Dec. 17, 1940. W. ERNST 2,224,957

TONNAGE CONTROL DEVICE WITH INDICATOR

Filed June 20, 1938

Fig. 1.

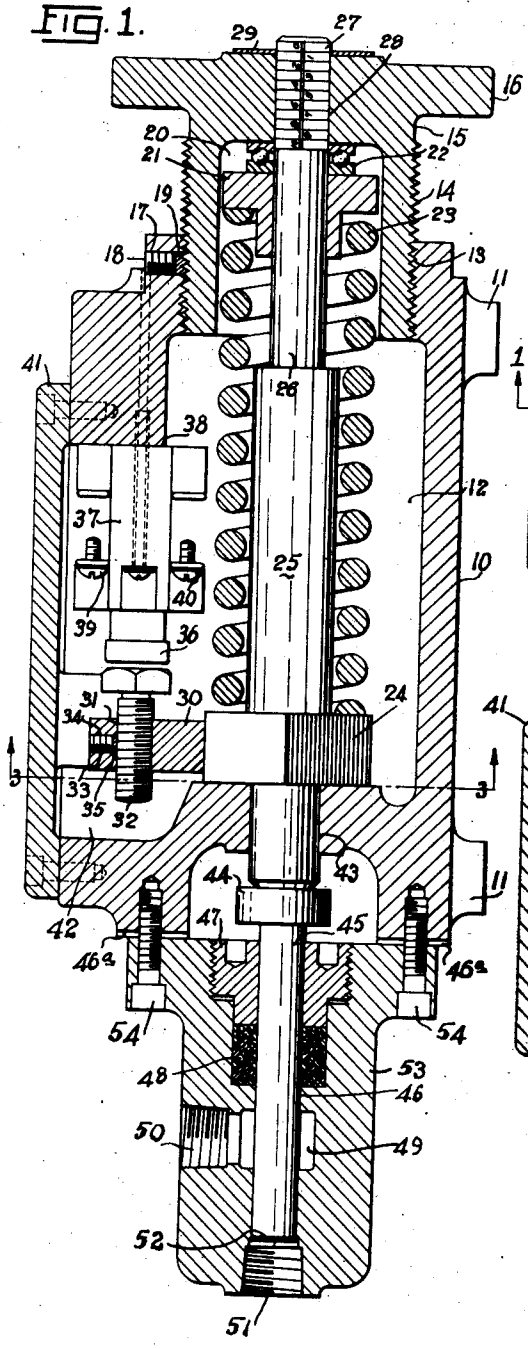


Fig. 2.

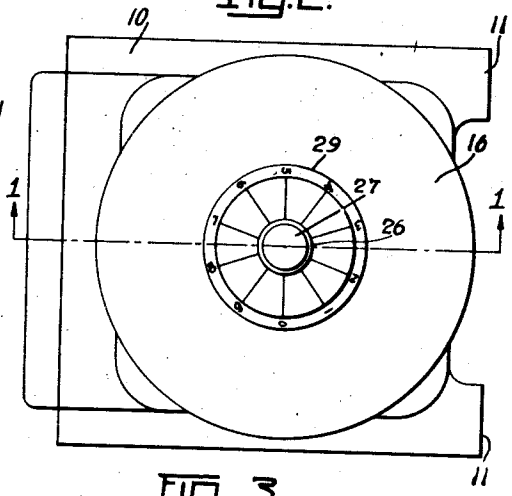
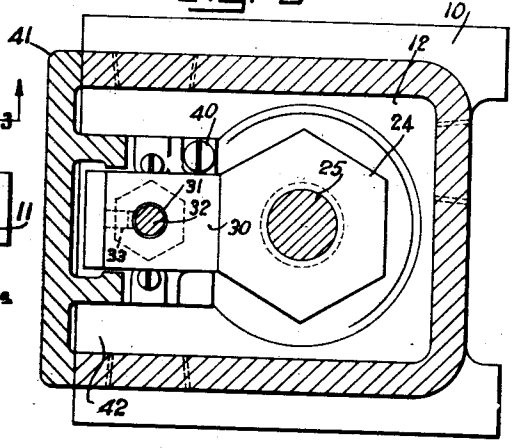


Fig. 3



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TONNAGE CONTROL DEVICE WITH INDICATOR

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9 Claims. (Cl. 200—82)

This invention relates to hydraulic machines, and in particular, to devices for regulating the operating pressures of such machines.

