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UNIVERSAL MATERIALS TESTING MACHINE

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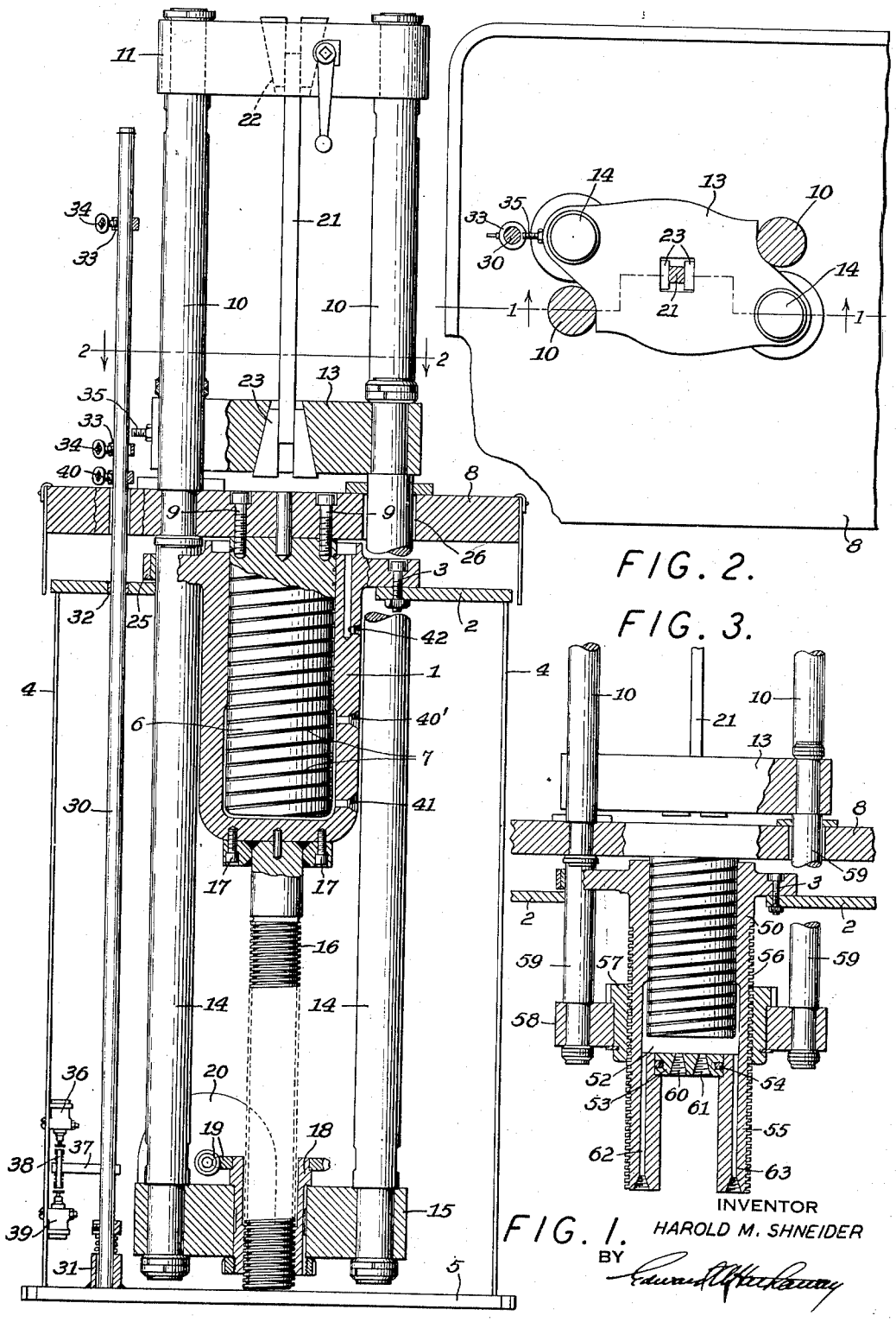


FIG. 1.

FIG. 2.

FIG. 3.

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UNIVERSAL MATERIALS TESTING MACHINE

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7 Claims. (Cl. 73—93)

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This invention relates to materials testing machines of the hydraulic type and it is an object of my invention to provide an improved machine in which the various elements are structurally and functionally related so that its initial cost is relatively low combined with a high degree of ruggedness, stability and compactness, together with accessibility and ease of operation and adjustment for different specimen lengths, as well as obtaining a reasonably high degree of accuracy and sensitivity.

