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AUTOMATIC THICKNESS COMPENSATOR FOR RIVETING MACHINES.

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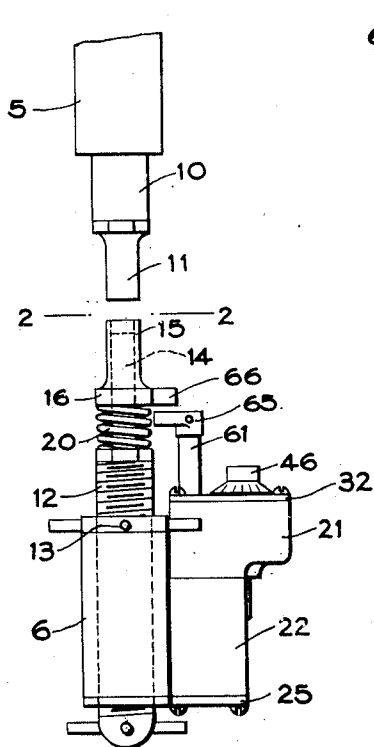


FIG. 1

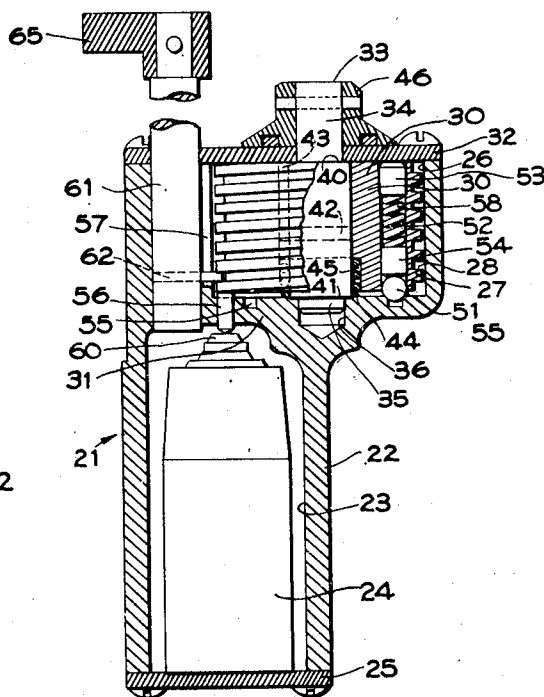


FIG. 3

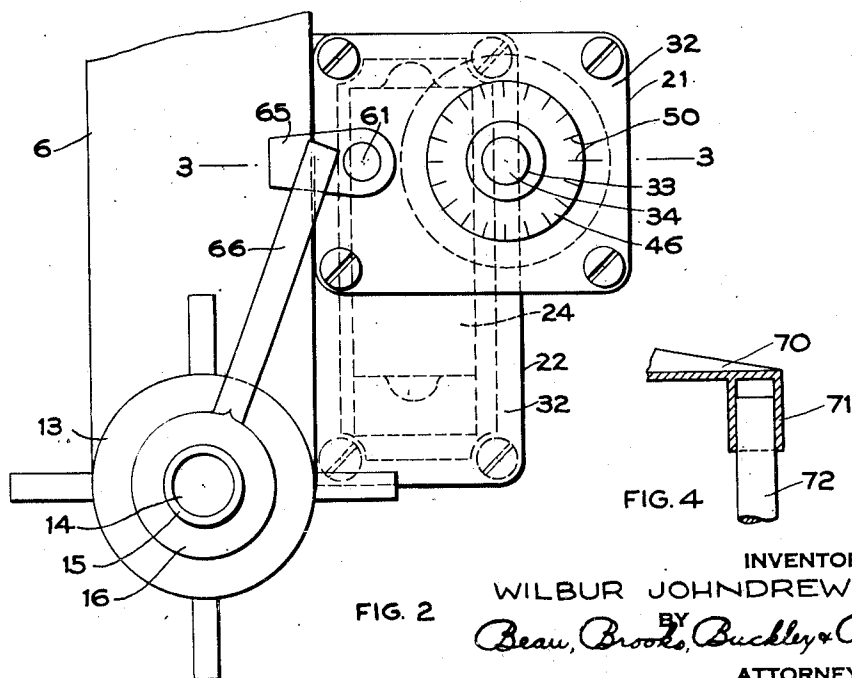


FIG. 2

FIG. 4

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AUTOMATIC THICKNESS COMPENSATOR
FOR RIVETING MACHINES

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20 Claims. (Cl. 78—48)

My invention relates in general to compensators, and more particularly to compensators used in connection with the switches or control means of riveting machines to terminate the riveting action of such machines at a predetermined point in the riveting operation.

