 76 of the non-operated keys for locking them in that position upon the release of an arm 79 formed with plate 77 by an extension *ex* carried by the U-shaped bar 17Y upon the movement of the latter by any one of the keys from normal to operated position, the operated key being released upon the return of sector plate 34 to normal position following each digit transmitting operation, while the return of U-shaped bar 17Y to normal non-operated position causes the projection *ex* carried thereby to reengage the arm 79 of plate 77 for moving the latter in the position as shown in Fig. 2 and thereby unlocking the non-operated keys.

The sector-shaped plate 34, as shown in Figs. 2 and 3, is provided with a pin 80 disposed in engageable relation with an arm 81 keyed on a shaft 82 journaled at both ends in upright supports 12 and 26 and on this shaft is mounted a wedge-shaped arm 83 provided for engaging a stop 84 carried by the balance wheel 44 for stopping the movement of the latter upon the return movement of sector plate 34 to normal and the consequent operation of arm 68 and pawl 75 by lug 67 for releasing the operated key which is returned to normal non-operated position by the tension of its retractile spring 17X, followed by the return of the common U-shaped bar 17Y to normal, this bar as above described engaging the arm 79 of locking plate 77 for moving the latter out of the path of the key members K1, K2, K3, etc., preparatory to the operation of a succeeding key.

In a typical example of operation, the movement of any one of the key members as K5, for example, from the position shown in Fig. 2 to the position shown in Fig. 4, is effective to impart a corresponding angular movement to the U-shaped bar 17Y and thereby to the arms 20 and 21 keyed on sleeve 19 against the tension of retractile spring 62. The movement of arm 21 through the belt 23 is effective to impart an angular movement to arm 24 on shaft 25 against the tension of its retractile spring 30 while the movement of arm 24 through the engagement of pawl 32 carried by the arm with projection 33 carried by the pivoted sector-shaped plate 34 rotates the latter to the point wherein the projection 66 formed with the pawl 32 engages the

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piano wire W5 which has been moved in its guiding tube *tu5* across the groove *dg* in the arcuated support 64 by the operation of key K5 for releasing the sector plate 34. The movement of this plate 34 as effected by the arm 24 is effective to tension the spring 38, the function of which is to return the plate 34 to normal non-operated position for actuating the time mechanism in a manner which will be hereinafter described in detail.

The operation of arm 20 and that of link bar 51 which occurs simultaneously with the operation of arm 24 by belt 23 is effective to impart a clockwise angular movement to the balance wheel 44 through the engagement of pawl 53 carried by arm 52 with the ratchet tooth portion 54 on the balance wheel to the point wherein the projection 55 formed with pawl 53 engages the pin 56 for releasing the balance wheel 44. The movement of the balance wheel by pawl 53 is effective to engage the block *b* with the stationary pin SP to cause the tension built up of spiral spring 47. The movement of link bar 51 and the stop 52 carried thereby is effective to release the spring 59 preparatory to the disengagement of the ratchet tooth 61 of this spring from the retaining pin 60 by the rotation of the escapement wheel 39 now actuated by the engagement of pawl 33 carried by the sector plate 34 engaging the ratchet wheel 37. The movement of escapement wheel 39 is effective to operate the anchor member 41 to cause the oscillation of the balance wheel 44 and therefore the successive tensioning of the spiral spring 47 and thereby the operation of contact spring 59. It is to be noted, however, that due to the end of spiral spring 47 resting against the block 43, the initial movement of the balance wheel 44 as imparted by the pawl 53 and the consequent tensioning of spring 47, this contact spring is not operated until the tooth 61 formed at the end of spring 59 is disengaged from the pin 60 by the rotation of escapement wheel 39 so as to permit the movement of block 43 away from the end of spiral spring 47 and thereby the free movement of spiral spring 47 in phase with the oscillation of balance wheel 44 for operating the contact 56 once for each counter-clockwise oscillation period of the balance wheel for transmitting as for example above-mentioned five pulses when the sector-shaped plate 34 reaches its normal non-operated position following the operation of arm 68 of latch bar 75 for releasing the operated key and the engagement of pin 80 with arm 81 to move the wedge 83 in engagement with the projection 84 carried by balance wheel 44 for stopping the operation of the latter and the engagement of the pawl 32 with the projection 33 of the plate 34 which defines the normal non-operated position of the plate.

