A powdered metal press, including a frame supported die or mold table having a die or mold cavity therein receiving metal powder to be compressed. The press includes a pair of concentric powder compressing rams and an axially opposed powder compressing ram mounted on the frame for movement together and apart in the cavity to compress the powder and form a part. The rams are each movable relative to the frame and to each other to provide maximum sequencing flexibility.

5 Claims, 16 Drawing Figures
POWDERED METAL PRESS

BACKGROUND OF THE INVENTION

This invention relates to a powdered metal press of the type including opposed punches or rams which are moved together to compact powder metal particles and form a unitary part that may subsequently be sintered to bind the particles together. Such presses may include a die or mold table having a vertical die cavity and opposed upper and lower rams or punches received in the cavity for compressing the metal powder to form the part. When powdered metal is pressed to form a part having portions of two different thickness, commonly referred to as a two-level part, it is important that the powdered metal in the various levels be proportionately compressed so that the relative thicknesses of the levels before and after pressing remain substantially constant. If the levels are not proportionately compressed, powder may transfer from one level to another with the result that the density of the part is not uniform and cracks and fissures form during sintering, or when the parts are used, at the intersection of the different levels.

It is an object of the present invention to provide a multiple punch, powdered metal press which is easily adjustable, accurate, and operative at high speeds to attain maximum press utilization and enhance productivity.

Another object of the present invention is to provide a powdered metal press of the type described in which an upper powdered metal compacting ram is lowered toward a pair of opposing concentric rams received in a die table mold to provide compacting pressure for forming the part and in which part ejection is accomplished by conjunctively downwardly withdrawing the die table and lifting at least one of the opposing rams.

One of the prior art powdered metal presses known to us includes a stationary lower ram, a movable lower ram, and maintenance prone wedge blocks which interrupt the downward movement of the movable ram to maintain the movable ram at a higher level than the stationary ram during the pressing operation. To eject the part from the die cavity, the die table is lowered while the part is supported by the underlying lower rams. The wedge blocks are then withdrawn to remove the support for the movable ram which is then withdrawn downwardly away from the portion of the part supported by the stationary ram. This system of operation is relatively cumbersome, slow and inconvenient. Accordingly, it is an object of the present invention to provide a powdered metal press of the type described wherein a movable powder pressing ram and a pair of opposing, powder pressing rams which are independently vertically movable permit more rapid machine operation.

It is another object of the present invention to provide a powdered metal press of the type described which is readily convertible to either an opposed ram press or a modified withdrawal press.

Another object of the present invention is to provide a multi-ram, powdered metal press of the type described, which has sizing bars on each ram to control the end position of that ram in relation to all other rams in the system during the compression phase of the cycle to positively and accurately form the part to desired precision tolerances.

SUMMARY OF THE INVENTION

A powdered metal press for forming a part having portions of at least two different thickness comprising a pair of lower powdered metal pressing rams, an opposed upper powdered metal pressing ram, and mechanism mounting the lower rams so that one of the lower rams moves relative to the other lower ram during part-forming and the other lower ram is movable during part ejection.

The present invention may more readily be described by reference to the accompanying drawings, in which:

FIG. 1 is a partly sectional, side elevational view of a powdered metal press constructed according to the present invention;

FIG. 1A is a schematic top view plan of the press, taken along the line 1A—1A of FIG. 1, particularly illustrating the ram moving cylinders;

FIG. 1B is an enlarged top plan sectional view showing the lower rams, taken along the line 1B—1B of FIG. 1;

FIG. 2 is an enlarged, fragmentary, sectional side view of the die table illustrating the powdered metal in the die cavity prior to compacting;

FIG. 3 is an enlarged sectional view illustrating a two-level flanged tablet or part formed with apparatus constructed according to the present invention;

FIG. 3A is a bottom plan view of the part formed, taken along the line 3A—3A of FIG. 3;

FIG. 4 is an end elevational view illustrating a filler shoe for delivering powder to the mold cavity;

FIG. 5 is a side view of the filler shoe, taken along the line 5—5 of FIG. 4;

FIGS. 6 and 6A, taken together, comprise a schematic diagram of a hydraulic control circuit for controlling the apparatus illustrated in FIGS. 1 and 2; FIGS. 7 – 9 schematically illustrate the machine depicted in FIG. 1 in various sequential positions during the formation of the two-level flanged part illustrated in FIG. 3; and FIGS. 10 – 12 schematically illustrate various sequential positions of a modified machine constructed according to the present invention for forming a two-level, cup-shaped part.