The art is replete with many attempts to provide a low cost materials testing machine for moderate load ranges but these attempts have involved sacrifices in one or more of the many desirable features above mentioned.

In my present invention, I have so constructed and arranged the parts that multiple functions are effectively performed by individual parts. The manner in which this is accomplished will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a vertical sectional view taken substantially on the line 1—1 of Fig. 2 with certain parts broken away for clarity of understanding;

Fig. 2 is a horizontal section taken substantially on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary vertical section showing a modified adjusting screw arrangement.

My improved materials testing machine comprises a main hydraulic loading cylinder 1 mounted upon and secured to a frame top 2 by bolts 3, the sides 4 of the frame being of relatively lightweight sheet metal extending around at least three sides of the machine and secured at their lower edge to a relatively heavy bottom plate 5. A ram 6 preferably having a lapped fit with the cylinder is provided with a spiral lubricating groove 7 throughout the ram length. A loading frame consists of a lower moving platen 8 secured to the upper end of the ram by tap screws 9 and carrying a pair of loading columns 10 to which is rigidly secured an upper movable crosshead 11. A reaction frame consists of a normally stationary intermediate platen 13 connected by a pair of tension columns 14 to a bottom crosshead 15 located within the frame 4. To obtain vertical adjustment of this reaction frame in order to adjust for different specimen lengths while at the same time laterally supporting the columns 14 at their lower ends, together with minimizing the action and reaction effects of the hydraulic loading pressure within cylinder 1, I have provided a relatively heavy non-rotatable and axially stationary screw 16 formed with the cylinder as a rigid integral part thereof by being rigidly connected to the bottom of cylinder 1 by studs 17. This screw is connected to lower crosshead 15 by a rotatable nut 18 journalled therein. A worm and gear 19 driven by a motor 20 is adapted to rotate nut 18 to cause it to travel vertically along screw 16 and carry crosshead

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15, tension rods 14 and lower movable platen 13 to whatever position is desired to accommodate the length of either a tension specimen 21 located between upper and lower grips 22 and 23, or a compression specimen disposed between loading platen 8 and normally stationary platen 13. The upper ends of tension columns 14 freely extend with ample clearance through openings 26 to be fixed in platen 13 and laterally supported by being slidably guided in suitable bearing lugs 25 formed on the cylinder 1. The reaction frame is thus effectively laterally supported at its top and bottom by the top and bottom of the rugged main cylinder 1 and heavy integral screw 16. The motor 20 and gears 19 are supported from the crosshead 15 so as to travel vertically with the same.

To provide relatively simple and effective stops for limiting vertical movement of the reaction frame, a vertical rod 30 is slidably supported in a bearing 31 at its lower end and in a bearing 32 in frame top 2. Stop collars 33 may be located at any place along the rod and are adjustable thereon by thumb screws 34. A pin 35 is secured in the normally stationary but adjustable platen 13 so that when this platen reaches a predetermined adjusted position the pin 35 will engage one of the stop collars 33 and thereby raise rod 30 to operate a limit switch 36 which is mounted upon the frame side 4. This is accomplished by an arm 37 and switch actuating pin 38 extending laterally from rod 30. The downward motion of adjustable platen 13 is similarly controlled by a second limit switch 39. If desired, a third adjustable collar 40 may be engaged by loading platen 8 to limit its upward travel. The limit switches control the electric circuit for adjusting motor 20 and the main pump motor (not shown) thereby to stop the same. Thus it is seen that by first adjusting collars 33 the machine may be quickly adjusted for commercial testing of specimens of different predetermined lengths without danger of jamming the platens and crossheads together.

Any suitable type of load measuring device may be used, such as Bourdon tubes connected into the cylinder 1 as at a connection 40', while fluid pressure from any suitable source such as a hydraulic pump may be supplied to the loading cylinder through a port 41. Leakage may be drained back to the pump sump through the port 42.