It is well known to those skilled in the art that in certain types of riveting machines the height of the rivet head being formed is determined by the total length of the finished rivet. It is obvious that by this method of determining rivet head thickness, any variation in thickness of the preformed rivet head, the thickness of the materials being riveted, or the overall length of the rivet blank will materially affect the thickness of the formed rivet head. It is also well known to those skilled in the art that in certain industries, as, for instance, the airplane industry, where pieces of material are fastened together by numerous rivets, it is of the utmost importance that the formed head of the rivet have a definite predetermined thickness, irrespective of any of the variations above mentioned.

It has, therefore, been the principal object of my invention to provide a thickness compensator by which the rivet head may be accurately formed and its thickness predetermined without regard to any of the above mentioned variables.

Another object has been to provide such a device as an article of manufacture which can be easily attached to existing riveting machines.

Moreover, my device is provided with sensitive adjusting means, whereby the thickness of the rivet head being formed may be accurately predetermined, such adjusting means being graduated so that variously sized rivets may be logged numerically to avoid repeated trial for rivet head size.

The above objects and advantages have been accomplished by the device shown in the accompanying drawing of which:

Fig. 1 is a front elevation of my device showing it attached to a riveting machine, fragmentary portions only of the machine being illustrated;

Fig. 2 is an enlarged top plan sectional view of my device attached to a machine and taken on line 2—2 of Fig. 2;

Fig. 3 is a sectional elevation of my device taken on line 3—3 of Fig. 2; and,

Fig. 4 is a fragmentary sectional view of a modified actuator arm and connection to the elevator shaft.

In carrying out my invention, I employ the pressure sleeve or pad used on some riveting machines for pressing together the two pieces of

material being riveted before the riveting operation is effected.

In the drawing, 5 and 6 represent the portions of a riveting machine at the outer end of the throat of such machine. As is customary the upper portion 5 carries the reciprocating ram 10 of the riveting machine to which is attached the movable anvil 11. The lower portion 6 carries the usual height control screw 12 which is screw-threaded in this portion, the usual locking nut 13 being provided for setting the screw in its adjusted position. This screw, as is customary, carries the stationary anvil 14 of the riveting machine. Slidably mounted upon the anvil 14 is the pressure sleeve 15 of my device. This sleeve is provided with the usual base flange 16 against which is disposed one end of a helical spring 20, the other end being in contact with the upper surface of the screw 12. The spring is mounted about the exposed portion of the stationary anvil 14, and serves to keep the upper end of the pressure sleeve extended above the upper surface of this anvil, whereby it will contact with the bottom surface of the lower workpiece and force the workpieces toward each other and toward the preformed rivet head which is forced thereby in contact with the upper movable anvil.

My compensator 21 which is preferably secured to the side of the portion 6 of the riveting machine, as shown in Figs. 1 and 2, comprises a housing 22 formed in its lower portion with a switch chamber 23, within which is mounted a sensitive control switch 24. A bottom plate 25 is secured to the lower surface of the housing, thereby serving to close the switch chamber and form a support for the switch 24.

The housing of my device is formed in its upper portion with a cylindrical chamber 26 within which an operating screw 30 is mounted. This chamber is preferably in offset relation with the lower portion of the casing. A lateral partition 31 serves to separate the switch chamber 23 from the cylindrical chamber 26 for that portion which is common to both chambers and also serves as bottom wall for the cylindrical chamber where it overhangs the lower portion of the body having the switch chamber. A top plate 32 extends across the top of the casing and serves to close the cylindrical chamber 26.

