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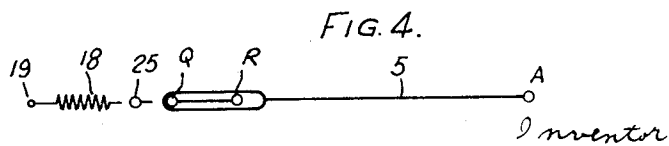
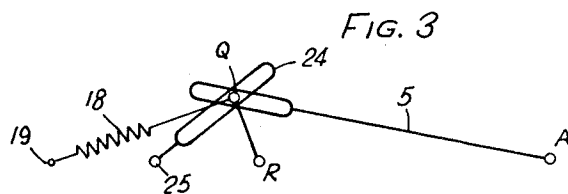
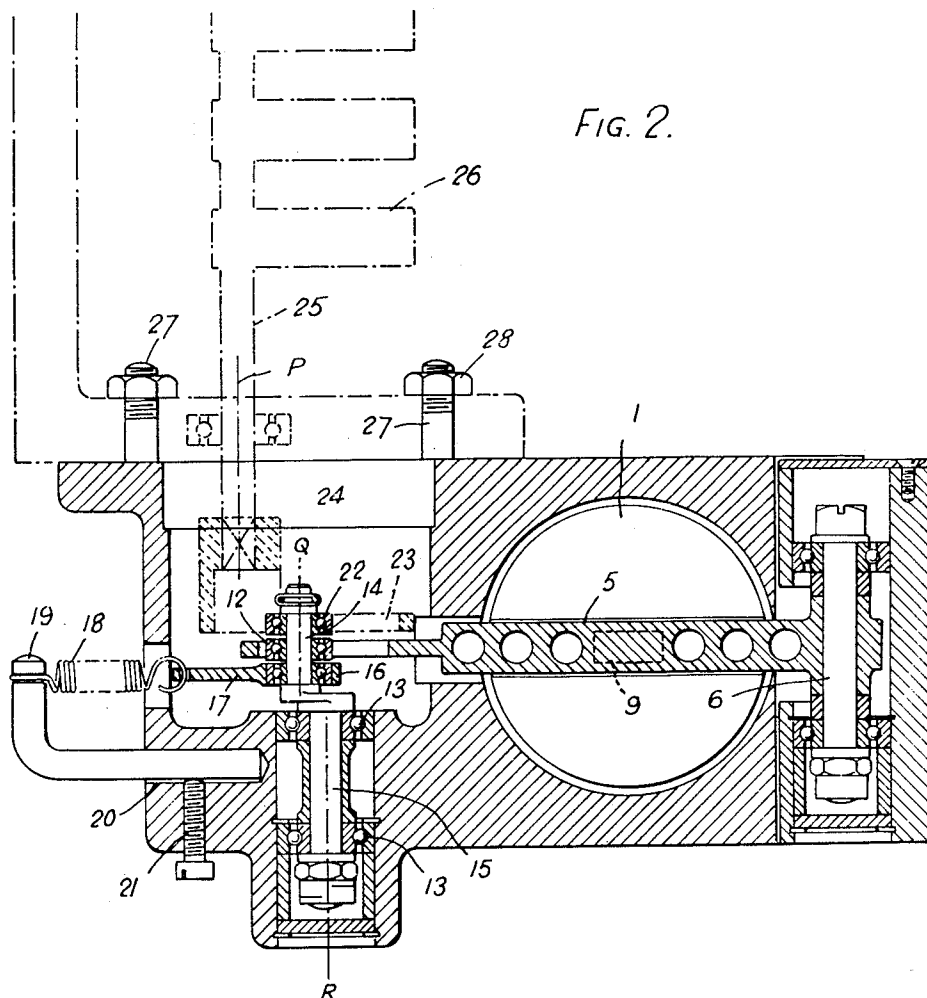
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2,717,966

ELECTROMAGNETICALLY OPERATED MOVEMENTS

Filed Aug. 21, 1951

8 Sheets-Sheet 2



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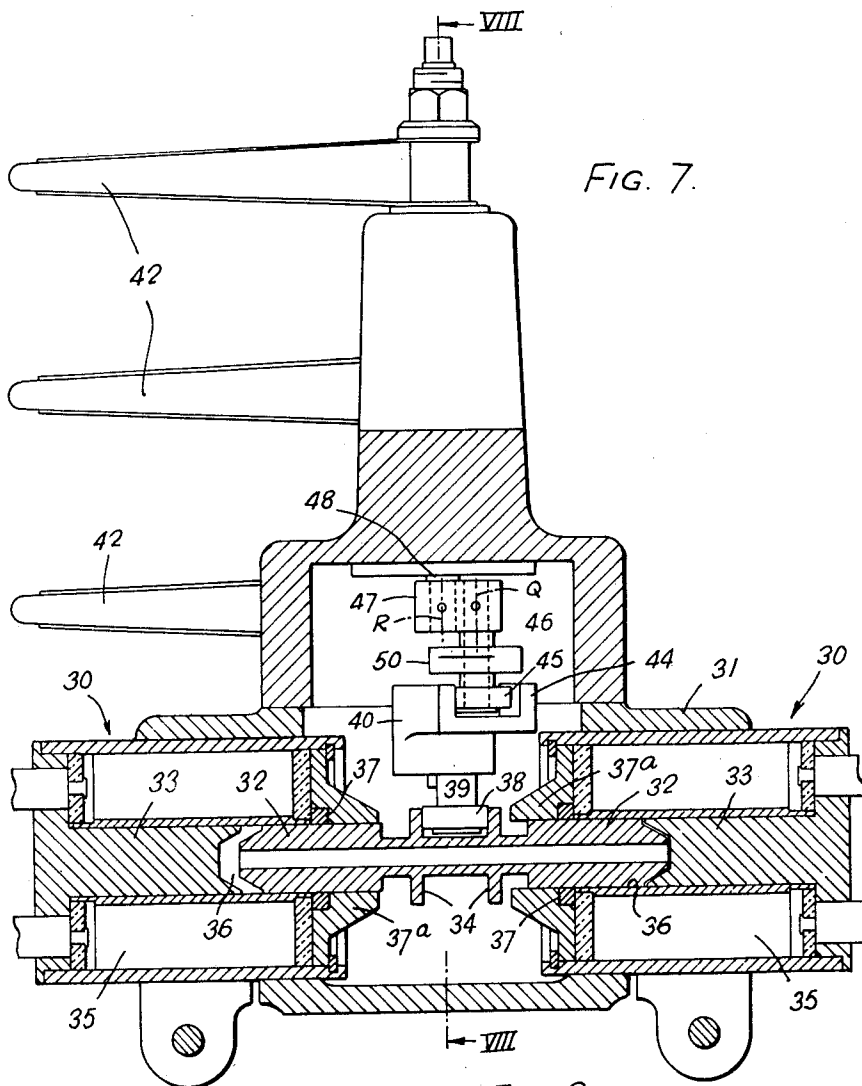
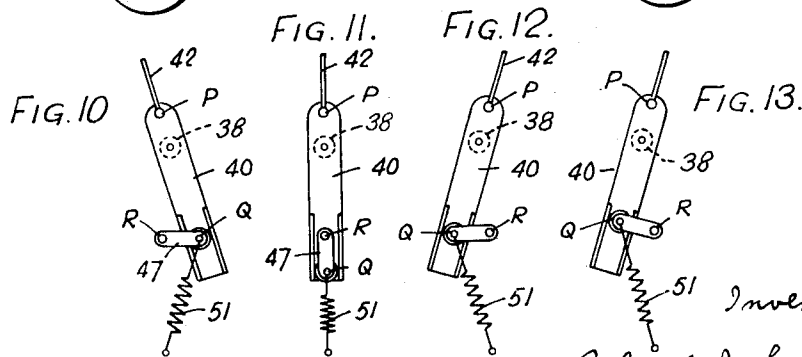


