

June 15, 1954

J. D. DURKEE
MECHANICAL MOVEMENT

2,680,970

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2 Sheets-Sheet 1

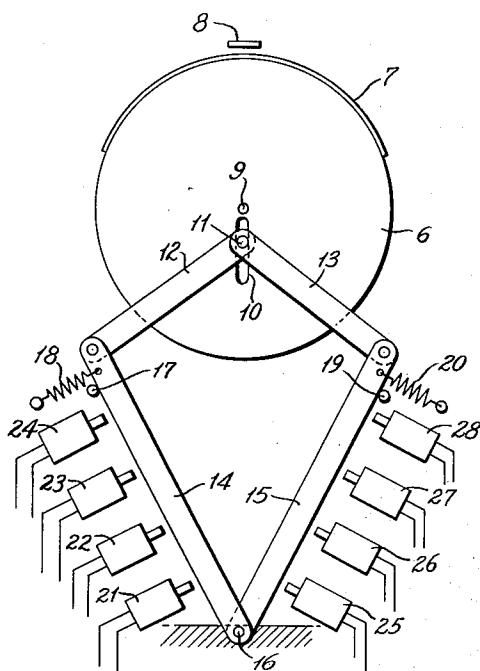


Fig. 1.

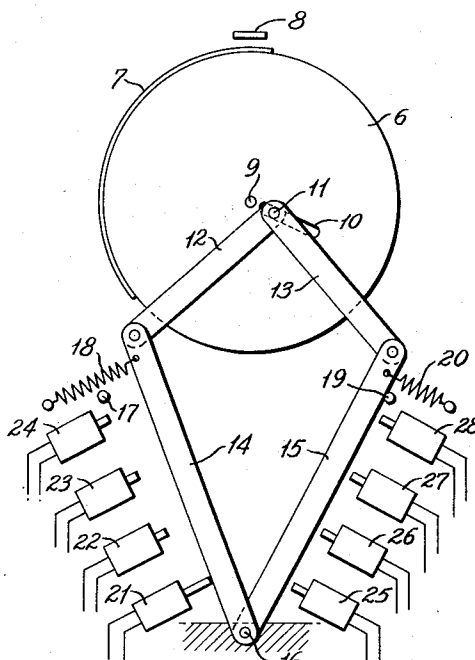


Fig. 2.