One object of this invention is to provide a tonnage control device for hydraulic machines, this device being pressure-actuated to make or break an electrical circuit at an adjustable and predetermined pressure setting. Another object is to provide such a tonnage control device, wherein the device is provided with scales and a micrometer adjustment, whereby the operator may set the device for the approximate pressure at which it will operate.

Another object is to provide such a tonnage control with an internal adjustment, whereby the electric switch will be operated at a certain pressure and a certain setting of the control device, and whereby the device may also be adjusted to accommodate springs of slightly varying tensions.

Another object is to provide such a tonnage control device having means for preventing a variation in the pressure setting during operation, particularly when caused by the turning of the adjusting screw due to vibration or other causes.

Another object is to provide a tonnage control device, wherein the hydraulic actuating portion of the device is separate from the spring tension and switch portion so that either may be replaced or repaired without disturbing the other.

In the drawing:

Figure 1 is a longitudinal section, taken on the line 1—1 of Figure 2, of a preferred embodiment of the tonnage control device of this invention.

Figure 2 is a top plan view of the tonnage control device shown in Figure 1.

Figure 3 is a cross section along the line 3—3 in Figure 1.

In general, the tonnage control device of this invention consists of a hydraulic cylinder having a piston opposing a spring to make or break an electrical circuit at an adjustable and predetermined pressure setting. In particular, the casing of the device is provided with a hollow adjustment screw engaging a coil spring for adjusting the spring tension upon the plunger, this plunger having micrometer graduations thereon to indicate the pressure being obtained. The operating plunger of the device is provided with an arm having an adjustable contact member for making contact with the electrical switch, or other circuit breaker employed in connection with the device. The micrometer screw or nut is prevented from rotating during operation by means of a set screw having a soft metal jam member engaging the threads to provide a predetermined frictional drag sufficient to prevent rotation.

Hitherto, in prior-art devices of this class, the tonnage control pressure was set by a "cut-and-try" method. The practice with such devices was to adjust the device while the press was performing a pressing stroke, the operator watching the pressure gauge on the press while making the adjustment. These prior-art devices, however, had no means for predetermining the setting of the control device, and hence, this could be found only experimentally. In the present invention, however, a predetermined setting of the device for a predetermined pressure can be made. After the desired pressure setting has once been obtained, the indication of the scales can be noted and the device later adjusted to the same setting, even if the setting meanwhile has been altered. Furthermore, a table can be prepared to show the setting in terms of pounds per square inch fluid pressure or in tons for a given size of ram. If desired, the size of the hydraulic plunger, pitch of the threads on the adjusting nut and size of the spring may be co-related and proportioned so that the figures on the scales read directly in pounds per square inch pressure.

Referring to the drawing in detail Figure 1 shows a preferred embodiment of the tonnage control device of this invention as consisting of a casing 10 having lugs 11 for facilitating the attachment of the device to a hydraulic press or other suitable support. The casing 10 is provided with an internal chamber 12 with a threaded bore 13 at one end thereof. This threaded bore is engaged by the threads 14 of a hollow nut 15 having an adjustment flange 16 serving as a hand wheel portion. A threaded bore 17 in the casing 10 is adapted to receive a set screw 18 and a soft metal jam member 19, such as a copper slug for engaging the threads 14. The set screw 18 may be adjusted to press the jam member 19 more or less firmly against the threads 14 so as to provide a frictional drag sufficient to prevent accidental rotation of the hollow nut, such as might be caused by vibration during the operation of the controlled machine.

