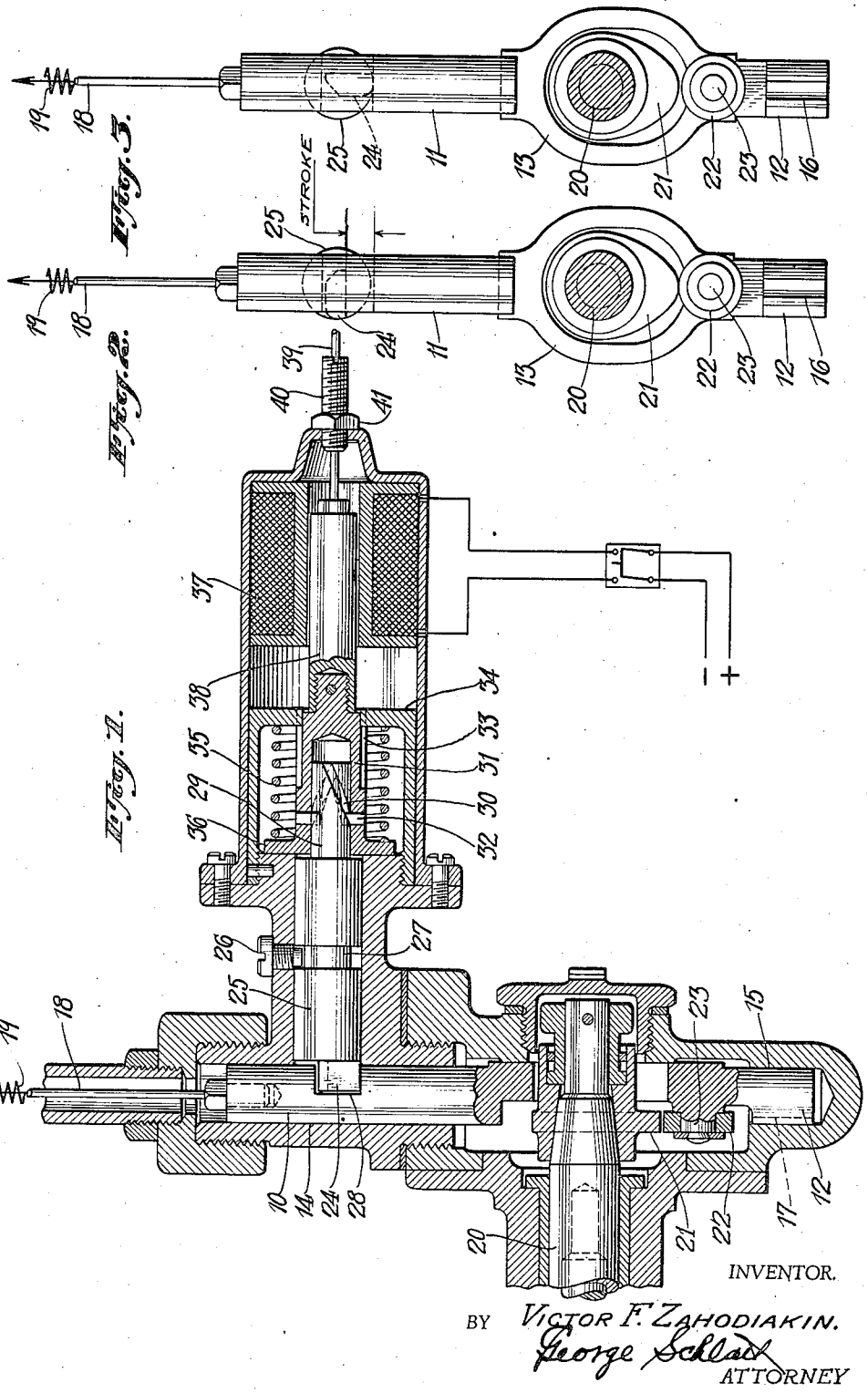
Feb. 13, 1945. V. F. ZAHODIAKIN 2,369,512