The operating screw 30 is provided with an external screwthread 27, thereby forming a helical groove 28. This screw is preferably shorter than the distance between the partition 31 and the top cover 32, and is, therefore, permitted to move slightly in an axial direction. The screw is slid-

ably mounted upon an actuating shaft 33 which has a reduced portion 34 extending through and having bearing support in the top plate 32. The shaft also has a reduced portion 35 at its lower end which is disposed in a bearing recess 36 formed in the partition 31. The reduced portions 34 and 35 of the shaft provide shoulders 40 and 41, respectively, which are spaced apart a distance substantially equal to the distance between the opposing surfaces of the partition 31 and the top plate 32, whereby the shaft 33 will be prevented from having axial movement by contact of the shoulder 40 with the top plate 32, and the shoulder 41 with the partition 31. So as to prevent rotative movement of the operating screw upon the shaft 33 but to permit axial movement of the said screw thereon, the shaft is provided with a key 42 which engages with a suitable keyway 43 formed in the bore of the screw. The operating screw is maintained in its upper position in contact with the top plate 32 by suitable resilient means which may be in the form of an operating spring 44 preferably mounted within a recess 45 formed in the lower end of the bore of the screw. The upper end of this spring bears against the shoulder formed in the screw by the recess 45 and the lower end of the spring bears against the top surface of the partition 31, thereby normally urging the screw upwardly. A dial 46 is suitably attached to the upper exposed end of the reduced portion 34 of the shaft, and provides means whereby the shaft and screw may be rotated. The dial is provided with graduations 50 whereby the degree of rotation of the screw may be accurately accomplished.

The screw preferably is provided with detent means in the form of a detent ball 51 which is slidably mounted in a longitudinal bore 52 extending longitudinally through the operating screw. Plugs 53 and 54 are preferably also slidably mounted within the bore 52 and between which is located a helical spring 58, whereby the plugs will have a separating tendency. Since the plug 54 bears against the ball 51, and the plug 53 bears against the top plate 32, the ball 51 will be forced downwardly and in engagement with one of a number of indentations or recesses 55 formed in the upper surface of the partition 31. The indentations or recesses 55 are preferably so positioned and spaced that the screw will come to rest at each of the graduations formed on the dial 46.

A contact pin 56 is disposed in a suitable aperture formed in the partition 31 and has its lower end in cooperative relation with the operating button 60 of the switch 24. The upper end of the contact pin is engageable with the lower surface of the operating screw. Arranged adjacent the operating screw is the elevator shaft 61 of my device. This shaft is slidably mounted within the body of the casing and in the top plate 32. It is provided with an elevator shaft pin 62 which projects inwardly toward the operating screw through a longitudinal slot 57 and engages with the helical groove 28 of the screw. The screwthread 27 is preferably of square shape and, as the screw is rotated, the elevator shaft 61 will be moved axially in relation to the screw by the engagement of the shaft pin 62 with the groove 28. It is obvious that if greater strength or bearing surface is needed in the connection between the elevator shaft and the screw, I may use a helically-shaped member formed to fit the groove 28, instead of the shaft pin 62. A shaft arm 65 is located at the upper end of the elevator

shaft 61 and is arranged in the path of an actuator arm 66 which is carried by the flange 13 of the pressure sleeve. In the form of invention shown in Fig. 4, the actuator arm 70 is provided at its outer end with a sleeve 71 which is loosely disposed about and has sliding engagement with the upper end of the elevator shaft 72. By this connection, the arm and shaft are kept in alignment at all times.