FIG. 7.



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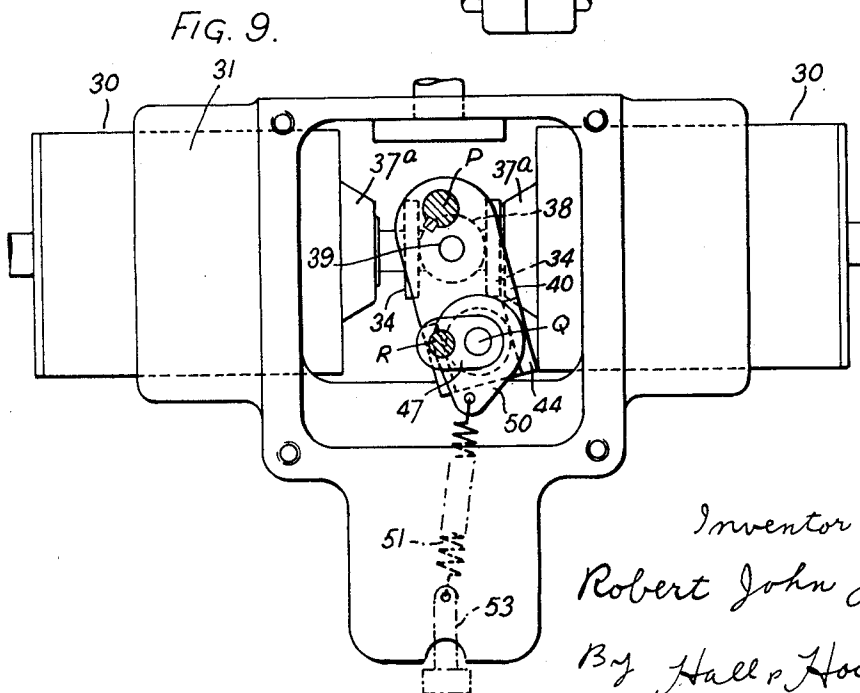
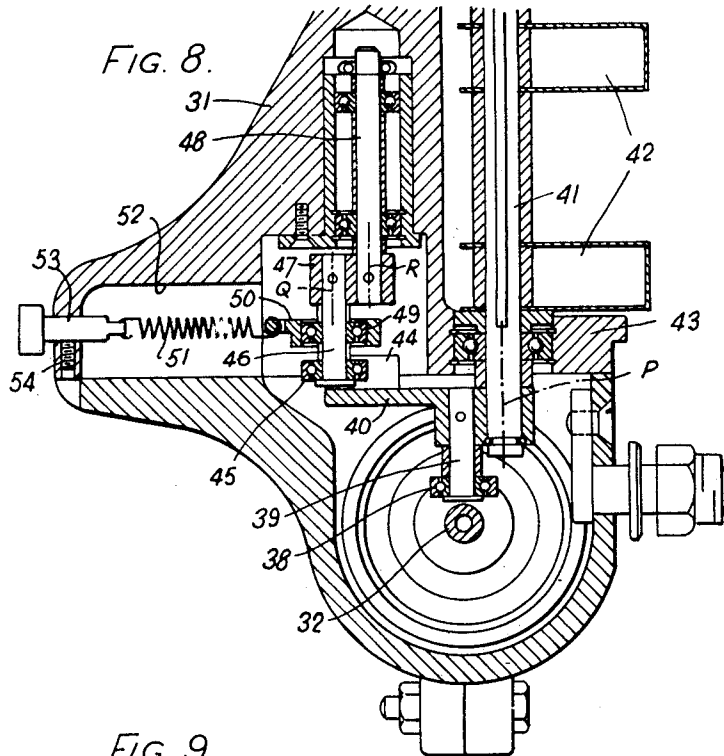
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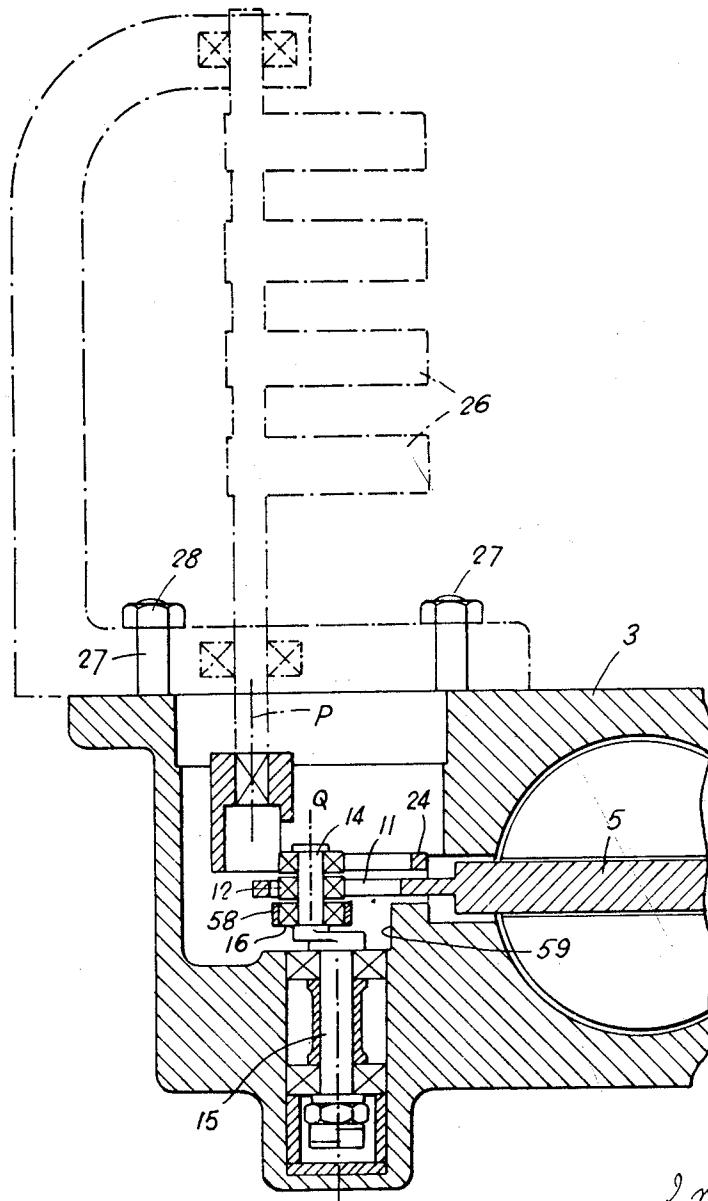
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FIG. 14.