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Fig. 3

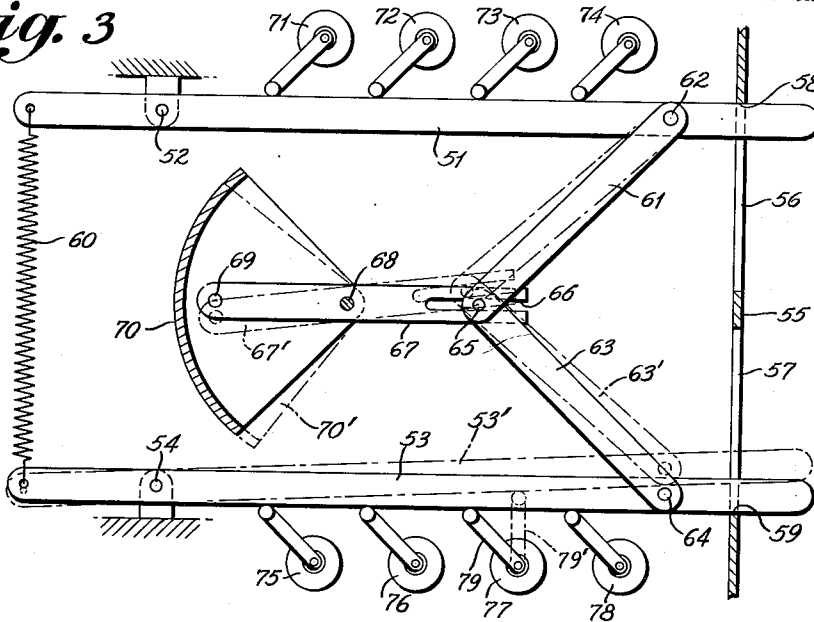
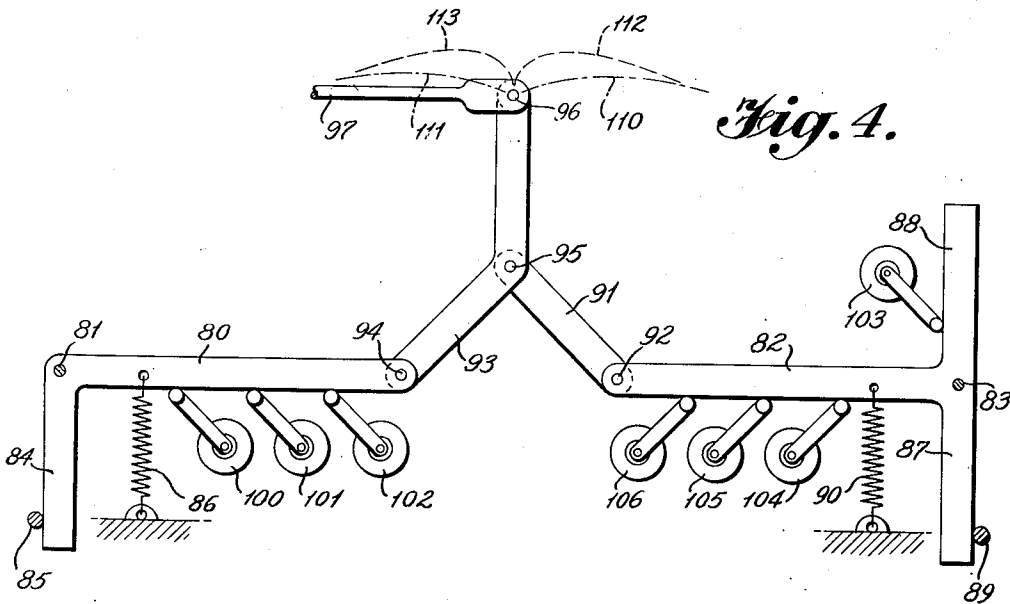


Fig. 4.



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UNITED STATES PATENT OFFICE

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MECHANICAL MOVEMENT

James D. Durkee, Arlington, Va., assignor, by direct and mesne assignments, to Dualux Corporation, a corporation of Delaware

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8 Claims. (Cl. 74-96)

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The present invention relates to mechanism for rapidly moving and accurately positioning a mechanical element in any of a plurality of prescribed positions. The invention is of general utility, but by way of example of one field of use reference may be made to the positioning of a printer wheel of a telegraphic typewriter. A printer wheel for a telegraphic typewriter must be properly positioned to present the desired character to the inked ribbon and the paper. The positioning must be precise for neatness of the typewritten material. The movement of the printer wheel from one prescribed position to another must occur very rapidly in order for the typewriter to be capable of high speed. There are many other fields of utility for mechanisms capable of rapidly and precisely positioning a mechanical element in any of a plurality of desired positions.

One of the primary objects of my invention is to provide a mechanical linkage which is capable of rapidly and accurately positioning a mechanical element in any one of a number of desired positions. Another object of the invention is to provide such a mechanism which is extremely simple so that it can be produced economically and so that there is a minimum of expense for maintenance or repair. Still another object of the invention is to provide such a mechanism in combination with a plurality of motors or drive means, which motors or drive means are identical in order to reduce costs and to simplify repairs. Still another object of the invention is to provide mechanism of the type described in which the mechanical element to be positioned has an assigned neutral position which is intermediate its other positions. The mechanical element can be moved from its neutral position to any of its other positions by traveling through a shorter path than would be the case if the element's assigned neutral positions were otherwise placed. Still another object of the invention is to provide mechanism of the type described which provides for relatively slow acceleration and/or deceleration of the mechanical element.

The foregoing and other objects and advantages of the invention will be more fully understood by reference to the following description taken in connection with the accompanying drawing, wherein:

Figure 1 is a front elevational view of mechanism embodying my invention arranged to control the movement of a printer wheel, the mechanism and the printer wheel being shown in the neutral position;

Figure 2 is a front elevational view of the apparatus shown in Figure 1 but illustrating the printer wheel moved to its extreme position in one direction from the neutral position;

Figure 3 is a front elevational view of a modi-

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fied form of apparatus embodying the invention; and

Figure 4 is a front elevational view of still another embodiment of the invention.