CONTROL MECHANISM

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CONTROL MECHANISM

Filed Dec. 17, 1940 2 Sheets-Sheet 2

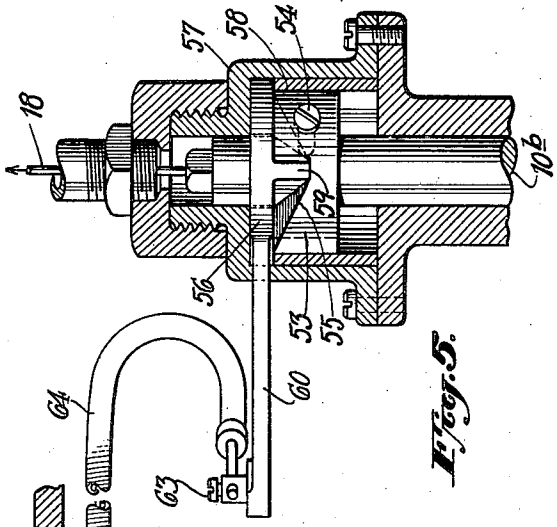


Fig. 5.

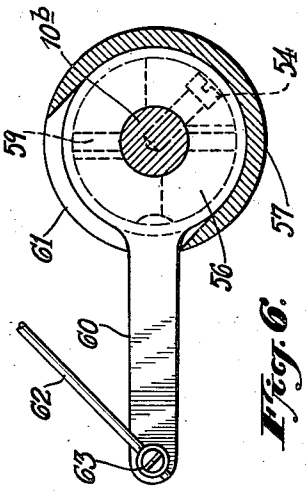


Fig. 6.

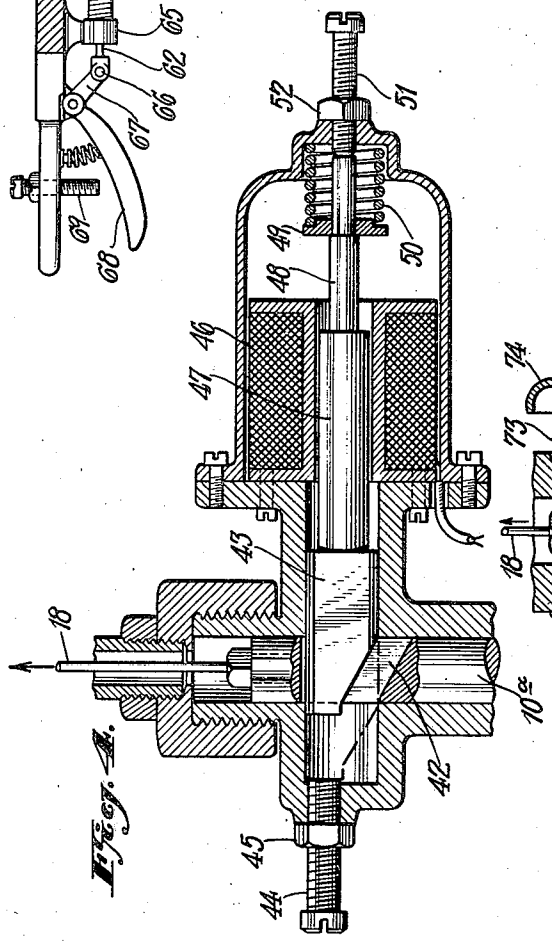


Fig. 4.

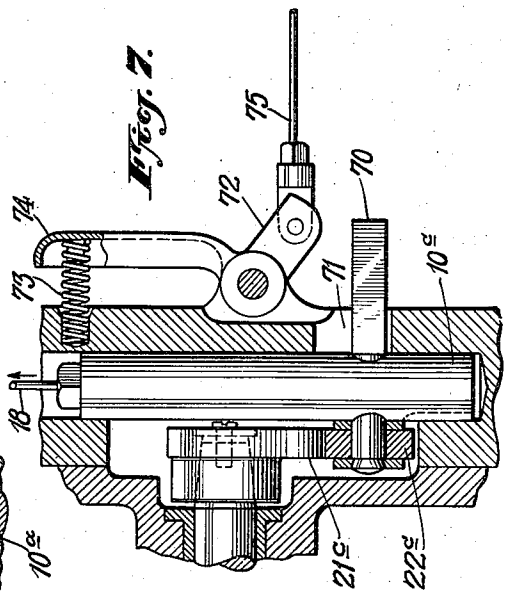


Fig. 7.

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CONTROL MECHANISM

Victor F. Zahodiakin, Maplewood, N. J.

Application December 17, 1940, Serial No. 370,467

4 Claims. (Cl. 74—569)

This invention relates to improvements in control mechanisms, and more particularly to an apparatus for controlling movement of a reciprocable member such as machine gun triggers or the like.