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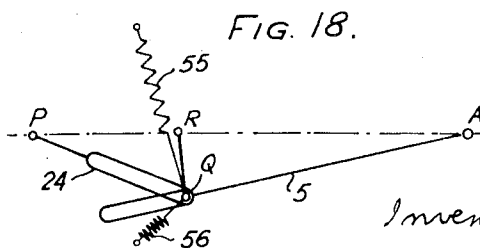
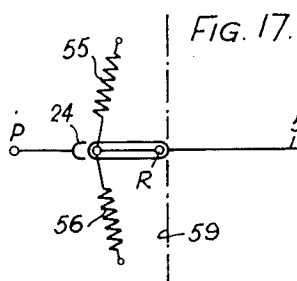
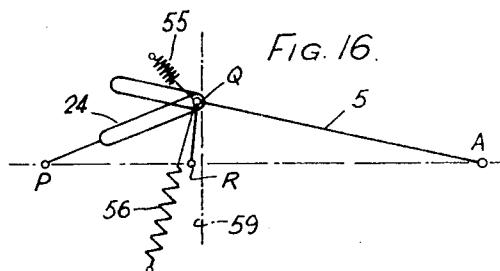
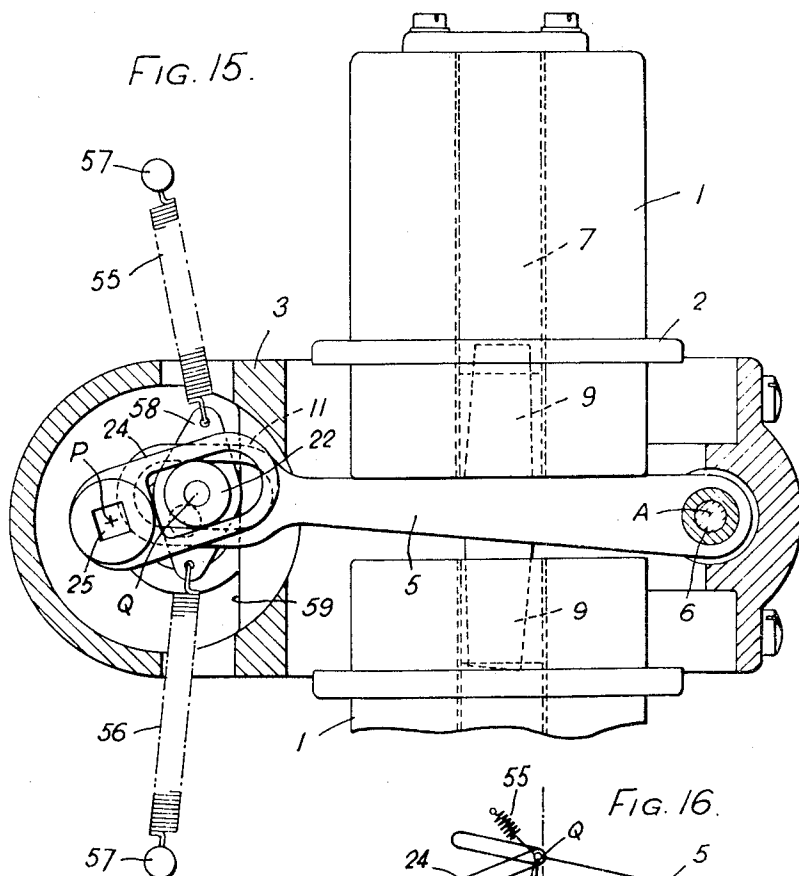
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ELECTROMAGNETICALLY OPERATED MOVEMENTS

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FIG. 19.

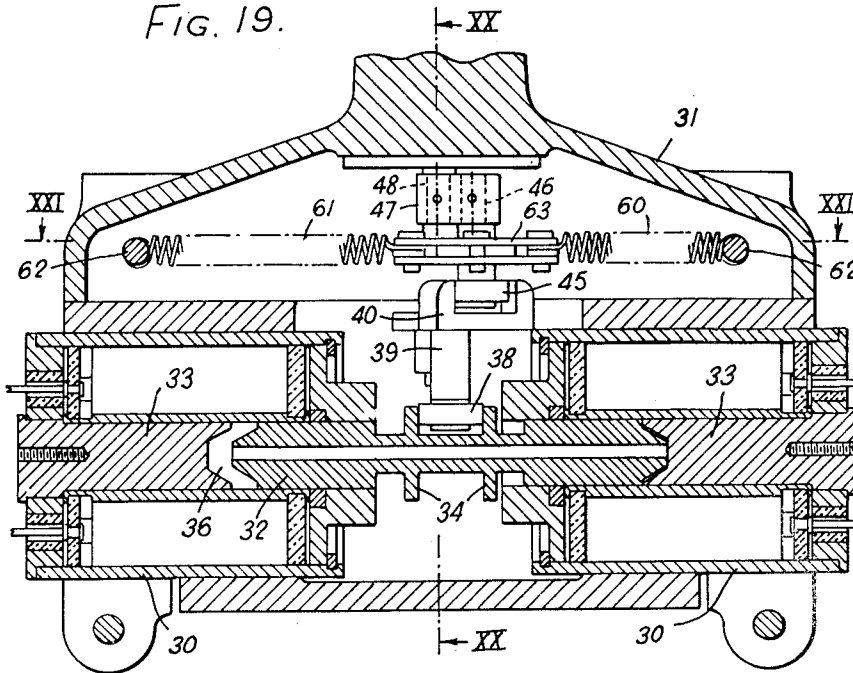
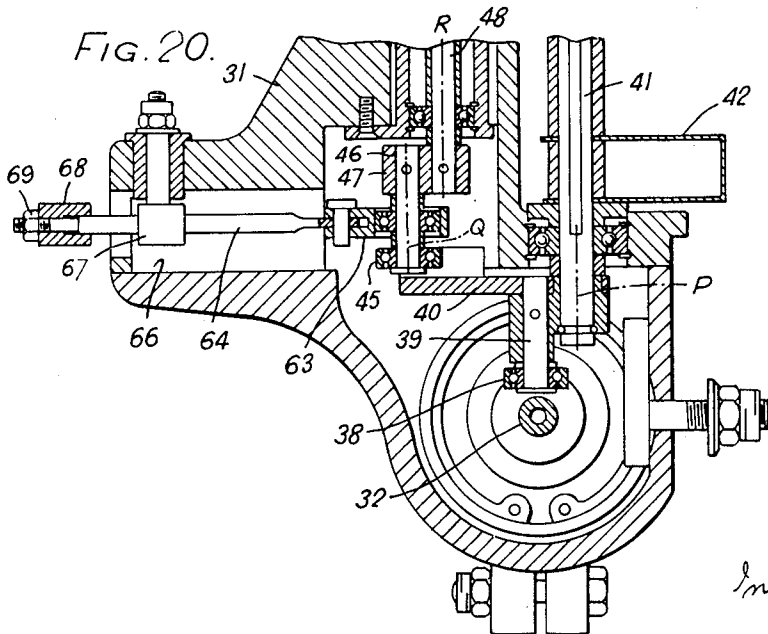