Apparatus constructed according to the present invention is supported on a frame or base, generally designated F, including a base plate 10 supported by upstanding legs 12. An upper frame plate 14 is mounted on the lower frame plate 10 by vertical rods 16.

A non-magnetic die table, generally designated 18, is suspended between the upper and lower frame plates 10 and 14 by the piston rods 22 of a pair of double acting, fluid pressure operated, solenoid actuated cylinders 20 mounted on the upper frame plate 14. The pis-
The die table 18 includes a central counterbored aperture or opening 26 mounting a die plate 28 having a die cylinder or mold 30 fixed thereto via a clamping ring 32. The mold 30 includes a central, vertical die cavity 34 in which metal powder material M is deposited and compressed to form a part P (FIG. 3). The cylinders 20 permit the die table 18 to "float" downwardly when a part P (FIG. 3) is being formed and are also actuated to move the die table 18 downwardly to strip the table 18 away from the part P after it is formed.

For depositing metal powder material M to be pressed in the die cavity 34, a filler shoe, generally designated 38, is mounted on a pair of frame supported guide rods 40 for to-and-fro movement in the directions represented by the arrows a and b between a retracted position, illustrated in chain lines in FIG. 4, and a forward powder depositional position, illustrated in solid lines in FIG. 4, by a fluid operated, double acting, solenoid actuated cylinder 41. The powder metal material M may suitably or typically comprise an admixture of 300 mesh iron powder fillings or particles and a fraction minimizing lubricant, such as 0.5 percent zinc stearate. The filler shoe 38 rides along the upper surface 18a of the die table 18 and includes a downwardly opening cavity 42 which receives powered metal M via an opening 42a at the upper side thereof. Spring loaded nylon seals or the like 44a are provided on the underside of the filler shoe 38 to prevent the escape of metal powder material M from the shoe as the shoe 38 moves forwardly. The filler shoe 38 also strips or removes the previously formed part P (FIG. 3) from the die table 18 after it is ejected from the die cavity 34.

Apparatus for supplying the powdered metal M to the filler shoe 38 in the retracted position may comprise a filler housing 36 having an aperture 36a therein communicating with a powder supply hopper generally designated 37. The upper surface 38a of the shoe 38 operates as a cut-off slide for interrupting the supply of powdered metal M when the shoe 38 moves forwardly to the position illustrated in solid lines.

Apparatus for compressing the metal powder M in the die cavity 34 comprises opposed, upper and lower ram mechanisms, generally designated 44 and 46, respectively. The upper ram mechanism 44 includes an upper non-magnetic ram carrier or platen 45, mounted for rapid vertical movement toward the die table 18 by a pair of solenoid actuated, fluid operated, double acting, "kicker" cylinders 47 which are mounted on the frame plate 14 and have piston rods 49 connected to the ram carrier 45. The ram carrier 45 is also mounted by the enlarged diameter piston rod 48 of a double acting, solenoid actuated, fluid operated cylinder 50 which is mounted on the frame plate 14. The piston rod 48 moves the ram carrier 45 during the terminal part of the die pressing stroke as will presently be described.

Mounted on the underside of the upper ram carrier plate 45 is an upper ram, generally designated 52, which is receivable in the die cavity 34 as the upper ram platen 45 is moved downwardly to the lowered, powder compressing, position illustrated in chain lines. The upper ram platen 45 includes a central bore 54 and a plurality of circumferentially spaced, smaller diameter bores 56, for receiving the complementary die parts of the lower mold mechanism 46 as will later become apparent.

Mounted atop the upper ram carrier cylinder 50 is a prefill valve assembly, generally designated 58, which supplies pressurized, cylinder operating, fluid via a line 60 to the upper end of the piston rod 48 when the kicker cylinders 47 are moving the upper ram 52 to the position shown in chain lines in FIG. 1. When the upper ram 52 starts to enter the die cavity 34 the fluid is diverted from the kicker cylinders 47 and redirected to the upper end of main cylinder 50, which has been pre-filled with fluid by the valve 58. Since the diameter of the piston 48 is substantially larger than the pistons of the kicker cylinders 47, the cylinder 50 will move the upper platen 45 at a substantially reduced pressing speed. The upper ram carrier 46 also includes guide sleeves 57, guiding on frame supported vertical guide rods 59.