Objects

Among the principal objects which the present invention has in view are: to provide a control mechanism to function as a variable in conjunction with a constant stroke-actuating prime mover; to thus enable a reciprocable member to be actuated through a desired stroke from zero to maximum from a constantly operating prime mover; to actuate the reciprocable member from the prime mover and utilize the control mechanism for obtaining variable actuating contact between said prime mover and said member; to utilize a cam on the prime mover which is subject to constant rotation but variable actuating contact with the reciprocable member; to provide a control mechanism for the reciprocable member which will limit the stroke of the said member within the range of full stroke of the cam to zero reciprocation without interrupting rotation of the cam; to impart control by said mechanism for variable stroke of the reciprocable member by twisting an eccentrically disposed lug; to effect the control from zero to maximum of the reciprocable member with a limited rotation of the eccentrically disposed lug; to confine the necessary rotation of the eccentrically disposed lug to an amplitude not exceeding 90 degrees; to provide simple and effective means for revolving the eccentrically disposed lug; to employ a solenoid to establish a reciprocable motion and translate the reciprocable motion into rotary motion in its transfer to operate the eccentrically disposed lug; to incorporate means for manually operating the said lug when desired or in event of failure of the solenoid; to provide means for limiting action of the solenoid and of the manual means in the action thereof to revolve the said lug; to obtain simple operation and construction; and to obtain other advantages and results as may be brought out in the following description.

Drawings

Figure 1 is a longitudinal sectional view of a control mechanism embodying my invention;

Figures 2 and 3 are sectional elevations of the reciprocable member showing its relationship to the prime mover and to the controlling eccentric lug;

Figure 4 is a sectional view similar to Figure 1 showing a modified construction of control mechanism;

Figure 5 is a similar sectional view of a still further modified construction of control mechanism;

Figure 6 is a sectional view substantially on a transverse plane to Figure 5 situated substantially just above the operating lever; and

Figure 7 is another sectional view of a still further modified construction of control mechanism.

Description

There are often instances of reciprocation of a member wherein it is desired to vary the stroke of reciprocation of such member. One such instance is in connection with the trigger or tripping mechanism of machine guns, and the present invention relates generically to the control mechanism applicable to any of the numerous apparatuses where a control of the stroke is desired. The present invention inheres in the parts associated with a reciprocable member by which the member is susceptible to a variable stroke and with which is associated mechanism for controlling such stroke. One specific embodiment is illustrated more particularly in Figures 1 to 3 in which reference numeral 10 designates in general a reciprocable member. The upper and lower end portions of said member are shown as aligned cylinders or rods 11 and 12 integrally connected by an intervening yoke portion 13. The reciprocable member is carried in a suitable housing appropriately shaped to provide an upper bearing portion 14 for the upper rod portion 11 of the reciprocable member and a lower bearing portion 15 for the lower end portion 12 of said member. The member is permitted to have a controlled reciprocation within said bearings, but is prevented from rotating by suitable means such as key-way 16 situated longitudinally of the lower rod portion 12 engaging a corresponding longitudinal spline 17 in the housing. The upper end of the reciprocable member 10 is shown connected by a wire or other connecting means 18, which is preferably flexible, to the particular device to which controlled reciprocation is to be applied. A spring 19 is diagrammatically shown in connection with said connecting means 18 which tends to actuate the reciprocable member at all times towards the upper end of its stroke. The spring is to be understood as any tensioning means either incorporated in direct association with the connection 18 or forming part of the apparatus to which the control mechanism of the present invention is applied.

In association with the reciprocal member 10 is a prime mover 20, here shown as a constantly rotating shaft transverse to the reciprocable member 10 and projecting through the yoke 13 thereof. Fast upon this shaft 20 is a cam 21 situated adjacent to said yoke 13 and rotatable in a plane parallel to said yoke. The said shaft and cam are constantly rotating under influence of suitable motivating means (not shown), such as an electric or other motor while the associated apparatus is in use. At the front of the yoke in a plane common to the plane of the cam is a roller 22 carried by a suitable bearing or stud 23 from the reciprocable member. At such time as said reciprocable member is free to respond to the tensioning of spring 19, the said roller 22 is drawn into peripheral contact with the periphery of cam 21, consequently, as said cam rotates the reciprocable member will move upwardly under influence of the spring as the cam rotates to present its portion of diminishing diameter to the roller. As the cam proceeds to present its periphery of increasing diameter to the roller, the said member 10 is thereby depressed. The rotary action of said shaft and cam in conjunction with spring 19 will accordingly impart a reciprocating movement to reciprocable member 10 and as so far described, such reciprocation is for the full stroke which the cam is designed to impart.