FIG. 20.



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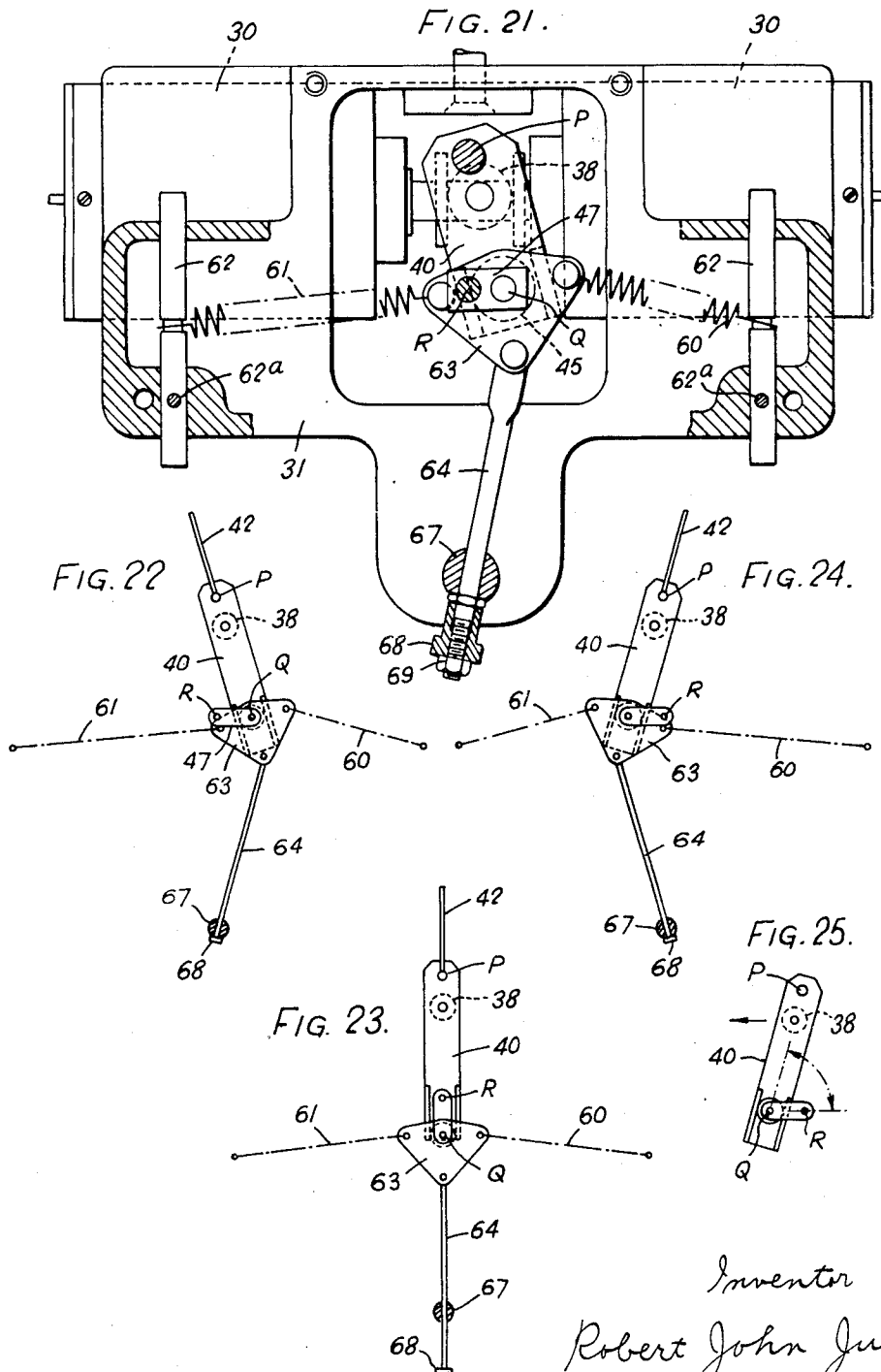
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ELECTROMAGNETICALLY OPERATED MOVEMENTS

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2,717,966

ELECTROMAGNETICALLY OPERATED MOVEMENTS

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Application August 21, 1951, Serial No. 242,937

12 Claims. (Cl. 310—24)

This invention relates to electromagnetically operated movements for producing motions of a member through a predetermined angle in alternate directions at desired instants of time.

In a postal letter facing machine, that is to say a machine for sorting or orienting postal letters prior to franking, such as that described in the specification of copending patent application No. 2,910/49, and in other mail or like article handling machines, devices are required in certain circumstances to effect deflection of letters or similar articles from a stream into a path displaced from the stream. Such devices may for example be required to divert from the stream letters which are not appropriately oriented for franking, letters which are not within a predetermined range of dimensions, or simply to divide a main stream of letters into two or more subsidiary streams.

In the machine described in the specification referred to a stream of letters is conveyed by driven belts between which the letters are sandwiched and a diverting or deflecting device in the form of a vane or vanes pivoted about a vertical axis for movement in a horizontal plane is positively driven to effect deflection of selected letters from a stream of letters fed to the vane or vanes, into one or another path.

The object of the present invention is to provide a letter diverting device of simple construction which is reliable in operation and is designed so as to require a minimum of attention over very long operating periods.

According to the present invention, a device for effecting reciprocating movement of a member comprises electromagnetic means which are energised to attract an armature first in one direction and then in an opposite direction, resilient means being provided which oppose the attraction of the armature due to the electromagnetic means, and in which the opposing force produced by the resilient means increases with decreasing distance between the armature and a co-operating pole of the electromagnetic means, during at least part of each movement of the armature towards the co-operating pole.

According to one feature of the invention, a single resilient means may be made effective to oppose the attraction of the armature in one or the other opposite direction and the maximum opposing force produced by the resilient means may be produced at the limit of approach of the armature to the co-operating pole of the electromagnetic means.