The lower ram mechanism 46 includes a pair of vertically spaced, non-magnetic, lower ram supporting platens 60 and 62. The uppermost lower platen 60 is mounted on the piston rods 66 of a pair of double acting, solenoid actuated, fluid pressure operated cylinders 64 mounted on the upper frame plate 14. The piston rods 66 freely pass through passages 18b in the die table 18. The cylinders 64 permit the uppermost lower platen 60 to float or move downwardly with ram 52 when the material M is under compression in the die cavity 34 so that regardless of the depth of fill of each level the relative compression of the central portion and the flange f of the part being formed is the same. The uppermost lower platen 60 includes a central aperture 68 covered by a removable ram mounting plate 70 having a vertical, cylindrical ram 72 provided with a central bore or guide opening 74 and a plurality of smaller, circumferentially spaced bores or guide openings 76 for a purpose to be presently described.

The lowermost platen 62 is mounted on the piston rods 86 of a pair of double acting, solenoid actuated, fluid operated cylinders 84 (FIG. 1A) mounted on the upper frame plate 14. The piston rods 86 are freely received in passages 18b provided in the die table 18 and uppermost lower platen 60. The lowermost lower platen 62 includes a central opening 88, covered by a mounting plate 90 supporting an upstanding hollow, cylindrical ram or punch 92 received within the central bore 74 of the cylindrical ram member 72. The ram member 92 is clamped to the plate 90 by a clamping ring 93. Extending through the cylindrical punch or ram 92 is a core rod 94 mounted on a vertical, externally threaded post 96 which is freely passed by the lower frame plate 10 and connected as at 101 to a crossbar 98 supported by double acting, fluid pressure operated, solenoid actuated cylinders 97. A set screw 102 is provided to lock the core rod supporting post 96 to the underlying crossbar 98 when the post 96 has been vertically positioned.

Mounted on the support post 96 for movement therewith is a core rod support cage, generally designated 106, including a pair of vertically spaced plates 80 vertically spanned by rods 82 which are freely vertically movable in apertures 87 provided in the lowermost platen 62. The uppermost cage plate 80 mounts a plurality of circumferentially spaced, vertical core rods 78, receivable in the apertures 76 in the lower ram 72 and apertures 56 in the upper ram 52, which provide verti-
cal apertures A (FIG. 3A) in the flange f of the part P being formed.

The relative vertical positions of the cage 106 and central ram 94, and the lower hollow cylindrical ram 72, may be adjusted by a pair of nuts 104 which are threaded on the externally threaded post 96 on vertically opposite sides of the lowermost plate 80 of the rod supporting cage 106. By adjustment of the nuts 104, the rods 94 and 78 may be raised and lowered relative to the cylindrical ram members 52, 72 and 92 to insure that the rods 94 and 78 extend completely through the flange f when the part is being formed.

To avoid transfer of powder M from one level to another, the "float" of each ram supporting plate 60 and 62 and die table 18 is closely controlled. The hydraulic cylinders 20 and 64 are used to insure adequate resistance force to floating when required. The same hydraulic cylinders are used to move the die tables and platens when desired. The cylinders 64, for example, can be used to permit the uppermost lower plate 60 to float downwardly when a part P is being compressed or they can move the plate 60 downwardly under its own power.

To insure the dimensional accuracy of the part P being formed, a pair of circumferentially spaced sizing bars 108 are attached to the upper ram plate 45 in opposed relation to a pair of hollow, cylindrical sizing bars 110, mounted on the uppermost lower plate 60, and a set of sizing bars 112 which are mounted to the lowermost lower plate 62 and freely received within the cylindrical sizing bars 110. The upper ram sizing bars 108 which first contact the cylindrical sizing bars 110, and then the sizing bars 112, when the upper plate 45 is lowered, determine the stroke of the upper punch or ram 56 in relation to the lowermost punches 72 and 92 in the compression phase of the cycle. The sizing bars 110 are threadedly received by worm gear actuated nuts 116 mounted on the uppermost lower plate 60 for adjusting the relative positions of the sizing bars 110 and 108. The lowest sizing bars 112 are threadedly received by worm gears 118 on the lowermost plate 62 and may be vertically adjusted in position with relation to the sizing bars 110 and 108 by rotating the worm gears 116.