In the modification of Fig. 3, I still retain the dual functions of providing a rigid adjusting screw formed integrally with the loading cylinder and of utilizing the screw and cylinder for laterally supporting the reaction frame. To accomplish this and still further reduce the vertical space required for the mechanism, I have provided a loading cylinder 50 rigidly supported on frame top 2 and having a bore 52 closed by a sealing plate 53 seated in a suitable recess and sealed by an O ring 54. The cylinder 50 ex-

tends, as at 55, beyond the end of bore 52 and the external cylindrical surface of the cylinder 50, including its extension 55, is threaded, as at 56, to receive a rotatable nut 57 journalled in a lower crosshead 58 of the reaction frame. The nut 57 may be driven by a suitable belt around its periphery or by a worm and gear 19 of Fig. 1. The crosshead 58 has tension columns 59 corresponding to the tension columns 14 in Fig. 1 and the remainder of the machine and its operation is identical to that shown in Fig. 1 and, hence, does not need to be described further except to point out that the hydraulic loading fluid for the cylinder and the fluid connection for the load indicating mechanism, such as a Bourdon tube, may be made through suitable ports in plate 53 as indicated at 60 and 61, although if desired these fluid connections may be made through passages 62 and 63 extending axially through either the lower or upper wall portion of the cylinder terminating in the cylinder bore 52. In this modification, it is seen that the same simple but rugged relationship is maintained between the cylinder, screw and reaction frame as is present in the arrangement of Fig. 1. The modified arrangement has the same high degree of flexibility of operation and economy of construction with the additional advantage of minimum vertical space requirements.

From the foregoing disclosure, it is seen that I have provided an extremely compact and simple yet highly rugged and stable materials testing machine employing a minimum number of parts which are so structurally and functionally related as to insure a low initial cost but without sacrifice of accuracy and sensitivity or ease of operation and accessibility.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A materials testing machine comprising, in combination, a frame, a vertically extending cylinder supported thereby, a ram disposed within said cylinder, a movable loading platen secured to the upper end of the ram, a normally stationary platen disposed over the upper end of said ram in opposed relation to the movable platen, tension columns connected to said normally stationary platen and extending downwardly alongside of said cylinder, a crosshead connecting the lower ends of said tension rods, a screw rigidly formed with the cylinder, a nut supported by said crosshead and threaded on said screw, and means whereby said nut and screw may be relatively rotated to effect vertical adjustment of the normally stationary platen.

2. The combination set forth in claim 1 further characterized in that the screw is formed on the outside of the cylinder itself.

3. The combination set forth in claim 1 further characterized in that the cylinder includes two portions one of which contains a bore for receiving the ram and the other of which constitutes an extension beyond the bore, and the screw is formed on the outside of both portions of the cylinder.

4. A materials testing machine comprising, in combination, a frame, a vertically extending cylinder supported thereby, a ram disposed within said cylinder, a movable loading platen secured to the upper end of the ram, a normally stationary platen disposed over the upper end of the ram in opposed relation to the movable platen for loading a specimen disposed between the movable platen and normally stationary platen, tension columns connected to said normally stationary platen and extending downwardly alongside of said cylinder, a crosshead connecting the lower ends of said tension rods, and means attached to the outside of said cylinder as a fixed part thereof for vertically movably supporting said crosshead to effect vertical adjustment of the side rods and of the normally stationary platen to various fixed positions in accordance with the length of specimens to be tested.

5. A materials testing machine comprising, in combination, a frame, a vertically extending cylinder supported thereby, a ram disposed within said cylinder, a movable loading platen secured to the upper end of the ram, a normally stationary platen disposed over the upper end of said ram in opposed relation to the movable platen, a crosshead disposed beneath the lower end of said cylinder, tension columns connecting said normally stationary platen and crosshead, a screw, means for supporting the screw in fixed relation against the bottom of said cylinder, a nut threaded on said screw and journalled in said crosshead, and means for rotating said nut to effect vertical adjustment of the normally stationary platen.

6. The combination set forth in claim 5 further characterized in that the means for supporting the screw is non-rotatably, rigidly connected to the cylinder so as to comprise a fixed lateral support for the crosshead and tension columns, and an electric motor is supported by said crosshead for rotating said nut to effect vertical adjustment of the normally stationary platen whereby said motor moves vertically with said tension columns and crosshead.

7. A materials testing machine comprising, in combination, a frame, a vertically extending cylinder supported thereby, a ram disposed within said cylinder, a movable loading platen secured to the upper end of the ram, a normally stationary platen disposed over the upper end of said ram in opposed relation to the movable platen, a crosshead disposed beneath the lower end of said cylinder, tension columns connecting said normally stationary platen and crosshead, a vertically extending screw disposed below the cylinder, means for supporting the screw in a laterally and vertically fixed position relative to the cylinder, a nut threaded on said screw and supported by said crosshead so that the nut and crosshead move vertically together, and means for relatively rotating said screw and nut to effect vertical adjustment of the normally stationary platen.

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