The arrangement illustrated in Figures 1 and 2 includes a printer wheel 6 having a type bar 7 thereon. The type bar 7 carries a plurality of printing characters, not shown, which are circumferentially spaced and which are intended to be presented selectively to a printing zone which is diagrammatically indicated by the reference numeral 8. The printing wheel must be oscillated to present the desired printing characters to the printing zone and this oscillatory movement must occur rapidly in order that the machine may print at high speed. The positioning of the printer wheel must be precise for each of its angular positions in order that the printed characters will be neatly and accurately disposed on the paper.

The printer wheel is provided with a fixed axis of rotation 9. A radially extending slot 10 is provided in the printer wheel. This slot receives a pivot pin 11 which is free to slide therein. The pivot pin 11 pivotally connects the ends of a pair of actuator links 12 and 13. The opposite end of the actuator link 12 is pivotally connected to a base link 14 while the actuator link 13 is similarly connected to a base link 15. The base links 14 and 15 are independently oscillatable about a fixed axis 16. In this form of the invention the base links 14 and 15 are independently oscillatable about the same fixed axis, although in forms of the invention hereinafter described these links are oscillatable about axes which are not coincident.

The base link 14 is provided with a stop member 17 which limits its outward movement. A tension spring member 18 resiliently biases the base link 14 into position against the stop member 17. The base link 15 is provided with a similar stop member 19 and a tension spring member 20. The stop members 17 and 19 and the spring members 18 and 20 determine definite normal positions for the base links 14 and 15, to which those links will turn when permitted to do so.

Figure 1 illustrates the base links 14 and 15 in their normal positions. Under such circumstances the printer wheel 6 occupies a definite position which may be termed its neutral position. In this neutral position one printing character may be presented to the printing zone 8, and it is unnecessary to oscillate the printing wheel 6 to print such character. Figure 2 of the drawing illustrates the condition of the mechanism when it has been actuated to move the printer wheel to its extreme position in a counterclockwise direction. The base link 15 still occupies its normal position against the stop

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member 19, but the base link 14 has been oscillated to the position shown in the drawing. The pivot pin 11, engaging as it does the walls of the slot 10, has caused the printer wheel 6 to oscillate to the position shown in Figure 2. It will be apparent from an inspection of Figures 1 and 2 that a lesser movement of the base link 14 would result in a lesser extent of oscillation of the printer wheel 6 in the counterclockwise direction. It will also be apparent from an inspection of these figures that movement of the base link 15 away from its stop member 19 will cause oscillation of the printer wheel 6 in a clockwise direction, the extent of such oscillatory movement of the printer wheel being dependent on the extent of movement of the base link 15.

Means for effecting oscillatory movement of the base links 14 and 15 are illustrated as identical solenoids 21 to 28, inclusive. The solenoids 21 to 24, inclusive, are positioned along the base link 14 at different distances from the fixed axis 16. The solenoids 25 to 28, inclusive, are positioned along the base link 15 at different distances from the fixed axis 16. Figure 2 illustrates the solenoid 21 as being energized. Its plunger has engaged the base link 14 and, since the solenoid 21 is positioned near the axis 16, the extent of movement of the base link 14 has been greater than would be the case with energization of the solenoids 22, 23 or 24. It will be readily understood that energization of the solenoid 22 would cause somewhat lesser counterclockwise movement of the printer wheel than that shown in Figure 2, whereas energization of solenoids 23 or 24 would cause progressively lesser such movement of the printer wheel. Energization of the solenoid 25 will cause maximum movement of the printer wheel in a clockwise direction, whereas energization of solenoids 26, 27 or 28 will cause progressively lesser movement of the printer wheel in that direction. All movements of the base links 14 and 15 occur in opposition to the resilient action of the springs 18 or 20, and those springs serve to immediately return the base links to their normal positions upon deenergization of the solenoids.