According to a further feature of the invention, separate resilient means may be arranged to operate in mutual opposition in opposing the attraction of the armature in one or the opposite direction and the opposing force applied to the armature by the resilient means may rise to its maximum at an intermediate stage of the armature movement towards each co-operating pole and may thereafter be reduced as the armature reaches its limit of approach towards the co-operating electromagnetic pole.

The energy stored in the resilient means while the armature is moving towards either of the opposed elec-

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tromagnet poles serves to assist the acceleration of the armature in the opposite direction upon the cessation of the attraction of the pole towards which the armature has last moved.

According to another feature of the invention, the resilient means which oppose the attraction of the armature by the electromagnet means may be energised sufficiently to balance the magnetic attraction opposed thereby when the armature reaches its limit of approach to the co-operating electromagnetic pole so that the reciprocating member is yieldingly located in each fully operated or rest position of its reciprocatory movement.

According to yet another feature of the invention, movement limiting stop means may be provided for positively locating the reciprocating member in each fully operated or rest position of its reciprocatory movement and such stop means may be used in conjunction with separate mutually opposed spring means arranged so as to be energised sufficiently to balance when the armature has been moved to an intermediate position between the opposed poles of the electromagnetic means, the arrangement being such that the one spring means accelerates the movement of the armature to the intermediate position from the pole which has ceased to attract and the opposed spring opposes the movement of the armature towards the opposite attracting pole so that the impact of the mechanism with the movement limiting stop means is controlled and moderated, but at the fully operated position, the energised spring has such a line of action that its opposition to the magnetic attraction is small and the reciprocating member is held firmly in position by the magnet.

In order that the invention may be clearly understood and readily carried into effect, several forms of devices constructed in accordance therewith and designed for reciprocating or oscillating the letter diverting vanes of machines of the kind referred to above, will hereinafter be described by way of example and with reference to the accompanying drawings in which:

Fig. 1 is a part sectional plan view of one form of electromagnetically operated device embodying the invention and showing the operating parts in one fully operated position;

Fig. 2 is a sectional elevation taken on line II—II of Fig. 1, but showing the operating parts in an intermediate or neutral position;

Figs. 3—6 are functional diagrams showing relative operating positions of the parts in several main stages of operation of the device shown in Figs. 1 and 2;

Fig. 7 is a part sectional side elevation of an alternative form of electromagnetically operated device embodying the invention, showing the parts in one fully operated position;

Fig. 8 is a sectional elevation taken on line VIII—VIII of Fig. 7, but showing the operative parts in an intermediate or neutral operating position;

Fig. 9 is a plan view of the device shown in Fig. 7;

Figs. 10—13 are functional diagrams showing relative operating positions of the parts in the several main stages of operation of the device shown in Figs. 7—9;

Fig. 14 is a fragmentary sectional elevation of a modified form of the device shown in Figs. 1 and 2, with the operating parts in an intermediate or neutral position;

Fig. 15 is a fragmentary part sectional plan view thereof, but showing the operative parts in one fully operated position;

Figs. 16, 17 and 18 are functional diagrams showing the relative operating positions of the parts in the several main stages of operation of the device shown in Figs. 14 and 15;

Fig. 19 is a fragmentary part sectional side elevation of

a modification of the device shown in Figs. 7-9, with the operating parts in one fully operated position;

Fig. 20 is a fragmentary sectional elevation taken on line XX—XX of Fig. 19 but with the parts in the intermediate or neutral position;

Fig. 21 is a part sectional plan view thereof taken on line XXI—XXI of Fig. 19, and

Figs. 22-25 are functional diagrams showing relative operating positions of the parts in the several main stages of operation of the device shown in Figs. 19-21.

The device shown in Figs. 1 and 2, comprises a pair of electromagnets 1 secured by flanges 2 to opposite sides of a casing 3 so that the bobbins 4 of the electromagnets are located in axial alignment with their opposing end faces spaced apart to accommodate therebetween a lever armature 5 which extends longitudinally between the bobbin faces, i. e. at right angles to the axes of the bobbins and at one end is pivoted on a vertical pin 6, journaled in ball bearings mounted in the casing 3, so as to rock about a vertical axis A. Each bobbin 4 is provided with an axially extending soft iron core 7 of rectangular cross section and which is shorter than the bobbin so that a space 8 is left at the inner end of the centre of each bobbin. The lever armature 5 is provided with an integral cross piece or two separate arms projecting outwards from opposite sides of the lever armature and approximately at right angles thereto to form lateral armature projections 9 each of which extends into the hollow space 8 of its co-operating bobbin 4 and terminates at its free end short of the inner end of the core 7 so as to leave an air gap therebetween which is decreased to a predetermined minimum when the armature projection reaches its limit of approach to the attracting pole. The air gaps may be adjusted by the use of shims in known manner. The end of each core 7 is formed with a V-groove 10 and the free extremity of the cooperating projection 9 of the lever armature is wedge shaped so as to fit in the V-groove of the core.

The free end of the lever armature remote from its pivot axis A is formed with an elongated loop or closed slot 11 in which engages the outer race of a ball or roller bearing 12 carried on a short vertical upper limb 14 of a vertical cranked spindle 15. The lower end of the cranked spindle 15 is rotatably mounted in ball bearings 13 supported in the casing 3, the arrangement being such that the axis Q of the cranked spindle limb 14 is eccentric to and carried around the fixed axis R of the cranked spindle 15.

A second ball or roller bearing 16 mounted upon the cranked spindle limb 15 below the bearing 12 serves pivotally to connect to the spindle limb one end of a short horizontal arm 17 the other end of which is attached to one end of a horizontal helical tension spring 18. The further end of the tension spring 18 is anchored to the vertical limb of a rod 19 bent at right angles and having the horizontal end thereof rigidly secured in a horizontal socket 20 by means of a set screw 21 which provides for adjustment of the rod in order to adjust and pre-set the normal tension of the spring 18.

The helical spring 18 is normally in slight tension when the linkage of which it forms a part is in the neutral position shown in Figs. 2 and 4 and the spring tension is increased by movement of the short pivotal arm 17 on attraction of the lever armature by one or the other of the electro-magnet poles, the movement of the lever armature being transmitted to the upper limb 14 of the cranked spindle 15 through the bearing 12 slidably engaged in the loop 11 of the lever armature, so that the cranked spindle moves from the position shown in Figs. 2 and 4 to one or the other of the fully operated positions shown in Figs. 1 and 3 or Fig. 5.

The outer race of a third ball or roller bearing 22, mounted upon the upper limb 14 of the cranked spindle, is engaged in the elongated loop or slot 23 of a crank

arm 24 keyed to the vertical shaft 25 of diverter arms or vanes 26 which are adapted to reciprocate or oscillate about the pivotal axis P of the shaft 25 to serve a purpose of the kind previously referred to above. As shown in Fig. 2, the shaft 25 and the vanes 26 form part of a unit which is mounted on top of the casing 3 and secured in position thereon by threaded studs 27 and nuts 28. It will be seen that the pivotal movement of the lever armature about its pivot axis A will also be transmitted to the diverter vanes 26 through the sliding engagement of the bearing 22 in the looped crank arm 24 attached to the diverter shaft 25.