In the upper rod portion 11 of the reciprocable member is provided a means for limiting reciprocation of the said member 10 notwithstanding the continued and constant rotation of the prime mover. The means here shown contemplates the introduction of a limiting factor which is interposed in the path of upward movement of the reciprocable member. The specific limiting factor here shown is an eccentric lug 24 carried on the end of a rotatable member 25. This said member is prevented from longitudinal movement by a set screw 26 projecting through the housing into a peripheral groove 27. The eccentricity of lug 24 is accomplished by situating the same in a diametrical direction at the end of said member 25, but extending to the periphery of said member at one end of the lug only. The lug is situated at all times in a notch 28 in the reciprocable member, said notch having a height substantially the height of the lug when situated vertically. However, by rotating the rotatable member and lug so the lug will extend crosswise, as in Figure 2, the under wall of the lug is then spaced from the lower wall of the notch a distance representing the full stroke which can be accomplished by rotation of the cam from its highest to its lowest points. Consequently, with the lug in its horizontal position, the reciprocable member may be moved up and down by the spring and cam with a full stroke, but as the lug is rotated toward the vertical position, the lower corner or edge of the lug engages the lower wall of the notch as the reciprocable member rises and thus limits the upward movement or stroke of said member. When the lug has been rotated to a vertical position, the reciprocable member will be then held in its lowermost position and the peak of the cam when turned downwardly as shown in Figures 1 and 3, will not then engage the roller so that the cam will rotate without effecting any reciprocation of member 10 whatsoever in the stated position of the lug.

It is to be observed now that the construction so far described necessitates rotation of the rotatable control member 25 only through a displacement of 90° and its displacement will obtain a desired limitation or control of the reciprocation of member 10.

The rear end of rotatable member 25 has a reduced axial stem 29 projecting therefrom. In the outer cylindrical surface of this stem are one or more spiral grooves 30 with the spiral advancing a quarter turn around the stem. The stem is surrounded by a sleeve 31 from the inner surface of which projects a thread portion or pin 32 adapted to ride in the spiral groove. The sleeve is reciprocable upon the said stem but is prevented from rotating by a splined connection 33 with a fixed cup 34 forming part of the casing. The compression spring 35 is situated against an end of the cup furthest away from the end of the rotatable member having the lug 24, the opposite end of the spring bearing against a flange 36 at the end of the sleeve nearest to said lug so the sleeve will normally tend to slide longitudinally inward with respect to the rotatable member. When the sleeve is slid opposite to the tension of said spring 35 thread portion or pin 32 will cause said rotatable member 25 to rotate a proportionate amount due to the spiral groove 30 thereby obtaining a corresponding revolving of the lug 24.

Reciprocation of the sleeve 31 to a desired rearward position may be obtained by suitable means. As here shown a solenoid coil 37 is shown situated around a soft iron core 38 in axial continuation of said sleeve. The intensity of the current will determine the amount of retraction of the sleeve which in turn determines the amount of rotation of the rotatable member thereby controlling the position of the lug and the stroke of the reciprocable member 10. In event of failure of the electric current or if preferred to operate the retraction of the sleeve by manual means, suitable connection 39 may be made for that purpose. As here shown, said connection is in the form of a wire fastened to and extending from the rearmost end of solenoid core 38 outward through the housing. As shown, said wire or connection 39 passes slidably through a threaded bushing 40 which screws into the end of the housing and is secured in adjusted position by a lock nut 41. The inner end of this bushing constitutes a stop for engagement by the end of the solenoid core. The further the bushing is screwed into the solenoid the less will be the permitted movement of the solenoid and accordingly the position to which the lug may be revolved is thereby limited. Thus it is made possible to obtain a mechanical limitation rather than electric limitation as to the extent of sliding of the solenoid core.