By energizing the proper one of the solenoids 21 to 28, the printer wheel may be moved to a position to present any desired printing character to the printing zone 8. Preferably only one of the solenoids should be energized at any one time, although there may be some slight overlapping of the intervals during which the various solenoids are energized. The movement of the printer wheel 6 will occur very rapidly and its position will be very precisely determined by the mechanism. The printer wheel will return to its neutral position as shown in Figure 1 immediately upon deenergization of the solenoids. Since the neutral position of the printer wheel is a position intermediate its other positions, it will be seen that the wheel can move from the neutral position to any other desired position by traveling through a relatively small angle.

The embodiment of the invention illustrated in Figure 3 differs considerably in appearance from the arrangement described above but it embodies the fundamental concepts of the invention. A base link 51 is oscillatable about a fixed axis 52. A similar base link 53 is oscillatable about a fixed axis 54. A fixed plate 55 is provided with slots 56 and 57 which form guideways for the free ends of the base links 51 and 53. The end 58 of the slot 56 forms a stop member which defines a normal position for the base link 51.

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The end 59 of the slot 57 forms a stop member which determines the normal position for the base link 53. The base links 51 and 53 are resiliently biased toward their normal positions by means of the tension spring member 60.

An actuator link 61 is pivotally connected to the base link 51 at 62 and an actuator link 63 is pivotally connected to the base link 53 at 64. A pivot pin 65 pivotally connects the inner ends of the actuator links 61 and 63. The pivot pin 65 is slidably received in a slot 66 of a lever 67. The lever 67 is pivotally mounted on a fixed axis 68 and the end of the lever opposite the slot 66 is fixedly secured by means of a suitable fastening means 69 to a suitable mechanical element such as a printing wheel 70. The printing wheel 70 is oscillatable about the fixed axis 68.

A plurality of oscillatory motors 71, 72, 73 and 74 are positioned adjacent the base link 51 at different distances from the fixed axis 52. A plurality of similar oscillatory motors 75, 76, 77 and 78 are positioned adjacent the base link 53 at different distances from the fixed axis 54. The oscillatory motors are preferably electrically actuated and are identical in construction. The operation of the oscillatory motor 77 will be described, it being understood that the other oscillatory motors operate in the same manner. The oscillatory motor 77 has an arm 79 which occupies the position shown in full lines when the motor is deenergized. Upon energization of the motor 77 the arm 79 moves to the dotted line position 79'. In so moving, the arm 79 causes the base link 53 to move to the dotted line position 53', the actuator link 63 to move to the dotted line position 63', and the lever 67 to move to the dotted line position 67'. Movement of the lever 67 causes the printer wheel 70 to move to the dotted line position 70'. It will be understood that energization of any other oscillatory motor will cause its associated base link to move away from its respective stop member, and that the extent of movement of a base link will be dependent on the distance of the energized oscillatory motor from the fixed axis about which the base link operates. By energizing the proper motors 71 to 78, the printer wheel 70 will be moved quickly and accurately to any of its prescribed positions. Four oscillatory motors have been shown associated with each base link, but this number can be increased or decreased as required.

Attention should be called to the arrangement of the arms of the oscillatory motors 71 to 78 relative to the associated base links 51 and 53. By reference to the arm 79 of the motor 77 it can be seen that initial clockwise movement of that arm will cause rapid initial movement of the base link 53. However, as the arm 79 approaches the dotted line position 79', the rate of movement of the base link 53 will be substantially lower. Thus the printer wheel 70 will be given a rapid rate of initial movement and this rate will gradually decelerate as the printer wheel approaches its prescribed position. This is a distinct advantage in that it eliminates the shock which would result from sudden deceleration or sudden stopping of the printer wheel.

The form of the invention illustrated in Figure 4 embodies the fundamental concepts of the invention and additionally possesses certain advantages over the arrangements described above. A base link 80 is oscillatable about a fixed axis 81 and a base link 82 is oscillatable about a fixed axis 83. The base link 80 is provided with an

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angularly extending arm 84 which is arranged to engage a fixed stop member 85 which determines the normal position of the base link 80. The base link 80 is biased to its normal position by means of the tension spring member 86. The base link 82 is provided with angularly extending portions 87 and 88. The angularly extending portion 87 is arranged to engage a fixed stop member 89 which determines the normal position for the base link 82. The base link 82 is biased toward its normal position by means of a tension spring member 90.

