May 13, 1969 R. J. HERZBERG 3,443,422

TESTING MACHINE

Filed Oct. 4, 1965 Sheet 1 of 2

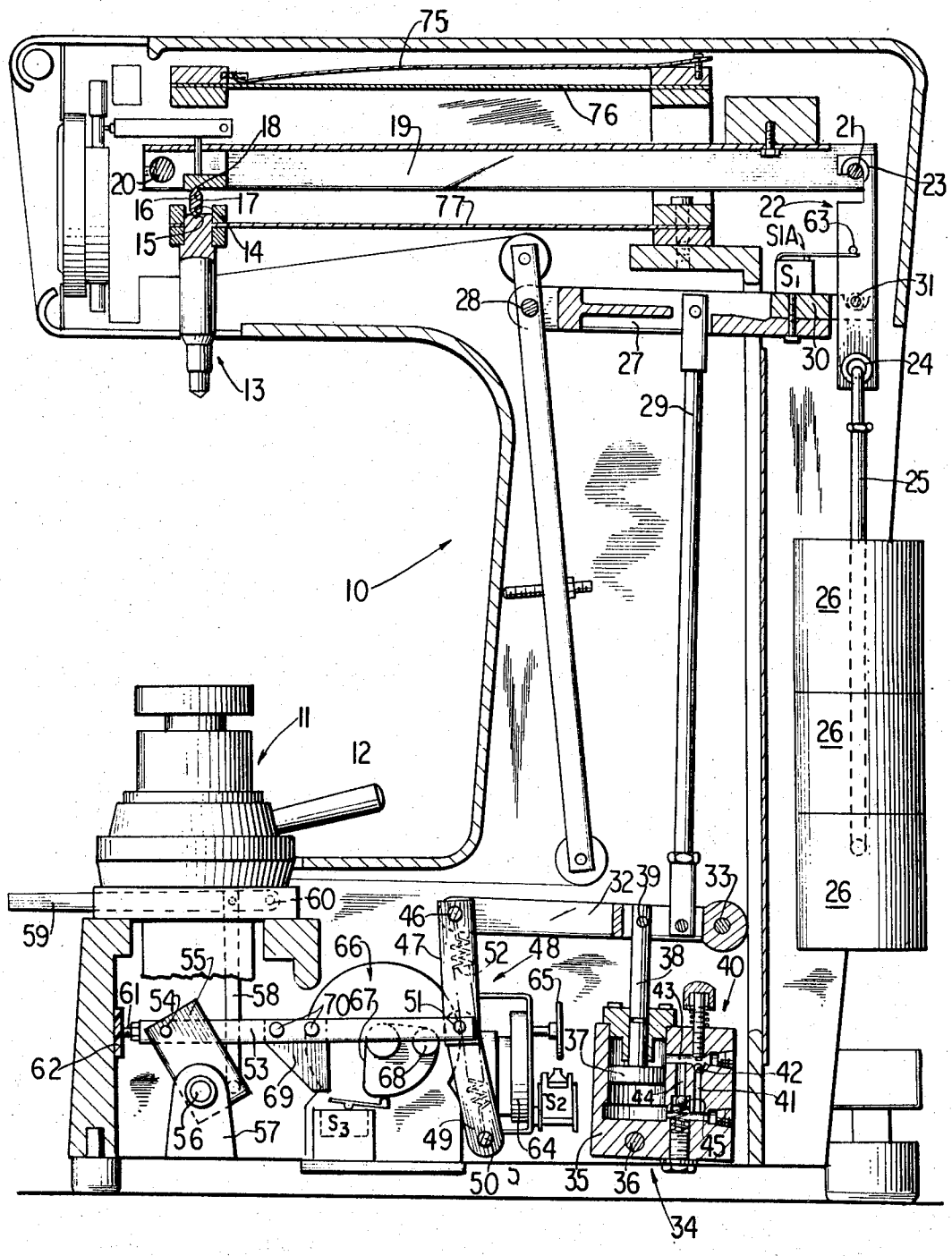


FIG. 1

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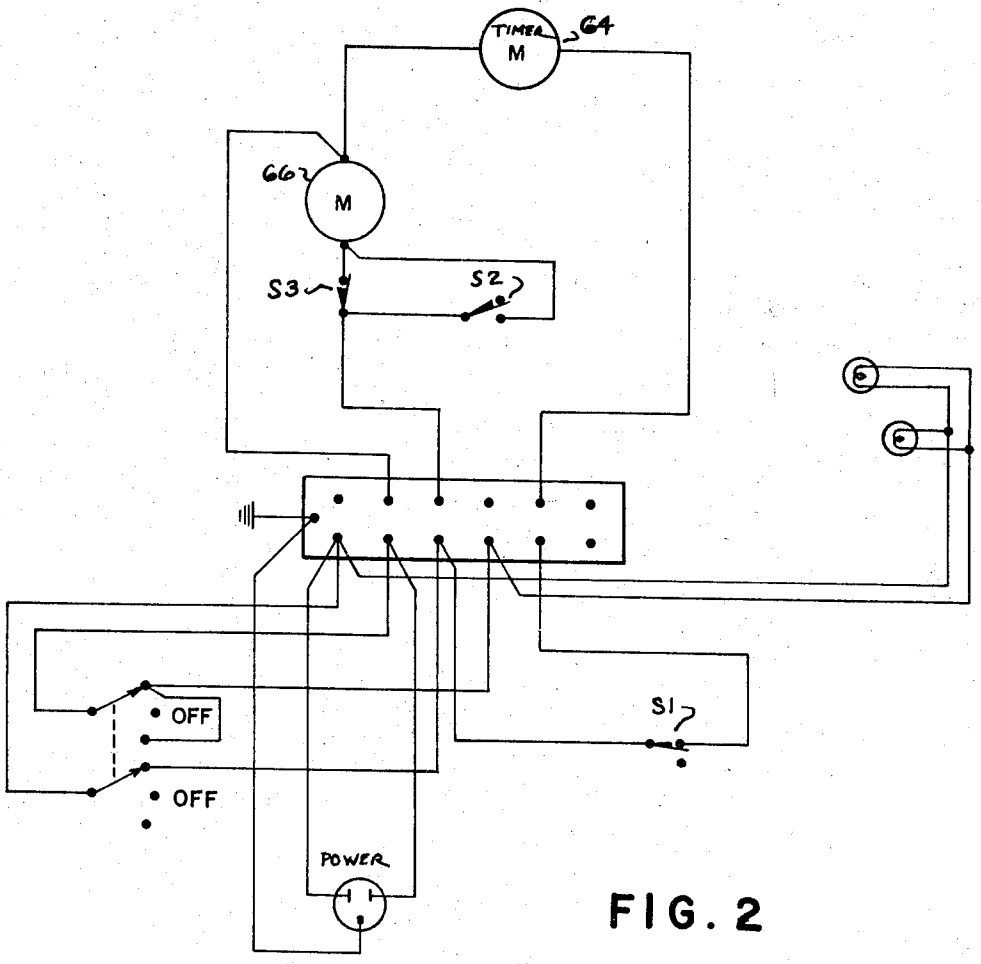


FIG. 2

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TESTING MACHINE

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U.S. Cl. 73—81 2 Claims

ABSTRACT OF THE DISCLOSURE

A hardness testing machine in which the major load will remain constant and be independent of the depth of penetration of the indenter in succeeding operations.

This invention relates to hardness testing machines, and particularly to an improved hardness testing machine in which the major load will remain constant and independent of the depth of penetration of the indenter into the work.

In the testing of specimens for hardness, inaccuracies often occur because the duration of the application of the major force varies from piece to piece. Particularly is this condition noticeable when the hardened case is relatively thin.

The principal object of the present invention is to provide a hardness testing machine in which the major load will remain constant and be independent of the depth of penetration of the indenter in succeeding operations.

Another object of the invention is to provide such a hardness testing machine that will operate correctly with smooth load applications even if the machine is out of lateral plumb.

A further object of the invention is to provide such a hardness testing machine having a power driven timing mechanism for controlling the application of the major load to the work being treated.

In one aspect of the invention, a hardness testing machine may comprise the usual C-type frame construction in which a vertically movable spindle or post is provided for supporting work to be tested.

In another aspect of the invention, the C-frame may include a vertically reciprocable indenter that is moved downwardly by a pivotally mounted power lever.

In another aspect of the invention, the opposite end of the power lever may include a pin adapted to cooperate with a hook assembly, to one end of which assembly a series of replaceable weights may be applied for applying a major load to the work to be tested.

In a still further aspect of the invention, a pivoted load-supporting lever may include a hooked element adapted to cooperate with the hook assembly for raising the hook assembly off the pin on the power lever. This load-supporting pivoted lever may be connected to another pivoted lever having dash pot means connected to it for dampening its movement in either direction.