While the foregoing description of Figures 1 to 3 has of necessity been somewhat specific as to the details of construction there shown, it is to be understood that the broad concept of the invention is susceptible to incorporation in other specific embodiments. For instance, in Figure 4, a modified construction of control unit is depicted. In this view, a reciprocable member 10a is slidably mounted as before in a housing, similar to the housing of the previously described embodiment, said member likewise being under a lifting resilient tension through a flexible connection 18 as before. In this instance, the notch 28 of the preceding construction is modified to extend through member 10a in a direction parallel to the transverse member and has its lower wall sloping upwardly outward to thus provide a side passage or notch 42 of varying height from

one side to the other of the reciprocable member. The housing is shaped to mount a transverse member 43 directly opposite this notch or opening 42, the lower forward portion of this transverse member being tapered at the same angle as the lower wall of the opening and constituting a lug for limiting engagement with respect to said wall. Said transverse member 43 is preferably slidable in this instance in consequence of which the gap between the underside of the tapered lug and the sloping wall of the opening may be increased or decreased. When the transverse member 43 is slid through opening (as indicated by dot and dash lines) to an extent which positions the tapered underside of the lug beyond the opening, the upper corner of the sloping wall of the opening will then engage the lowermost part of the lug, whereas retraction of the transverse member to the full line position shown will obtain maximum separation of the tapered under wall of the lug and the sloping wall of the opening, thereby permitting the reciprocable member to move upwardly an extent representing the full stroke of the motivating means or cam 21 of Figure 21. The transverse member 43, in association with the taper of its forward end, the slope of the bottom wall of the opening, and the operating tension of connection 18 pulling the member in one direction and the cam heretofore described pulling the member in the other direction, constitutes a control for the variable stroke from zero to maximum. An adjustable stop, such as set screw 44 and lock nut 45 situated directly in front of the forward end of the transverse member 43 enables the transverse member to be stopped at any desired position and thus limit the maximum stroke for the reciprocable member.

The rear end of the transverse member is shown having a soft iron core 47 projecting therefrom and associated with a surrounding solenoid coil 46 which is fixed with respect to the housing. The core 47 is shown with an extension 48 passing through and extending beyond coil 46. A flange 49 is situated on this extension to provide a bearing for the end of a compression spring 50, the other end of which is prevented from displacement by engagement with a part of the housing. Said spring tends to normally press the transverse member forward to its position limiting minimum stroke of the transverse member and the solenoid operates to retract the transverse member to position where maximum stroke for the reciprocable member is permitted. Adjustment must be provided for limiting the retracted position for the transverse member, as by providing another set screw 51 and lock nut 52 directly opposite the said end of the member which projects rearwardly through the solenoid.

While the construction illustrated in Figure 4 utilizes reciprocable movement of the transverse member, it is to be understood that a transverse member having rotary motion in conjunction with a tapered wall on the controlled reciprocable member may be employed if desired. As an example of this feature, reference is made to Figure 5 wherein is shown a reciprocable member 10b slidably mounted in a housing as before and having a flexible member 18 under tension as previously described for purposes of pulling the reciprocable member upward as described in connection with Figure 1. Downward movement of the reciprocable member is obtained as more particularly described in connection with the preceding figures. In this particular instance, the reciprocable member is shown with an enlargement or collar 53 situated thereon and prevented from either slidnig or rotating with respect to the reciprocable member 10b by means of a screw 54 extending radially inward of the collar and secured to the said reciprocable member 10b. The upper surface of the collar 53 is tapered, as at 55, and in that respect corresponds to the sloping bottom wall of opening 42 in the construction of Figure 4. Immediately above the said collar 53 is a rotatable member 56 mounted co-axially and upon the slidable member 10b, said slidable member conveniently forming the axle upon which said member 56 may rotate, but said reciprocable member being slidable up and down whereas said rotatable member 56 is longitudinally immovable. As a convenient means for preventing reciprocation of said rotatable member 56, the housing 57 is shown overlying the marginal portion of said member at the upper side and the upper end of a sleeve 58 is shown underlying the marginal portion of said member, said sleeve surrounding the collar 53 and the rotatable member having a greater diameter than the collar. The said rotatable member is in the form of a disc from the underside of which projects a downwardly extending lug 59. This lug may therefore be revolved with respect to the reciprocable member and its lower edge engages a corresponding portion of the sloping surface 55 of the collar. When the lug seats in the lowest engageable portion of the sloping surface, the reciprocable member will have maximum stroke, but when the rotatable member is moved around so the lug engages at the top portion of the sloping surface or collar, the reciprocable member will have correspondingly less stroke, the means thus again illustrating limitation of stroke from zero to maximum.