The operation of arm 68 and the consequent return movement of the operated key to normal non-operated position by the tension of its retractile spring 17X is followed by the return movement of the U-shaped bar 17Y under the tension of retractile spring 62 and the return movement of arms 20 and 21. The movement of arm 20 to normal position as shown in Fig. 2 permits the reengagement of tooth 61 formed with spring 59 with the pin 60 simultaneously with the movement of block 43 in the path of spiral spring 47 and the engagement of the end of spring 59 in one of the teeth of escapement wheel 39 while the movement of arm 21 permits the return movement of arm 24 under the tension of its retractile spring 30 to a point wherein

the arm 66 of pawl 32 engages the lug *in* formed with the arcuated supporting member 64 to cause this pawl to reengage the portion 33 of sector plate 34 and the transmitter mechanism is now ready for the operation of a successive key.

The time mechanism above described which determines the intervals between pulses requires a low tension motor spring and therefore low pressure on the manually operable keys in comparison to call transmitters of the type using centrifugal governors requiring high friction coefficient, high tension on the motor spring and thereof high pressure on 16 key members for proper operation of the pulsing mechanisms.

What is claimed is:

1. In a switching device; a contact, a time mechanism having an escapement wheel, an anchor member, a balance wheel and a spiral spring, a set of numbered key members manually operable individually for tensioning said spiral spring and means operable for starting and stopping the operation of said balance wheel for controlling the number of make and break of said contact according to the operated key member in said set.

2. In a switching device, a time mechanism having an escapement wheel, a balance wheel and a spiral spring, a plurality of key members manually operable individually for tensioning said spiral spring for actuating said escapement wheel to cause the operation of said balance wheel and the successive tensioning of said spiral spring, and a contact actuated by the successive tensioning of said spiral spring by the movement of said balance wheel.

3. In a make and break contacting device, a time mechanism, said mechanism comprising an escapement wheel, an anchor, a balance wheel and a spiral spring, a contact disposed in engageable relation with the end of the outer convolution of said spiral spring, a motor spring, manually operable means for tensioning said motor spring for actuating said mechanism, and a mechanism operable by the tension of said motor spring for engaging means carried by said balance wheel for controlling the operation of said contact by said spiral spring.

4. In a call transmitter, a set of key members, a pivoted U-shaped bar operable by the operation of any one of said key members, a time mechanism having an escapement wheel, an anchor engaging said wheel, a balance wheel and a spiral spring, a ratchet mechanism, having a spring tensioned by the movement of said bar for actuating said time mechanism, and a pulsing contact actuated by said spiral spring upon the operation of said balance wheel.

5. In a call transmitter, a pulsing contact, a set of key members, a U-shaped bar disposed for operation by the movement of any one of said key members, a common shaft for pivoting said key members and said bar, a sleeve on said shaft rotated by said U bar, a pair of arms secured to said sleeve, another shaft, a lever member pivoted on said other shaft, a belt operatively connecting one of said arms to said lever member for rotating the latter upon the operation of said U bar by one of said key members, a sector-shaped plate pivoted on the last-mentioned shaft, a spring-pressed pawl carried by said lever member, engaging means carried by said plate for rotating it, an escapement wheel, a motor spring tensioned by the movement of said plate for actuating said escapement wheel, an anchor mem-

ber actuated by said escapement wheel, a balance wheel actuated by said anchor members and a spiral spring successively tensioned by the movement of said escapement wheel for actuating said pulsing contact according to the operation of one of said key members.