For interrupting the downward movement of the uppermost lower plate 60, a pair of adjustable stop rods 122 are threadedly received by worm gear nuts 124, actuated by worm gears 124a provided on the lowermost frame plate 10. The rods 122 are in vertical alignment with a pair of stationary stop rods 120, which are mounted on the underside of the plate 60 and are freely passed by passages 62a provided in the lowermost plate 62. Identical stationary stop bars 123 are provided on the underside of the lowermost plate 62 in position to be engaged by vertically adjustable stop rods 126, threadedly received by worm gear nuts 127, which are actuated by worm gear 127a mounted on the lower base frame plate 10. For interrupting the downward travel of the die table 18, on the frame F, vertically adjustable stop rods 130 are threadedly received by worm gear nuts 132, actuated by worm gears 132a mounted on the die table 18, and are engageable with stop blocks 134 on the frame F. Recesses 24a are provided in the mounting blocks 24 for receiving the upper ends of the rods 130.

Limit switches, such as LS-1, LS-2, LS-3 and LS-4, are provided for controlling the operation of the machine. Each of the limit switches LS-1 through LS-4 is actuated by a vertically movable actuating rod 136 which is engageable by one of the bars 130, 122, and 112, respectively, when the various parts are moved together. For example, when the plate 60 is lowered, the limit switch actuating rod 136 will engage the stop 122 and will be moved upwardly relative to the stop bar 120 to trip the limit switch LS-2. Regardless of the adjustment of the stop bars 122, 126, and 130 and the sizing bar 112, the limit switch position is not affected and the positions of limit switches LS-1 through LS-4 need not be adjusted when the positions of the stop bars and sizing bars are vertically adjusted.

The upper ends of the sizing bars 108 are externally threaded at 108a to receive vertically adjustable nuts 140 which engage upstanding cylinders 142 carried on the die table 18 after a predetermined downward movement of plate 45 and move the die table 18 downwardly with the plate 45 thereafter.

All of the hydraulically operated cylinders 20, 64, 84, 47 and 50 are mounted above the die table 18. This is important, because if the cylinders are inversely disposed and mounted below the die table 18, metal powder M which escapes the cavity 34 may collect around the cylinder rods 66 and eventually work its way into the various cylinders, abrading the moving cylinder parts.

Stop members for interrupting upward movement of the die table 18 and lower ram plates 60 and 62 are schematically illustrated in FIG. 7 at 152, 154, and 156, and comprise the cylinders 20, 64, and 84 and the piston rods 22, 66, and 86 respectively. The upper stop members 154 and 156 for the lower rams 72 and 92 are vertically adjustable and for this purpose the cylinder rods 66 and 86 are threadedly received by worm gear nuts 154a, actuated by worm gears 154d on the platens 60 and 62. Flexible dust and dirt shields 160 may be provided for protecting the moving parts.

Referring now more particularly to FIGS. 6 and 6A, a hydraulic circuit for controlling the operation of the system is schematically illustrated. Fluid to the various cylinders is provided by a high pressure pump 160 and a low pressure pump 162, concurrently driven by an engine or motor 164 to pump fluid from a reservoir 168 along a pair of output lines 170 and 172, respectively. Each of the die table moving cylinders 20 and the platens moving cylinders 64, 84, and 97 has one end connected to the low pressure line 172 via a check valve 174 and either end selectively connected to the high pressure line 170 via a check valve 176 and a valve 178 dependent upon the position of the valve 178. The resistance to "float" can be adjusted by a valve 180 which can be adjusted so that the piston rods of the various cylinders will start to move when the pressure in the valves 18 reaches 500-600 p.s.i., for example.