In describing the operation of the device it is assumed that the diverter vanes are lying in the neutral position with the operating parts in the relative positions shown in Figs. 2 and 4. Energisation of one or other of the electro-magnets will effect rotation of the diverted vane shaft about its axis P and deflect the diverter vanes 26 in one direction or the other i. e. to the fully operated or rest position shown in Figs. 1 and 3 or Fig. 5. The normally tensioned helical tension spring 18 will operate to oppose the magnetic attraction produced by either of the electro-magnets and, in doing so, will become further tensioned and energised.

By virtue of the cranked linkages described, the energisation of the spring and consequent restraining effect exerted thereby upon the movement of the lever armature and parts linked thereto will increase rapidly as each of the lever armature projections 9 approaches its co-operating magnetic core 7, and the energisation of the spring and its restraining effect will reach a maximum as the limit of approach of the armature projection to the core is reached. Shock actuation of the diverter vanes is thereby prevented and smoothness of operation assured.

It may be arranged so that the tension or loading of the spring 18 acting through the cranked spindle and the force of the magnetic attraction exerted upon the lever armature by the electro-magnet means are balanced when the vanes have been moved into one or the other of the fully operated or rest positions. Furthermore, the pivot axes R and Q may be relatively positioned and the proportions of the pivotally linked parts so chosen that the crank arm 24 can move to a limited extent beyond the fully operated or rest positions, to a position, e. g. with the crank arm of the cranked spindle at an angle slightly greater than 90° to the longitudinal axis of the lever armature as shown in Fig. 6, and oscillate about the position shown in Fig. 3 before coming to rest. By such means, the diverter vanes may be yieldingly located in the fully operated or rest positions without the use of positive stop means, thereby preventing the noise, wear and shock involved in the use of such stop means.

Figs. 7, 8 and 9 show a modified form of the device last described, in which the construction is simplified by making use of an armature which slides instead of pivoting.

In this arrangement, the bobbins 35 of two electro-magnets 30 are located in co-axial alignment in a horizontal bore of the casing 31, with their inner opposing ends spaced apart at equal distances from opposite sides of the vertical centre line of the casing.

Each bobbin 35 is provided with a co-axial longitudinally extending soft iron core 33 which is shorter than the bobbin and leaves a centrally disposed space 36 at the inner end thereof. A tubular armature 32 extends longitudinally between the inner ends of the bobbins and is mounted to slide in co-axial relation thereto in guides 37 held in place by the soft iron pole-pieces 37a secured to the opposed ends of the electro magnets. Each end of the armature 32 extends into the space 36 in the inner end of the co-operating bobbin and terminates short of the inner end of the core 33 to provide an operating air gap. The extremities of the sliding armature are given a frusto-conical shape for engagement in recesses of similar shape formed in the inner ends of the cores.

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A pair of collars or flanges 34 are mounted or formed in spaced relation upon the sliding armature 32 at equal distances from the mid point of the latter for engagement with the outer race of a ball or roller bearing 38 carried by a pin 39 which is secured to and projects downwards from a horizontal crank arm 40 keyed to the lower end of a vertical shaft 41 upon which the diverter vanes 42 are mounted for oscillatory or reciprocating movement about a vertical axis P. The diverter vane shaft 41 is journaled in bearings mounted in suitable bearing brackets 43 formed integral with the casing 31.

The outer end of the horizontal arm 40 carries upwardly extending jaws 44 spaced apart to receive therebetween and engage the outer race of a ball or roller bearing 45 carried at the lower end of a spindle 46 which extends vertically downwards from and is secured to a horizontal crank arm 47. The crank arm 47 is keyed to the lower end of a vertical crank spindle 48 which is mounted in bearings supported in an upward extension of the casing 31 so that the crank spindle 48 rotates about a fixed axis R which is eccentric to the axis Q of the lower spindle 46. The spindles 46, 48 and crank arm 47 together constitute a cranked spindle which could be made as an integral whole, if so desired.

The spindle 46 carries a second ball or roller bearing 49 which serves pivotally to connect thereto one end of a short horizontal arm or link 50. The free end of the arm 50 is coupled to one end of a helical tension spring 51 which is housed in a recess 52 in the casing 31 and anchored at its further end to an eye rod 53. The eye rod 53 is engaged in the end wall of the recess 52 so that the rod can readily be moved longitudinally to adjust the initial tension of the helical spring 51, and a set screw 54 is provided to lock the eye rod in the position to which it is adjusted.

The helical spring is normally held in slight tension when in the neutral position as shown in Figs. 8 and 11 and the tension thereof is increased by movement of the short arm 50 to which it is coupled. The sliding movement of the armature 32 is transmitted by the bearing 38 and pin 39 to the horizontal crank arm 40 which translates the reciprocatory movement of the armature into a rotary or oscillating movement of the diverter shaft 41 and vanes 42 and transmits its movement by the guide jaws 44 and bearings 45 to the lower eccentric spindle or crank limb 46 so that the latter moves in an arcuate path about the fixed axis R of the crank spindle 48. The short arm 50 pivotally coupled to the spindle 46 is moved bodily with the spindle 46 whilst turning slightly about the vertical axis Q and so extends and increases the tension of the helical spring 51, as shown in Fig. 9.

The operation of the last described device is substantially the same as that of the first described embodiment of the invention as already above set forth and will be obvious from inspection of Figs. 10-13.

The fully operated position of the parts shown in Figs. 7 and 9 and diagrammatically illustrated in Fig. 10 are existent when the sliding armature is attracted by the core or pole of the right hand electro-magnet 30. Upon de-energisation of the right hand electro-magnet and energisation of the left hand electro-magnet, the fully tensioned spring 51 will accelerate the movement of the armature to the left. In the first stage of this movement, the tension of the spring will be reduced and will reach normal in the neutral position shown in Fig. 11 which represents the end of the said first stage of movement. Thereafter the spring will again become extended and further tensioned in opposing the second stage of sliding movement of the armature towards the attracting pole of the left hand electro-magnet. When the attracted armature reaches its limit of approach to the left hand pole the parts will be in the position shown in Fig. 13. The fully tensioned spring 51 may be in balance with the magnetic force to which the armature is submitted when the parts are in fully operated positions shown in Figs. 10

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and 12, while the oscillation of the parts at the fully operated position i. e. about the position shown in Fig. 12 may be permitted for the purpose above set forth.