Rotation of the rotatable member 56 is obtained by means of an arm 60 projecting therefrom at one side through a slot opening 61 in the housing. Suitable operation of the arm is obtained by appropriate means. As here shown, a flexible wire 62 is attached to an outer part of the arm through suitable swivel 63, said flexible connection 62 passing through a flexible housing 64 to a place convenient to the operator. Through the flexible housing is secured in a bracket 65 and the flexible connection 62 projects through the bracket for pivotal mounting at 66 to the short arm 67 of a manual operating spring actuated lever or hand grip 68. The extent the movement of the rotatable member 56 may be controlled by providing a stop in the nature of a set screw 69 adjacent to the hand grip 68. This showing in Figure 5 of manual attachment and control of the flexible member 62 may be considered as illustrative of means for operating the flexible connection 39 of Figure 1.

The embodiment of Figure 7 provides a reciprocable member 10c as before under lifting tension of flexible connection 18. As in the preceding constructions, the reciprocable member has a roller 22c thereon in conjunction with an associated cam 21c for applying a depression actuation to the reciprocable member. The control means of this showing utilizes a lateral projection 70 from the reciprocable member. This projection may be conveniently located and in this instance is shown as an extension of the stud on which said roller 22c is mounted. The housing for the reciprocable member is appropriately slotted as at 71 to permit the said projection to move

up and down an amount equal to the maximum stroke of the reciprocable member. Situated above the projection 70 is a pivoted lug 72. Said lug can be swung upward as shown in the drawings thereby permitting upward movement of projection 70 for the maximum stroke of the reciprocable member. However, said lug can be swung downward and when in vertical position will engage the upper surface of the said projection and hold said projection in its lowermost position, thereby preventing reciprocation of the reciprocable member. Positions of the lug anywhere between the extreme positions just described will permit a corresponding stroke for the reciprocable member, and thus again is illustrated means for varying the stroke from zero to maximum.

The lug 72 is preferably depressed to its vertical position by means of a spring 73 which is shown situated between the housing and a hand grip 74, the lower end of which is integral with the pivoted end of said lug 72. Remote control for the position of said lug and the same may be obtained through a flexible connection 75 attached to the lug and corresponding to flexible connection 62 of the preceding figures. By utilization of a manual control such as illustrated in Figure 5, the flexible connection can be drawn upon by the operator against the compressive tension of spring 73 for controlling the increase of permissible stroke for the reciprocable member.

Obviously detail changes and modifications may be made in the construction and operation of my improved control mechanisms without departing from the spirit and scope of the invention, and I do not wish to be understood as limiting myself to the exact construction or operation shown or described.

I claim:

1. A control mechanism comprising an elongated member longitudinally reciprocable with a normal length of stroke, said reciprocable member having an opening in the side thereof, and a control member having a part always in said opening, said part having its maximum height substantially the minimum length of the opening and having a thickness less than said maximum height, said control member being transverse to and movable with respect to the reciprocable member for changing relation of said part to the opening at any given position of reciprocation of the reciprocable member, said part of the control member having one position in said opening which permits full normal-stroke reciprocation of said reciprocable member and having another position which engages the said part of the control member with a wall of said opening and displaces the reciprocable member beyond its normal-stroke position.

2. A control mechanism comprising an elongated member longitudinally reciprocable with a normal length of stroke, said reciprocable member having an opening in the side thereof, and a control member having a part always in said opening, said part having its maximum height substantially the minimum length of the opening and having a thickness less than said maximum height, said control member being transverse to and rotatable with respect to the reciprocable member for changing angular relation of said part to the opening at any given position of reciprocation of the reciprocable member, said part of the control member having one angular position in said opening displacing said part from an end wall of the slot and having another angular position at which said part of the control member engages with said end wall of the opening and displaces the reciprocable member beyond its normal-stroke position.

3. A control mechanism comprising an elongated reciprocable member and reciprocating means therefor, and an elongated control member at right angles to said reciprocable member, said control member having a part thereof protruding into the side of the reciprocable member part way through said member, and said control member having means retaining it non-slidable but rotatable, means limiting rotation of said control member, said part protruding into the side of the reciprocable member having position at one limitation of rotation of the control means displacing the reciprocable member from engagement by said reciprocating means and locking said reciprocable member against longitudinal movement in either direction.

4. A control mechanism comprising in combination with an elongated reciprocable member having an opening, a rotatable member transverse to said reciprocable member and situated opposite said opening and having a lug in said opening, said lug having a flat face substantially at the axis of the rotatable member and having an edge substantially at the periphery of said rotatable member, and means for rotating said edge to interrupt the stroke of the reciprocable member and for turning said flat face transverse to direction of movement of the reciprocable member for permitting reciprocation thereof.

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