6. In a call transmitter, a set of digit key members, a movable bar disposed for operation by any one of said key members, a time mechanism, a motor spring for actuating said mechanism, a pivoted lever member actuated by the operation of said bar, said lever member having a pawl, a plate having a ratchet tooth element engaged by said pawl and operable for tensioning said motor spring, means positioned in the path of said pawl by the movement of the operated key for disengaging said pawl from said element carried by said plate for actuating said time mechanism in its return movement to normal position for operating said contact a number of times corresponding to the digit of the operated key.

7. In a call transmitter mechanism, a set of key members, a U-shaped bar disposed for operation by the movement of any one of said key members, a time mechanism comprising an escapement wheel, an anchor, a balance wheel and a spiral spring, a motor spring tensioned by the operation of said U bar for actuating said mechanism, and a pulsing contact actuated upon the successive tensioning of said spiral spring by the operation of said balance wheel.

8. In a call transmitter, a pulsing contact, a set of key members, a U-shaped bar disposed for operation by the movement of any one of said key members, means operable upon the operation of any one of said key members for latching the non-operated keys in that position, a time mechanism, a sector-shaped plate actuated in one direction by the movement of said bar, a motor spring tensioned by the movement of said plate for actuating the latter in the reverse direction, a time mechanism actuated by the movement of said plate, said time mechanism having a spiral spring for actuating said pulsing contact, means operable upon the operation of said plate in the first-mentioned direction for locking the operated key in that position, said plate actuating the last-mentioned latching means upon its return movement to normal non-operated position by the tension of said motor spring for releasing the operated key following the operation of said contact.

9. In a call transmitter, a set of key members, a U-shaped bar disposed for operation by the individual movement of each of said key members, an arm actuated by the movement of said bar, a shaft, a lever member mounted for free rotation on said shaft, means operatively connecting said arm to said lever member for actuating the latter, a sector-shaped plate mounted for free rotation on said shaft, a pawl carried by said lever member engaging means carried by said plate for rotating it upon the movement of said lever member, a time mechanism actuated by the movement of said plate, said mechanism comprising a ratchet wheel, a pawl carried by said plate engaging said ratchet wheel, an escapement wheel rotated by said ratchet wheel, an anchor member actuated by said escapement wheel, a balance wheel and a spiral spring actuated by said anchor member having one of its ends connected to said balance wheel, a block member normally disposed in the path of the other end of said spring to cause the latter to tension upon

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the oscillation of said balance wheel, another arm actuated by the operation of said bar, another lever member mounted for free rotation on said shaft, a link bar operatively connecting said other lever member to said other arm, a pawl carried by the last-mentioned arm, a ratchet tooth formed with said balance wheel normally engaged by the last-mentioned pawl for imparting the first oscillation to said balance wheel for tensioning said spiral spring, a contact disposed in operative relation with said spiral spring, and means operable upon the operation of said link bar for moving said block from the path of said spiral spring to cause the operation of said contact upon the continued operation of said balance wheel during the return movement of said sector-shaped plate, and a motor spring for effecting return movement of said plate.

10. In a call transmitter, a set of key members representing symbols, a bar disposed for operation by the individual movement of said key members, a shaft, a time mechanism having an escapement wheel and a balance wheel mounted on said shaft, a motor spring for actuating said mechanism, piano wires secured to said key members, a guiding element for each of said wires, an arcuated support having means for

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securely receiving one end of each of said guiding elements in equal spaced relation to each other, a sector-shaped plate mounted on said shaft having a clutch element, a lever member mounted on said shaft having a clutch element normally engaging the first-mentioned clutch element for rotating said plate for tensioning said motor spring, the clutch element carried by said plate operating upon its engagement with the wire actuated by one of said key members for controlling the operation of said escapement wheel and said balance wheel according to the symbol represented by the operation of one of said key members, a spiral spring in said time mechanism, and a contact actuated by said spiral spring.

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