The absence of means for positively locking the reciprocating member (diverter vanes), in each fully operated or rest position is not always desirable and it may be found to be of advantage to provide limiting stop means which serve positively to locate the reciprocating member in each fully operated position without interfering with the functioning of the electro-magnetically operated means for moving the reciprocating member from one operating position to the other.

The lever armature device described above with reference to Figs. 1-6 of the drawings may be modified as shown in Figs. 14 and 15 to include movement-limiting stop means and a pair of opposed springs in place of the single helical spring 18 described above. In general construction and arrangement, the operating parts of the modified device are the same as the corresponding parts of Figs. 1-3 and like parts are indicated by like references. In the modified form, however, the spring means comprise a pair of helical tension springs 55, 56 secured at their inner ends to the outer ends of a double arm horizontal lever 58 which is pivotally coupled by the ball or roller bearing 16 to eccentric limb 14 of the cranked spindle 15. The outer ends of the springs are anchored to the upstanding limbs of bent rods 57, the horizontal limbs of which are adjustably secured in axially aligned sockets formed in the side walls of the casing so that the normal tension of the springs can be adjusted and pre-set by longitudinal displacement of the bent rods, and the line of action of the springs pre-set by bending the horizontal limbs of the rods.

The cranked spindle 14, 15 and associated linked parts are coupled to the lever armature 5 and slotted crank arm 24 of the diverter shaft 25 as already described above so that the eccentric axis Q of the cranked spindle is carried around the fixed axis R thereof and the slightly rotating double arm lever 58 bodily displaced as the diverter shaft and vanes are rotated about the axis P, thereby tensioning one and releasing the other of the springs 55, 56 in the movement of the parts towards one or the other of the fully operated positions shown in Figs. 15, 16 and 18.

The wall of the recess in the casing 3 in which the cranked spindle 14, 15 and associated parts are located is provided with an abutment or ledge 59, the vertical face of which is disposed at the level of the double arm lever 58 to form a stop against which the edge of the central hub of the lever 58 will abut, as shown in Fig. 15, when the cranked spindle limb 14 is moved into either of its fully operated positions.

The spring anchoring rods 57 are adjusted so that the springs are brought approximately into a straight line passing through the axis Q, of the cranked spindle when it is in the neutral position shown in Figs. 14 and 17.

Thus, in the operation of the last described arrangement the springs 55, 56 are tensioned in balance when the parts are in the neutral position shown in Figs. 14 and 17. As the cranked spindle rotates in clockwise direction, the spring 55 is increasingly tensioned and the spring 56 partly relaxed as the eccentric crank limb of the cranked spindle moves towards the fully operated position shown in Figs. 15 and 16. In this case, the stop or engaging abutment 59 is arranged in relation to the axis R so that the eccentric crank limb 14 and axis Q actually move slightly beyond the position in which angle $RQA=90^\circ$ before the stop operates. For example, the crank limb may move through approximately 188° in travelling between the alternative fully operated positions shown in Figs. 16 and 18.

As will be seen from Fig. 15, external pressure upon the vanes in one direction of rotation will tend to force the double arm lever 58 or crank limb 14 against the abutment 59, while pressure upon the vanes in the opposite direction of rotation will force the bearing 12 against

the wall of the loop 11 upon the attracted side of the armature which has reached its limit of approach to the co-operating pole in the direction of the force applied by the bearing and, therefore, is unyielding.

The diverter vane shaft and vanes thus remain positively locked in the fully operated or rest position shown in Figs. 15 and 16 until the co-operating electromagnet is de-energised and the other electromagnet is energised whereupon the tensioned spring 55 accelerates the initial return movement of the lever armature to the neutral position shown in Fig. 17 at which point the springs 55, 56 become balanced and thereafter the co-operating pole of the energised electromagnet attracts the armature and the diverter vanes and operating linkage parts move towards and are locked in the fully operated position shown in Fig. 18, while the spring 56 is energised and the spring 55 relaxed.

The sliding armature device described with reference to Figs. 7-13 of the drawings may be modified as shown in Figs. 19-21 to include movement limiting stop means and a pair of opposed springs in place of the single helical spring 51 described above. In general construction and arrangement, the operating parts of the modified device are the same as the corresponding parts of Figs. 7-9 and like parts are indicated by like references.

In the modified form of the device, however, the upper part of the casing 31 is adapted to house a pair of helical tension springs 60, 61 anchored at their outer ends to transverse notched rods 62 which slide in the walls of the casing for adjustment of the line of the springs and are locked in the pre-set position by locking screws 62a.

The inner ends of the springs 60, 61 are pivotally connected to opposite corners of a substantially triangular horizontal plate or frame 63 which is pivotally coupled to the downwardly extending spindle 46 carried by the crank arm 47 of the crank spindle 48.

The third corner of the triangular plate or frame 63 is pivotally coupled to the inner end of a rod 64 which extends through and projects from the open outer end of a clearance recess 66 in the casing 31.

The rod 64 passes through a pivotal guide sleeve 67 suspended in the clearance recess 66 to act as a fixed abutment for a stop member 68 comprising a threaded nut which is engaged and longitudinally adjustable upon the screw-threaded outer end of the rod and is locked thereon by a lock nut 69.

In the last described arrangement, the tension springs 60, 61 are equally tensioned and in balance when the operating parts are in neutral position as shown in Figs. 20 and 23, while the movable stop member 68 is outwardly displaced from the fixed abutment 67. As the parts are moved from the neutral position towards the fully operated or rest position shown in Figs. 19, 22 and 24, the spring 61 becomes increasingly tensioned by the bodily displacement of the member 63, as the eccentric spindle 46 rotates about the axis R, and increasingly opposes the movement of the attracted armature 32 towards the co-operating electro-magnet pole or core, but in the fully operated position the line of action of the springs in relation to the pivot of the member 63 is such that they have little or no effect upon the parts and the vanes are firmly held in the said fully operated or rest position by the magnetic force applied to the armature. In the corresponding displacement of the member 63, the rod 64 is drawn inwards through the fixed guide and abutment 67 also against opposition from the spring 61 until the stop 68 contacts the fixed abutment, which contact is regulated to take place when the diverted shaft and vanes and associated operative parts reach the desired fully operated or rest position.

When the operating electro-magnet is de-energised and the other electro-magnet energised to change the position of the diverter vanes, the energised spring 61 will become effective soon after the start of the return movement of

the armature and will serve to accelerate the movement of the parts to the neutral position shown in Fig. 23. The springs are then in balance and the movement of the armature towards the newly energised electro-magnet is completed by magnetic attraction so that eccentric spindle 46 is carried by the slotted crank arm 40 to the limit position shown in Fig. 25 and the opposing spring 60 is energised and the parts moved to the fully operated position shown in Fig. 24, while the stop 68 again abuts the fixed abutment 67.