The hollow nut 15 is provided with an internal chamber 20 adapted to receive an annular abutment 21 spaced apart from the end of the chamber 20 by a ball thrust bearing 22. The annular abutment 21 is engaged by one end of a coil

spring 23, the opposite end of which bears against the enlargement 24 upon the operating rod 25, the upper end of which is of reduced diameter, as at 26, and is provided with a graduated scale 27. The intervals between the graduations on this scale 27 correspond to the pitch or distances between successive threads 14. The reduced diameter portion 26 passes through a bore 28 in the hollow nut 15, and likewise through a graduated disc 29. The latter is provided with radial graduations cooperating with the graduations on the graduated portion 27 to provide an exact and fine adjustment of the operating rod 25.

The enlargement 24 upon the operating rod 25 is provided with an arm 30 having a threaded bore 31 engaged by the threads of a cap screw 32. A set screw 33 in the threaded bore 34, together with a jam slug 35, prevents accidental rotation of the cap screw 32. The free end of the cap screw 32 engages the push-button 36 of an electrical switch 37, which is mounted against the abutment 38 within the chamber 12 of the casing 10. The switch 37 is provided with terminals 39 and 40 serving as binding posts for the connection of external wiring. The switch 37 and adjusting screw 32 are made accessible by means of the cover plate 41 opening into the chamber 12 through the passageway 42, against one wall of which the switch 37 is mounted.

The end of the operating rod 25 beyond the enlargement 24 passes through a bore 43 and engages a head 44 upon the hydraulic plunger 45, the latter being reciprocable within the bore 46 and having a threaded plug 47 engaging a packing 48 to prevent leakage of fluid around the plunger 45. If such leakage occurs, however, it escapes through the passageway 46a. Some slight leakage frequently occurs because the tonnage control device is usually arranged at the bottom of the press, whereas the surge tank device is frequently located at the top of the press, thereby subjecting the device to a small "head" of liquid. The bore 46 contains an annular enlargement 49 having a threaded port 50 for access thereto. A threaded port 51 at the end of the bore 46 provides access to the end 52 of the plunger 45. The port 51 serves for the connection of a pipe serving as a pilot line and leading to the circuit in the press to which the tonnage control device of the invention is to be responsive. The threaded port 50, on the other hand, is connected to a drainage pipe for receiving the fluid leaking past the hydraulic plunger 45 into the annular chamber 49. The bore 46 is contained in the casing 53, secured by the set screws 54 to the casing 10. In this manner the hydraulic unit within the casing 53 may be removed from the spring and switch unit within the casing 10 without disturbing the interior adjustments of either portion of the device.

Operation

The port 51 is connected to a pipe leading to the portion of the circuit the pressure of which is to actuate the tonnage control device. A drainage pipe is likewise connected to the threaded port 50. The operator then rotates the nut 15 by means of the flange 16 so as to increase or decrease the tension of the coil spring 23 upon the operating rod 25. When the pressure within the device increases to an amount sufficient to overcome the force of the coil spring 23, the pressure against the end 52 of the hydraulic plunger 45 pushes the operating rod 25 upwardly, together with the arm 30 and the adjustable contact screw 32. The latter then engages the push-button 36 and opens or closes the circuit in the switch 37, as the case may be. The consequent alteration of the electrical condition of the circuit is caused in known ways to regulate the control circuit of the press.

When the operator has determined the pressure for a given setting of the scales, this pressure can again be obtained on some subsequent occasion by rotating the nut 15 until the same reading of the scales is again obtained. As previously stated, the scales may be graduated in pounds per square inch if so desired, merely by proportioning the sizes of the parts in a proper way. The adjustment will not be varied during the operation of the press because the set screws 18 and 33, together with their jam slugs 19 and 35, exert such a frictional drag upon the threads of the nut 15 and cap screw 32, respectively, that no such rotation will occur.

It has been found by experience that the tonnage control device is preferably made of heavy construction and a heavy spring 23 employed. Where a substantial force is exerted by a heavy spring against the operating rod 25, experience has shown that friction and other variable factors are much smaller in their effect, and the operation of the control is much more uniform and dependable than in a device of lighter construction.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, a switch adapted to be controlled by said operating member, an adjusting element provided with a graduated scale and adapted to effect a change in the thrust of said yielding means, and a graduated scale on said operating member cooperating with the scale on said adjusting element to predetermine that fluid pressure on said plunger which will cause operation of said switch.

2. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, an adjusting element provided with a scale and adapted to cause a change in the thrust of said yielding means, and a graduated scale with an index on said operating member adapted to be adjusted relative to said first mentioned scale so as to cause said yielding means to counteract a predetermined fluid pressure on said plunger, said casing having a threaded bore and said adjusting element comprising a hollow nut having threads engaging said threaded bore.

3. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, an adjusting element engaging said yielding means for adjusting the thrust thereof, said adjusting element comprising a hollow nut having a cavity surrounding a portion of said yielding means, a ball thrust bearing arranged between said adjusting element and said yielding means, a graduated scale associated with said operating member and

adapted to cooperate with said adjusting element, and an electrical circuit breaker engageable by said operating member at a predetermined fluid pressure on said plunger in accordance with the relative position of said scale and said operating member.

4. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, an adjusting element engaging said yielding means for adjusting the thrust thereof and having an index thereon, a graduated scale on said operating member cooperating with the index on said adjusting element, and an electrical circuit breaker engageable by said operating member, said index in cooperation with said scale being adapted to effect adjustment of said yielding means so as to cause operation of said circuit breaker at a predetermined fluid pressure on said plunger.

5. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, an adjusting element engaging said yielding means for adjusting the thrust thereof, a graduated scale on said operating member, a graduated scale on said adjusting element cooperating therewith, and an electrical circuit breaker adapted to be operated by said operating member at a predetermined fluid pressure on said plunger in correspondence with the relative positions of said scales.

6. In combination, a casing, an operating member movable therein, a fluid pressure plunger engaging said member, yielding means urging said member oppositely to said plunger, an adjusting element engaging said yielding means for adjusting the thrust thereof, a graduated scale provided on said operating member and cooperating with said adjusting element, a projection on said operating member, an adjustable member on said projection, and an electrical circuit breaker engageable by said adjustable member at a predetermined fluid pressure on said plunger in accordance with the position of said graduated scale relative to said adjusting element.

7. In combination, a casing having a threaded bore, an operating member reciprocable in said casing and having a scale arranged in the longitudinal direction of said operating member, a spring urging said operating member in one direction, a fluid pressure plunger positioned to urge said operating member in another direction against the thrust of said spring, a threaded adjusting element adjustably mounted in said threaded bore for varying the thrust of said spring, a ball thrust bearing mounted between said adjusting element and said spring to allow adjustment of said spring without imparting a torque thereon, a switch controllable by said operating member, and a further scale provided on said adjusting member and surrounding said longitudinal scale on said operating member, said two scales being adapted in cooperation with each other to predetermine that fluid pressure on said plunger which will cause said operating member to effect operation of said switch.

8. In combination, a casing having a threaded bore, a threaded adjusting element mounted in said bore, an operating member reciprocable in said casing and having abutment means, a resilient member urging said operating member in one direction, a fluid pressure plunger positioned to urge said operating member in another direction, a ball thrust bearing mounted between said adjusting element and said resilient means to prevent imparting a torque on said resilient means when operating said adjusting element, an electrical switch positioned for engagement by said operating member abutment means, means for adjustably positioning said switch and said abutment means relatively to each other, and indicating means associated with said operating member for indicating the pressure setting thereof.

9. In combination, a casing having a threaded bore, a threaded adjusting element mounted in said bore, an operating member reciprocable in said casing and having abutment means, a resilient member urging said operating member in one direction, a fluid pressure plunger positioned to urge said operating member in another direction, a ball thrust bearing mounted between said adjusting element and said resilient member, an electrical switch positioned for engagement by said operating member abutment means, means for adjustably positioning said switch and said abutment means relatively to each other, and a graduated scale associated with said operating member for indicating the pressure setting thereof.

WALTER ERNST.