In lieu of a conventional regenerative system for supplying oil to the voided or top sides of the cylinders 20, 64, 84, and 97 as their pistons 22, 66, 86, and 97a, the low pressure pump 162 supplies low pressure oil via valve 174 for this same purpose. This system thus functions to pre-fill the top or voided sides of the cylinders when the die table 18, for example, is to be moved downwardly after a part P is formed. There is no delay which would otherwise occur if it was necessary to wait until the cylinder filled with oil. The advantage of this construction is that both the hydraulic and electric circuitry is simplified.
A valve 184 (FIG. 6A) is actuated to supply oil to the kicker cylinders 47 to rapidly move the upper ram 52 downwardly. The prefill pilot valve 58 is provided to connect the reservoir 189 with the upper end of the cylinder 50 via a control check valve 190 in line 60 to provide oil to the upper side of the cylinder 50 when the kicker cylinders 47 are moving the upper ram platens 45 downwardly. A sequencing valve 192 is actuated when the upper ram 52 starts to enter the die cavity or passage 34 so that when the upper platen 45 is in the compression phase of the cycle, the speed of the upper ram 52 moving downwardly is substantially reduced. The filler shoe operating cylinder 41 is connected to the reservoir via a valve 134b.

IN THE OPERATION

It will be assumed that the upper and lower ram members 52, 72, and 92 are in the retracted positions illustrated in FIG. 1. To commence the operating cycle, the valve 134b is actuated to direct fluid to the cylinder 134 so as to move the filler shoe 38 from the retracted position, illustrated in chain lines in FIG. 4, to the extended position overlying the die cavity. The metal powder M passes through the openings 36a and 42a into the cavity 34 to provide a total powder fill T1 (FIG. 2) and a flange fill portion T2. The valve 134b is then actuated to retract the filler shoe 38.

Hydraulic fluid is then supplied to the kicker cylinders 47 which rapidly move the upper ram 52 downwardly. As the upper ram 52 starts to enter the die cavity 34, the sequencing valve 192 is actuated so that the hydraulic fluid will be directed to the main cylinder 50 as well as the kicker cylinders 47 which together move the upper ram 52 at a slower controlled rate of travel. As the upper ram platen 45 is moved downwardly and pressing commences, the friction between the material M and the walls of the die table 18 will force the die table 18 to float or move downwardly with ram 52. At the same time, the uppermost lower platen 60 will be forced slightly downwardly by the powder compressing forces. The values 178 are initially in the blocking positions shown in FIG. 6 and the piston rods 20, 66, 86, and 97 are forced downwardly to supply fluid from the righthand sides of the cylinders through the now closed valves 180c and the resistance to float values 180. Prefill oil is supplied to the top ends of the cylinders 20, 64, 84, and 97 via valves 174. The sizing bars 108 will engage the sizing cylinders 110, thus preventing further relative movement of the upper platen 45 and the flange forming outer arm 72 so that compression of the material in the flange f is interrupted. After further predetermined relative movement of upper ram 52 and lowermost platen 62, the sizing bars 108 will engage the sizing bars 112 and positively interrupt relative movement of the upper ram 52 and the lower ram 92, which is resting on lower stops 122. During the stroke of ram 52, the nuts 140 carried by sizing bars 108 engage the cylinders 142 mounted on the die table 18 to move the die table 18 downwardly to the position shown in FIG. 8. Limit switches LS-3 and LS-4 will be actuated by the rods 136 just before sizing bars 108 and 112 engage to positively interrupt relative movement of the ram members 52, 72, and 92. The unitary part P is thus formed with a flange portion f having material compacted from a thickness T2 to a thickness T2' and its central portion reduced from a thickness T1 to a thickness T1'. The ratio of tablet height T1' and flange height T2' is proportional to the ratio of the initial total powder fill T1 and initial powder flange fill T2. Because the relative thicknesses of the different levels remains constant, any transfer of powder from the flange level f to the central core is avoided.

To now eject the part P formed, the upper arm 52 is withdrawn and the valve 178 is actuated to the "flow through" position and the die table 18 is lowered to the level established by the adjustable stops 130 and blocks 134 to withdraw the die table 18 downwardly away from the flange f until the top surface 18a of the die table 18 lies in the plane of the upper surface 72a of the lower cylindrical ram 72, as illustrated in chain lines in FIG. 8. The upper ram 52 can be set to withdraw before ejection or to remain in position and hold control pressure during ejection, particularly if a very thin tablet on part P is being ejected. During this withdrawal, the ram members 72 and 92 provide complete support for the tablet or part P being formed.

The cylinders 84, supporting the lowermost platen 62, are then operated to raise the lowermost platen 62 and the ram 92 so that the part P will be moved upwardly above ram 72 to a position in which it is laterally removed by the next forward movement of filler shoe 38 to cavity filling position.