When a workpiece, in the form of two pieces of sheet metal with a rivet disposed in registering perforations formed in the sheet metal, is placed between the anvils 11 and 14, the movable anvil is caused to be actuated in a downward direction upon depression of the usual foot switch of the riveting machine (not shown) which is connected in well known manner to the normally closed control switch 24. The first effect of the downward movement of the movable anvil will be to force the rivet securely into the hole and against the top surface of the upper workpiece and also to force the workpieces together by reason of the contact of the pressure sleeve with the lower surface of the lower workpiece. After the pressure sleeve comes to rest, further downward movement of the movable anvil will cause the pressure sleeve to be moved downwardly upon and relatively to the stationary anvil and against the tension of the spring 20, whereby the riveting operation will be initiated. As the riveting operation continues the sleeve will continue in its downward movement upon the stationary anvil until the predetermined relative position therewith is reached, as determined by the desired thickness of the rivet head. When this point in the downward movement of the sleeve has been reached, the actuating arm 66 will have contacted the shaft arm 65, or the actuating arm 70 of Fig. 4 will have contacted the top of the elevator shaft 72 and will thereby have moved the operating screw 30 downwardly through the medium of the elevator shafts 61 or 72 and pin 62 and against the tension of the operating spring 44. At this point the switch 24, through the circuits and appliances above described, will cause the movement of the reciprocating ram and the upper anvil 11 to be interrupted. In the event that the thickness of the formed rivet head is greater or less than the desired amount, the condition may easily be corrected by adjusting the operating screw through the rotation of the dial 46 and the attached actuating shaft 33. This will cause the position of the shaft arm 65 to be altered in relation to the contact pin 56 and operating screw 30. When the thickness of the formed rivet head is too great, the screw will be operated in the proper direction to cause the elevator shaft to be lowered in relation to the screw. This adjustment will cause the switch 24 to be operated later than before the adjustment was made, and, therefore, the riveting operation will be proportionately prolonged so as to form a rivet head of the predetermined thickness. In like manner, should the thickness of the rivet head be less than the predetermined amount, then the elevator shaft would be raised by rotating the operating screw in the opposite direction, whereby the riveting anvil will come to rest at a point earlier in the riveting operation. From the foregoing it will be obvious that should there be a change in the thickness of the workpiece as repeated riveting operations are effected, there will be no need to make any adjustments, since with my device the height-determining factor is the actual thickness of the

formed rivet head, and, therefore, compensation is made by the device for all variations of work-piece thickness or overall rivet length. The same thing is true where there is an assortment of rivets used, assuming that the thickness of the formed rivet head is to be the same.

While the foregoing description has been given in detail, it is to be understood that the inventive principles herein disclosed may assume other physical embodiments without departing from the spirit or scope of the invention set forth in the appended claims.

What is claimed is:

1. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, means carried by said housing for controlling the operation of the riveting machine, an axially movable member carried by the housing and arranged so as to be actuated by the movement of the pressure sleeve, and means carried by said housing intermediate said member and said control means for adjustably connecting the latter to said member, whereby said member may be adjusted to operate said control means at any desired point in the travel of said member.

2. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch carried by said housing for controlling the operation of the riveting machine, an axially movable member carried by the housing and arranged so as to be actuated by the movement of said pressure sleeve, and means carried by said housing intermediate said member and said switch for adjustably connecting the latter to said member, whereby said member may be adjusted to operate said switch at any point in the travel of said member.

3. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, control means carried by said housing for causing the termination of the riveting operation, an axially movable member carried by the housing and arranged so as to be actuated by the movement of said pressure sleeve, adjustable means rotatably carried by said housing for changing the axial relationship of said axially movable member and said control means, means for rotating said adjustable means, means arranged within said housing for co-operatively connecting said axially movable member and said adjustable means for causing unison axial movement thereof, and contact means movably carried by said housing for connecting said adjustable means and said control means, whereby axial movement of said adjustable means will be transmitted to said control means.

4. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, control means carried by said housing for causing the termination of the riveting operation, an axially movable member carried by the housing and arranged so as to be actuated by the movement of said pressure sleeve, adjustable means rotatably carried by said housing for changing the axial relationship of said axially movable member and said control means, means for rotating said adjustable means, detent means for

holding said adjustable means in its adjusted position, means arranged within said housing for co-operatively connecting said axially movable member and said adjustable means for causing unison axial movement thereof, and contact means movably carried by said housing for connecting said adjustable means and said control means, whereby axial movement of said adjustable means will be transmitted to said control means.

5. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, control means carried by said housing for causing the termination of the riveting operation, an axially movable member carried by the housing and arranged so as to be actuated by the movement of said pressure sleeve, adjustable means rotatably carried by said housing for changing the axial relationship of said axially movable member and said control means, means for rotating said adjustable means, detent means for holding said adjustable means in its adjusted position, means carried by said axially movable member and cooperatively associated with said adjustable means for connecting said member to said adjustable means, contact means carried by said housing for connecting said adjustable means and said control means, whereby axial movement of said adjustable means will be transmitted to said control means.

6. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, means adjustably connecting said shaft and said switch, and resilient means carried by said housing for yieldably holding said adjustable means and said shaft in their normal inactive positions.

7. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an operating screw carried by said housing and having adjustable connection with said shaft, said screw being so mounted as to be reciprocated in unison with said shaft, and a contact pin intermediate said screw and said switch, whereby movement of said shaft and said screw will be transmitted to said switch.

8. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an actuating shaft rotatably carried by said housing and in spaced relation with said elevator shaft, an operating screw disposed within said housing, said screw being non-rotatably mounted upon said actuating shaft but axially movable in relation thereto, an index member carried by said actuating shaft for adjusting said screw, means arranged within said housing for co-operatively

connecting said elevator shaft and said operating screw to cause unison axial movement thereof, and contact means movably carried by said housing for connecting said operating screw and said switch, whereby axial movement of said screw means will be transmitted to said switch.

9. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an actuating shaft rotatably carried by said housing and in spaced relation with said elevator shaft, an operating screw disposed within said housing, said screw being non-rotatably mounted upon said actuating shaft but axially movable in relation thereto, an index member carried by said actuating shaft for adjusting said screw, detent means carried by said screw and said housing for maintaining said screw in each of the adjusted positions indicated by the index member, means arranged within said housing for co-operatively connecting said elevator shaft and said operating screw to cause unison axial movement thereof, and contact means movably carried by said housing for connecting said operating screw and said switch, whereby axial movement of said screw means will be transmitted to said switch.

10. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an actuating shaft rotatably carried by said housing and in spaced relation with said elevator shaft, an operating screw disposed within said housing, said screw being non-rotatably mounted upon said actuating shaft but axially movable in relation thereto, an index dial carried by said actuating shaft for adjusting the same, means arranged within said housing for co-operatively connecting said elevator shaft and said operating screw to cause unison axial movement thereof, resilient means carried by said housing for yieldably holding said elevator shaft and said operating screw in their normal inactive positions, and contact means movably carried by said housing for connecting said operating screw and said switch, whereby axial movement of said screw means will be transmitted to said switch.

11. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an actuating shaft rotatably carried by said housing and in spaced relation with said elevator shaft, said actuating shaft being fixed against axial movement, an operating screw disposed within a chamber in said housing for adjusting the axial relation between said screw and said elevator shaft, said screw being mounted upon said actuating shaft and having limited axial movement within said chamber, a spline connection between said screw and said actuating shaft, 60

means arranged within said housing for co-operatively connecting said elevator shaft and said operating screw to cause unison axial movement thereof, and contact means carried by said housing for connecting said operating screw and said switch, whereby axial movement of said operating screw will be transmitted to said switch.

12. The combination in a riveting machine, having co-acting anvils and a pressure sleeve movable relatively to one of said anvils, of a thickness compensator comprising a housing, an electric switch mounted in said housing for controlling the operation of the riveting machine, an elevator shaft slidably carried by said housing and movable axially by contact with said pressure sleeve, an actuating shaft rotatably carried by said housing and in spaced relation with said elevator shaft, said actuating shaft being fixed against axial movement, an operating screw disposed within a chamber in said housing for adjusting the relation between said screw and said elevator shaft, said screw being mounted upon said actuating shaft and having limited movement within said chamber, a spline connection between said screw and said actuating shaft, said operating screw being formed with external screwthreads, a shaft pin carried by said elevator shaft and engaging said screwthreads, whereby said operating screw and said elevator shaft may be relatively adjusted and moved in unison after adjustment, and a contact pin movably carried by said housing intermediate said screw and said switch.

13. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing for attachment to said machine, means carried by said housing for controlling the riveting movement of said machine, an axially movable member carried by said housing and arranged so as to be actuated by the movement of said pressure sleeve, and means carried by said housing intermediate said member and the control means for adjustably connecting the latter to said member, whereby the member may be adjusted to operate said control means at any desired point in the travel of said member.

14. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing formed with a switch chamber, a switch located in said chamber for controlling the operation of the riveting machine, an elevator shaft carried by said housing and axially movable in relation thereto, an operating screw carried by said casing and adjustably associated with said shaft, and contact means for connecting said screw and said switch, whereby axial movement of said shaft will be transmitted to said switch.

15. A thickness compensator for use on a riveting machine having a pressure sleeve movable relative to the anvils of said machine, comprising a housing for attachment to said machine, a switch carried by said housing for controlling the operation of the riveting machine, an elevator shaft carried by said housing and axially movable in relation thereto, an operating screw rotatably carried by said housing and axially movable therein, means for adjustably connecting said shaft and screw and arranged intermediate therebetween, and contact means arranged intermediate said screw and said switch, whereby axial movement of said screw will be transmitted to said switch. 75

16. A thickness compensator for use on a riveting machine having a pressure sleeve movable relative to the anvils of said machine, comprising a housing formed with a switch chamber, a switch located in said chamber for controlling the operation of the riveting machine, an elevator shaft carried by said casing and axially movable in relation thereto, an operating screw rotatably carried by said housing and axially movable therein, means for adjustably connecting said shaft and screw and arranged intermediately therebetween, means for adjusting said screw, detent means carried by said screw and said housing for maintaining said screw in its adjusted position, and contact means arranged intermediate said screw and said switch, whereby axial movement of said screw will be transmitted to said switch.

17. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing for attachment to said machine, control means for said machine carried by said housing, an axially movable member carried by said housing and arranged so as to be actuated by the movement of said pressure sleeve, an actuating shaft rotatably carried by said housing and axially fixed therein, an operating member carried by said actuating shaft and axially movable in relation thereto, spline means mounting said operating member upon said shaft, means formed on said axially movable member and said operating member for adjusting the axial relation of said members, said adjusting means permitting unison axial movement of said members after adjustment, and contact means arranged intermediate said operating member and said control means, whereby axial movement of said screw will be transmitted to said switch.

18. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing for attachment to said machine, a control switch for said machine carried by said housing, an axially movable elevator shaft carried by said housing and arranged so as to be actuated by the movement of said pressure sleeve, an actuating shaft rotatably carried by said housing and axially fixed therein, an operating screw carried by said actuating shaft and axially movable in relation thereto, spline means mounting said screw upon said shaft, said screw being formed with exterior screwthreads, a shaft pin carried by said elevator shaft and engaging said screwthreads, whereby said operating screw

and said elevator shaft may be relatively adjusted axially and moved in unison after adjustment, and a contact pin movably carried by said housing intermediate said screw and said switch.

19. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing for attachment to said machine, control means for said machine carried by said housing, an axially movable member carried by said housing and arranged so as to be actuated by the movement of said pressure sleeve, an actuating shaft rotatably carried by said housing and axially fixed therein, an operating screw carried by said actuating shaft and axially movable in relation thereto, spline means mounting said screw upon said shaft, means carried by said movable member and engageable with said screw for adjusting the axial relation of said member and said screw, an index dial carried by said actuating shaft for adjustably rotating said screw, said adjusting means permitting unison axial movement of said member and said screw after adjustment, detent means carried by said screw and said housing for maintaining said screw in any one of its adjusted positions, and contact means movably carried by said housing intermediate said screw and said switch.

20. A thickness compensator for use on a riveting machine having a pressure sleeve movable relatively to one of the anvils of said machine, comprising a housing for attachment to said machine, control means for said machine carried by said housing, an axially movable member carried by said housing and arranged so as to be actuated by the movement of said pressure sleeve, an actuating shaft rotatably carried by said housing and axially fixed therein, an operating screw carried by said actuating shaft and axially movable in relation thereto, spline means mounting said screw upon said shaft, an index dial carried by said actuating shaft for adjustably rotating said screw, detent means carried by said screw and said housing for maintaining said screw in any one of its adjusted positions, said screw being formed with exterior screwthreads, a shaft pin carried by said elevator shaft and engaging said screwthreads, whereby said operating screw and said elevator shaft may be moved in unison, and a contact pin movably carried by said housing intermediate said screw and said switch.

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