I claim:

1. An electro-magnetically actuated device for diverting articles such as letters from a stream into a path displaced from the stream, comprising a displaceable diverter member adapted for movement between alternative operative positions, a pair of opposed spaced apart electro-magnets adapted to be energized alternately, a movable armature disposed between the opposed cores of the said magnets and movable first in one direction and then in the reverse direction upon said alternate energizing of the electro-magnets, a first coupling means providing a driving connection between said armature and the diverter member whereby said movement of the armature is transmitted to the diverter member to positively displace the diverter member from one to the other of said alternative positions, resilient means and a continuously effective common driving connection from the armature and from the resilient means to the diverter member, the said common connection comprising a second coupling means operatively connecting the said resilient means to the said first coupling means, whereby movement of the armature when attracted to one of said opposed cores, is opposed by the said resilient means, the said second coupling means co-operating with the first coupling means so that the opposing force exerted on the armature by the said resilient means is varied as the armature moves towards said one of the opposed cores.

2. An electro-magnetically actuated device for diverting articles such as letters from a stream into a path displaced from the stream comprising a displaceable diverter member adapted for movement between alternative operative positions, a shaft secured to said diverter member and supported for oscillation about the axis of the shaft to effect said movement of the diverter member, a pair of spaced apart opposed electro-magnets adapted to be energized alternately, an armature positioned between opposed cores of said electro magnets and movable upon said alternate energization of the magnets, alternately towards the said cores, a first coupling means providing a driving connection between the armature and the said shaft and including a crank arm secured to said shaft and rotatable therewith and operatively connected to the armature so that the movement of the armature is transmitted through the crank arm to the shaft to effect positive displacement of the diverter member from one to the other of said alternative operative positions, resilient means and a second coupling means connecting said resilient means to the first said coupling means and including a rotatable cranked member having an eccentric crank limb to which the said resilient means is connected and which is operatively connected to the said crank arm and to the armature to provide a common driving connection from the armature and from the resilient means to the diverter member whereby the force exerted on the armature by the said resilient means is varied as the armature moves from one to the other of the said opposed cores.

3. A device as claimed in claim 2, wherein said resilient means is positioned to re-act from a fixed part of said device so disposed with respect to said eccentric crank limb that the force exerted by said resilient means is sufficient to balance the attraction opposed thereby when said armature reaches the limit of its approach to the co-operating electro-magnet, whereby the said displaceable diverter member is yieldingly located in either

of said alternative positions while the corresponding electromagnet remains energized.

4. A device as claimed in claim 2, including movement-limiting stop means arranged to co-operate with said displaceable armature to lock said displaceable diverter member in either of its alternative positions until released by de-energization of the corresponding electro-magnet.

5. A device as claimed in claim 2, wherein said resilient means comprises a tension spring connected at one end to said eccentric limb of said rotatable cranked member so that the said spring is alternately tensioned in opposing the movement of said armature towards the attracting electro-magnet and relaxed in assisting the movement of the said armature away from the electro-magnet which has ceased to attract, as said eccentric crank limb is rotated by the movement of said armature, the said spring being connected at the other end to an adjustable spring-anchoring member so that the operative tension of said spring can be pre-determined and varied by adjustment of said spring-anchoring member.

6. A device as claimed in claim 2, wherein each of the said electro-magnets comprises a bobbin wound about a central magnetic pole core so as to form a central opening leading to the operative end of said pole core, and wherein said armature comprises an elongated member extending longitudinally between the spaced inner ends of said opposed electro-magnets and pivotally supported in the manner of a lever for movement towards one and then the other of the operative ends of said pole cores of said electro-magnets, and oppositely extending lateral projections on said elongated member intermediate the length thereof adapted to extend respectively into said central openings in said electro-magnet bobbins towards the operative end of said pole cores, the length of said openings and the length of said projections being made such that a maximum operative air gap is left between the end of one of said projections and the operative end of the pole core co-operating therewith, when the end of the other of said projections reaches the limit of its approach to the operative end of the other co-operating pole core upon energization of the bobbin of said other co-operating pole core.

7. A device as claimed in claim 2, wherein said armature is pivotally mounted and extends between the spaced inner opposed ends of said electro-magnets in the manner of a lever and rocks about its pivot in moving towards one and then the other of said electro-magnets, said armature lever being formed with a slot to receive said eccentric crank limb of said rotatable cranked member so that said eccentric crank limb is loosely coupled to said armature and is oscillated about the axis of rotation of said cranked member as said armature is rocked about its pivot.

8. A device as claimed in claim 2, wherein fixed abutment means is positioned in the path of movement of said eccentric crank limb for limiting the said movement of said crank limb upon movement of the armature thereby to determine the fully operative positions of said displaceable diverter member.

9. A device as claimed in claim 2, including movement-limiting stop means disposed in the path of travel of said eccentric crank limb of said rotatable cranked member to limit the movement of said eccentric crank limb, so that external pressure applied to said displaceable diverter member in one direction of its movement tends to force said crank limb against said stop means, while

external pressure applied to said diverter member in the opposite direction of its movement re-acts through the operative connection of the crank limb with the armature to urge the armature in the direction of the magnetic attraction of the energized electro-magnet, whereby said armature is held at the limit of its approach to said attracting electro-magnet and the diverter member is locked in its fully operative position until said attracting electromagnet is deenergized.

10. A device as claimed in claim 2, wherein said electro-magnets each comprises a bobbin wound about a central magnetic pole core and having a central opening leading to the operative end of said pole core, and said armature comprises an elongated member extending longitudinally between the opposed ends of said electro-magnets and is supported for sliding movement axially of the said cores so that the opposite ends of said armature enter said central openings in said electro-magnet bobbins to approach said operative ends of said pole cores in such a manner that a maximum operative air gap is left between one end of said armature and the operative end of the pole core adjacent said one end when the other end of said armature reaches the limit of its approach to the operative end of the other pole core, and wherein said displaceable diverter member comprises a vane supported upon said shaft, the said sliding armature being provided with means located intermediate its ends in engagement with said crank arm whereby said sliding movement of the armature causes the crank arm to rotate the shaft to move said diverter member from one to the other of said operative positions.

11. A device as claimed in claim 2, including a spring coupling member pivotally mounted upon said eccentric crank limb of said rotatable cranked member, a pair of tension springs connected respectively at one end to said pivotal spring coupling member upon diametrically opposite sides of its pivotal axis, the other ends of said tension springs being anchored to stationary parts of said device positioned with respect to the cranked member so that said springs act in opposition upon said pivotal spring coupling member and said eccentric crank limb, a rod having one end thereof connected to said pivotal spring coupling member, a stop carried upon said rod adjacent the other end thereof, said rod slidably engaging in a fixedly located guide and abutment member so that said stop engages said abutment member to limit the rotary movement of said eccentric crank limb, thereby acting positively to locate said displacement diverter member in either of said alternative operative positions.

12. A device as claimed in claim 1 further comprising means for alternately energizing said electro-magnets, said energizing means during operation of the device always energizing one or other of the said magnets.

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