In a still further aspect of the invention, the last-mentioned pivoted lever may be connected through a toggle joint to a link that is caused to reciprocate by virtue of its connection to a bellcrank lever, which latter is actuated by a handle or depressible bar.

In another aspect of the invention, a timing motor is provide. When the handle is actuated to cause the major weight supporting lever to transfer the major weight onto the main power lever, the timing motor is energized to control the energizing of an unloading motor.

In a further aspect of the invention, the unloading motor may include a cam device adapted to actuate the toggle joint to raise the work-supporting lever to remove the weights from the main power lever.

In a still further aspect of the invention, the unloading motor is adapted to continue to rotate after the removal of the weights from the power lever until the timer cam returns to its starting position.

With the above described arrangement, the time of application of the major load to the specimen will remain constant and is independent of the depth of penetration of the indenter into the specimen.

The above, other objects and novel features of the invention will become apparent from the following specification and accompanying drawings which are merely exemplary.

In the drawings:

FIG. 1 is a sectional elevational view of a hardness testing machine to which the principles of the invention have been applied; and

FIG. 2 is a wiring diagram of the electrical components for the apparatus shown in FIG. 1.

Referring to the drawings, the principles of the invention have been shown as applied to a hardness testing machine including a C-frame **10** of hollow construction. The frame **10** may support a spindle or post **11** in the usual fashion which may be raised and lowered by a hand lever **12**, as is well known in the art.

An indenter **13** may be axially aligned with the spindle **11** and be mounted in the C-frame **10** for vertical movement. The upper end of the indenter **13** may include a V **14** for cooperation with a knife edge **15** of a force transmitting member **16**. The upper end of the member **16** may include a knife edge **17** adapted to cooperate with a V-groove **18** in one end of a power lever **19**. Power lever **19** may be pivoted on a pin **20** mounted within the C-frame **10**. Its opposite end may include a pin **21** adapted to cooperate with a hook assembly **22**. The hook assembly may comprise a hook portion **23** at its upper end and an eye **24** at its lower end. A bar **25** may be connected to the eye **24**, and it may be adapted to support removable weights **26** for applying a major load to the power lever **19**.

A load-supporting lever **27** may be pivoted on a pin **28** mounted within the C-frame **10**, and intermediate its ends it may be pivotally connected to a vertically extending bar **29**. A yoke assembly **30**, fixed to one end of lever **27**, may be adapted to cooperate with a pin **31** on the hook assembly **22** in a manner to provide considerable lateral clearance between it and the yoke **30**. This construction makes it possible for the apparatus to operate correctly with smooth load application, even if the machine is out of lateral plumb. This is accomplished by the fact that when the load is hanging on the power lever **19**, the hook assembly **22** can seek its own location in the yoke **30**, and since pin **31** is freely floating, it can compensate for misalignment in the yoke fingers.

The end of the bar **29** opposite that pivotally connected to the lever **27** is pivotally connected to another lever **32**, which latter is pivoted on a pin **33** mounted within the C-frame **10**. In order to dampen the movements of the lever **32** and bar **29**, a dash pot **34** is provided. It may include a cylinder **35** that is pivotally mounted on a pin **36** supported within the C-frame **10**. The cylinder **35** may comprise a piston **37** that is connected to a piston rod **38**, the end opposite the piston being pivotally connected at **39** to the lever **32**. Valving **40** may be provided for controlling the flow of liquid from one side of the piston **37** to the other side. Thus, with the piston **37** in the position shown in FIG. **1**, it is in its upper position and the liquid completely fills the lower portion of the cylinder **35** as well as the upper portion above the piston **37**. Movement of bar **29** and lever **32** downwardly causes piston **37** to move downwardly within the cylinder **35**, forcing the liquid below

it through a passage **41**, raising a ball check valve **42** so that it flows through a passage **43** into the cylinder **35** above the piston **37**. When the piston **37** moves upwardly within cylinder **35**, the liquid above piston **37** flows through passage **43**, thence through a passage **44**, past a spring check valve **45**, thence into the cylinder **35** beneath piston **37**.

The end of the lever **32** opposite that pivoted to the pin **33** is pivotally connected by a pin **46** to one link **47** of a toggle link **48**. The other link **49** of the toggle link **48** is pivotally connected to a pin **50** within the frame **10**. The two adjacent ends of the links **47** and **49** are pivotally connected by a pin **51**, and a spring **52** connected between the pins **46** and **50** tends to move the lever **32** downwardly.