This construction obviates the need for the removable wedge blocks which characterized the prior art "complete withdrawal" system. The present system also provides versatility because it can be converted from a "modified withdrawal" mode of operation to an "opposed ram" mode of operation in which either or both of the lowermost rams 72 and 92 and the upper ram 52 are concurrently moved.

FIGS. 10–12 schematically illustrate essentially the same machine, forming a slightly different cupshaped part C, including a flange C' and a central, reduced thickness core C'. In this instance, the central ram 92 is supported at a level above the ram 72 and is permitted to "float" downwardly whereas the uppermost lower platen 60 is initially supported in a lowered position by the stops 122. During the compression phase, illustrated in FIG. 11, the central ram 92 is permitted to float downwardly with the lowermost platen 62 so that the reduced thickness portion C' is compressed proportionately to the shoulder C". The downward movement of the ram 92 is interrupted by the stops 126. Modified withdrawal is accomplished by lowering the die table 18 to the position shown in chain lines in FIG. 11 so that the uppermost surface 18a of the die table 18 lies in the plane of the uppermost surface of the ram 92 and rests against the stops 134. The platen 60 is then moved upwardly to raise the ram 72 and strip the part from the central ram 92.

It is to be understood that the drawings and descriptive matter are in all cases to be interpreted as merely illustrative of the principles of the invention, rather than as limiting the same in any way, since it is contemplated that various changes may be made in the various elements to achieve like results without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In a powder press, a frame having a die table, having an open-ended die cavity mounted on said frame for vertical reciprocation, upper ram means and first and second lower ram means mounted on said frame in vertical alignment with each other and said die
table for vertical reciprocation relative to each other and said die table, and control means for driving said table and said ram means in vertical movement relative to said frame to compress a charge of powdered metal within said cavity between said upper and lower ram means and to subsequently eject the compressed metal from said cavity; the improvement comprising a first vertical sizing bar mounted upon said upper ram means and projecting downwardly therefrom, said die table having an opening therethrough slidably receiving said first sizing bar, a second vertical sizing bar mounted on the lowermost of said lower ram means and projecting upwardly therefrom in vertical alignment with said first sizing bar, the uppermost of said lower ram means having an opening therethrough receiving said second sizing bar, a collar in the last mentioned opening slidably receiving said second sizing bar and projecting upwardly from said uppermost lower ram means, said collar being engageable with said first sizing bar to establish a minimum spacing between said upper ram means and said uppermost lower ram means and said first sizing bar being engageable with said second sizing bar to establish a minimum space between said upper ram means and said lowermost lower ram means, and stop means on said upper ram means engageable with cooperating means on said die table to establish a minimum spacing between said table and said upper ram means.

2. A press as defined in claim 1 wherein said first sizing bar is fixedly mounted on said upper ram means, first means mounting said second sizing bar on the lowermost lower ram means for vertical adjustment relative to said lowermost lower ram means, second means for vertically adjusting said collar relative to said uppermost lower ram means, said cooperating means comprising a first stop member fixedly mounted on said die table and said stop means comprising a second stop member mounted on said first sizing bar for vertical adjustment thereon.

3. A press as defined in claim 2 further comprising positive stop means including a first stop fixedly mounted on one element of said press and a second stop vertically aligned with said first stop and mounted for vertical adjustment upon a different element of said press, one of the last two mentioned elements being said frame and the other of the last two mentioned elements being one of said ram means or said die table.

4. A press as defined in claim 3 further comprising a limit switch mounted on said one element adjacent said first stop, a limit switch actuator operatively engaged with said limit switch and slidably received for vertical movement in said first stop, said actuator projecting from said first stop to be engaged by said second stop to be driven in switch actuating movement as said first and said stops move into contact with each other.

5. In a powdered metal press having a frame, a plurality of platens mounted on said frame for vertical reciprocatory movement relative to each other, vertically extending stop members mounted on said platens and said frame for interengagement with each other to establish end limits of vertical movement of said platens relative to each other and to said frame, a limit switch actuator slidably received in one of said stop members for vertical sliding movement relative to the stop member and projecting vertically from opposite ends of said stop member, one end of said actuator being engageable by a second interengaging stop member upon movement of said one and said second stop members into engagement with each other to shift said actuator vertically relative to said one stop member, and limit switch means engaged with the other end of said actuator for actuation thereby upon the aforementioned shifting of said actuator.

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