An actuator link 91 is pivotally connected to the base link 82 by means of a pin 92. An actuator link 93 is pivotally connected by a pin 94 to the base link 80. The actuator link 91 is pivotally connected to the actuator link 93 by means of the pivot pin 95. The actuator link 93 is shown as extending beyond the pivot pin 95 and as being connected by means of a pin 96 to a connector 97 which may lead to any mechanical element the position of which it is desired to control.

A plurality of oscillatory motors 100, 101, and 102 are positioned adjacent the base link 80 at different distances from the fixed axis 81. Oscillatory motors 103, 104, 105 and 106 are positioned adjacent the base link 82 at different distances from the fixed axis 83. The motors 101 to 106, inclusive, may be the same as those described above in connection with the embodiment of the invention illustrated in Figure 3. It will be seen that energization of any of these motors will alter the position of the base link with which it is associated and that the position of the pivot pin 96 is controlled by the positions of the base links 80 and 82.

As indicated above, the embodiment of the invention illustrated in Figure 4 possesses advantageous characteristics which are not present in the forms of the invention described above. In the forms of the invention of Figures 1 to 3, movement of one of the base links of the mechanism creates no forces tending to move the other base link away from its stop member. For that reason, in the arrangements of Figures 1 to 3, either base link of the mechanism may be moved and there is no movement of the other base link of the mechanism. However, in the arrangement of Figure 4, movement of the base link 80 or the base link 82 sets up forces which tend to move the other base link from its normal position. This phenomenon has definite advantages in a rapidly operating mechanism such as is required in a printing machine operating at high speed. The tendency of the opposite base link to move in response to positive actuation of one of the base links is opposed by the inertia of such opposite base link and by the tension spring member tending to bias such opposite link toward its normal position. However, when one of the links is moved very quickly, the opposite link will overcome its own inertia and the effect of its biasing, and will momentarily move from its normal position, to be quickly returned, however, to such normal position by its biasing spring member.

The foregoing phenomenon may be understood by referring to the paths of movement of the pin 96 under various conditions of operation. If the base link 80 is moved relatively slowly from its normal position shown in the drawing, the forces tending to move base link 82 will be insufficient to overcome the inertia of base link 82 and the action of spring member 90. Under such conditions, the base link 82 will not move and the pin 96 will follow the path designated by the dot-

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dash line 110. Similarly, when the base link 82 is moved slowly there will be no movement of the base link 80 and the pin 96 will follow the dot-dash line 111. When the base link 80 is moved very suddenly from its normal position, there will be a momentary movement of the base link 82 from its normal position and the pin 96 will follow a path such as that illustrated by the dotted line 112. Similarly, the imparting of very rapid and sudden motion to the base link 82 will cause momentary departure of the base link 80 from its normal position and the pin 96 will follow a path such as that illustrated by the dotted line 113.

The fact that rapid operation of the form of the invention illustrated in Figure 4 causes the pin 96 to follow the dotted line paths 112 or 113 results in more gradual acceleration from rest of the mechanical element to which the connector 97 is attached. For the reasons pointed out above in the description of Figure 3, the oscillatory motors 100 to 106, inclusive, impart rather rapid initial movement to the base links 80 and 82 followed by gradual deceleration of such movement. The more gradual acceleration resulting from the pin 96 following the paths 112 and 113 in combination with the gradual deceleration resulting from the particular arrangement of the oscillatory motors relative to the base links gives a very smooth operation which is free from excessively sudden accelerations or decelerations of the controlled element.

It will be seen from the foregoing detailed description that I have provided a variety of mechanisms capable of accomplishing the enumerated objects of the invention. The illustrated embodiments are to be considered as exemplary only and the broader scope of the invention is defined by the following claims.

Having thus described my invention, I claim:

1. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position, comprising a pair of base links which are independently oscillatable about fixed axes, stop means which determine definite normal positions for said base links, means for biasing said base links to engage said stop means, a pair of actuator links pivotally connected to said base links at points spaced from the said axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their normal positions and which moves in one direction from said neutral position upon oscillation of one of said base links and in the opposite direction from said neutral position upon oscillation of the other of said base links, and means for independently oscillating said base links by controlled amounts from their normal positions whereby said pivot pin may be selectively moved to prescribed positions on either side of its said neutral position.

2. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position, comprising a pair of base links which are independently oscillatable about fixed axes, stop means which determine definite normal positions for said base links, means for biasing said base links to engage said stop means, a pair of actuator links pivotally connected to said base links at points spaced from the said axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral

position when both of said base links are in their normal positions and which moves in one direction from said neutral position upon oscillation of one of said base links and in the opposite direction from said neutral position upon oscillation of the other of said base links, and a plurality of solenoids positioned along said base links at different distances from said fixed axes, each of said solenoids being arranged, upon energization, to oscillate its associated base link from its normal position by an amount dependent on the distance of such solenoid from the fixed axis of said associated base link, whereby upon selective energization of such solenoids said pivot pin may be selectively moved to prescribed positions on either side of its said neutral position.

3. Mechanism as described in claim 2 in which the said fixed axes of said base links are coincident.

4. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position, comprising a pair of base links which are independently oscillatable about fixed axes, stop means which determine definite normal positions for said base links, means for biasing said base links toward said stop means, a pair of actuator links pivotally connected to said base links at points spaced from the said axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their normal positions and which moves in one direction from said neutral position upon oscillation of one of said base links and in the opposite direction from said neutral position upon oscillation of the other of said base links, and a plurality of motors positioned along said base links at different distances from said fixed axes, each of said motors being arranged, upon energization, to oscillate its associated base link from its normal position by an amount dependent on the distance of such motor from the fixed axis of said associated base link, whereby upon selective energization of such motors said pivot pin may be selectively moved to prescribed positions on either side of its said neutral position.

5. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position, comprising a pair of base links which are independently oscillatable about fixed axes, stop means which determine definite normal positions for said base links, which normal positions are generally parallel, means for biasing said base links toward said stop means, a pair of actuator links pivotally connected to said base links at points spaced from the said axes thereof, said actuator links being angularly disposed relative to each other and being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their normal positions and which moves in one direction from said neutral position upon oscillation of one of said base links and in the opposite direction of said neutral position upon oscillation of the other of said base links, and a plurality of oscillatory motors positioned along said base links at different distances from said fixed axes, each of said motors being arranged, upon energization, to oscillate its associated base link from its normal position by an amount dependent on the distance of such motor from the fixed axis of

said associated base link, whereby upon selective energization of such motors said pivot pin may be selectively moved to prescribed positions on either side of its said neutral position.

6. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position, comprising a pair of base links which are independently oscillatable about fixed axes, means for biasing said base links against stop means which determine definite normal positions for said base links, a pair of actuator links pivotally connected to said base links at points spaced from the said fixed axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their said normal positions, means for oscillating a first of said base links by a definite amount from its normal position to thereby move said pivot pin to a prescribed position on one side of its said neutral position, and means for oscillating the second of said base links by a definite amount from its normal position to thereby move said pivot pin to a prescribed position on the opposite side of its said neutral position.

7. Mechanism comprising a pair of base links which are independently oscillatable about fixed axes, said base links being biased toward definite normal positions, a pair of actuator links pivotally connected to said base links at points spaced from the said fixed axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their said normal positions, means for oscillating a first of said base links through a prescribed angle from its normal position to thereby move said pivot pin to a definite first position in one direction from its said neutral position, and means for pivotally moving the second of said base links through a prescribed angle from its normal position to thereby move said pivot pin to a definite second position in the opposite direction from its neutral position.

8. Mechanism for selectively moving a pivot pin to any of a plurality of prescribed positions on either side of an intermediate neutral position comprising a pair of base links which are independently oscillatable about fixed axes, stop means against which said base links may abut to define definite normal positions for said base links, a pair of actuator links pivotally connected to said base links at points spaced from the said fixed axes thereof, said actuator links being pivotally connected together by a pivot pin which occupies a definite neutral position when both of said base links are in their said normal positions, means for pivotally moving a first of said base links from its normal position to thereby move said pivot pin in one direction from its said neutral position, means for returning said first base link to its normal position to thereby return said pivot pin to its neutral position, means for pivotally moving the second of said base links from its normal position to thereby move said pivot pin in the opposite direction from its said neutral position, and means for returning said second base link to its normal position to thereby again return said pivot pin to its neutral position.