Spring **75** is for minor load correction, correcting for minor differences in weight between the indenter assembly and parallelogram formed by bars **76**, **77**. Spring **75** will tend to raise the parallelogram assembly.

A horizontal lever **53** has its one end connected to the pivot **51** and its opposite end pivotally connected at **54** to a bellcrank **55**, which latter is pivotally mounted at **56** to a support **57** within the frame **10**. The bellcrank **55** is connected to a lever **58**, the opposite end of which is connected to a handle **59** that is pivoted at **60** within frame **10**.

An adjusting screw **61** at the end of the lever **53** is adapted to cooperate with a pad **62** for limiting the leftward motion of the lever **53**. The construction and arrangement of the parts are such that movement of handle **59** downwardly causes the bellcrank lever **55** to move in a clockwise direction, thereby moving lever **53** rightwardly (FIG. 1) to thereby move the toggle joint **48** beyond dead center, whereupon the spring **52** moves lever **32** and the bar **29** downwardly, thereby to move the yoke **30** from beneath pin **31** so that the major weights **26** are transferred onto the pin **21** of power lever **19**.

Lever **27** and bar **29** move downwardly and when the load is fully applied, then switch operator S1A moves away from pin **63** on the hook assembly **22** to close switch S_1. Closing of the switch S_1 energizes a timing motor **64** (FIGS. 1 and 2) that drives a timing cam **65**. After a predetermined rotation of the timing cam **65**, it closes a switch S_2, thereby energizing unloading motor **66**. The unloading motor **66** has a cam **67** connected to its output shaft on which cam a roll **68** is mounted. As the unloading motor **66** rotates, the roll **68** engages a pad **69** that is fixed to the reciprocable bar or lever **53** by pins **70**. Engagement between roll **68** and pad **69** forces the lever **53** leftwardly, thereby returning the toggle **48** to the position shown in FIG. 1, raising bar **29** and lever **27**, thereby to cause the yoke **30** to engage the pin **31** and raise the weights **26** off the pin **21** of lever **19**.

Before the switch S_1 can open by virtue of the raising of bar **29** and lever **27**, cam **67** will close switch S_3 which will permit the motor **66** to continue to rotate after switch S_2 is opened to return the timing cam **65** to its initial position, whereupon the cam **67** opens switch S_3, de-energizing the motor **66**.

When the machine is actuated by lever **59**, the bar **29** moves down, permitting lever **27** to rotate about pin **28**. This action causes the weight and hook assembly to be lowered to make contact with pin **21**. At this point, the major load has started to be applied to the indenter. When the specimen to be tested has permitted the indenter to be impressed to its maximum depth in keeping with the hardness of the specimen, the power lever and the major load weights will stop moving. The lever **27** will continue down, and at this point the actuator of switch S_1 will move away from pin **63** and start the timer motor.

Although the various features of the improved hardness testing machine have been shown and described in detail to fully disclose one embodiment of the invention, it will be evident that changes may be made in such details, and certain features may be used without others without departing from the principles of the invention.

What is claimed is:

1. In a hardness tester, the combination comprising a frame; a spindle mounted in said frame for vertical movement; a vertically movable indenter plunger mounted in said frame in alignment with said spindle; a power lever pivotally mounted within said frame and connected to said plunger; a hook assembly connected to the end of said lever opposite its connection to said plunger; means for supporting weights connected to said hook assembly; a load-supporting lever pivotally mounted in said frame and including a yoke adapted to cooperate with means on said hook assembly for removing said hook assembly from said power lever; means for actuating said load-supporting lever; timing means for resetting said actuating means to remove the load from said power lever; and means for resetting said timing means.

2. In a hardness tester, the combination comprising a frame; a spindle mounted in said frame for vertical movement; a vertically movable indenter plunger mounted in said frame in alignment with said spindle; a power lever pivotally mounted within said frame and connected to said plunger; a hook assembly connected to the end of said lever opposite its connection to said plunger; means for supporting weights connected to said hook assembly; a load-supporting lever pivotally mounted in said frame and including a yoke adapted to cooperate with means on said hook assembly for removing said hook assembly from said power lever; toggle means for actuating said load-supporting lever; handle means for actuating said toggle means; timing means for resetting said toggle means to remove the load from said power lever; and means for resetting said timing means.

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