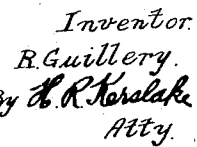


APPARATUS FOR MAKING RAPID TESTS OF THE HARDNESS OF METALS.

Patented Feb. 1, 1921.

1,367,133.



R. GUILLERY.
 APPARATUS FOR MAKING RAPID TESTS OF THE HARDNESS OF METALS.
 APPLICATION FILED JUNE 10, 1918.

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2 SHEETS—SHEET 2.

Fig. 2.

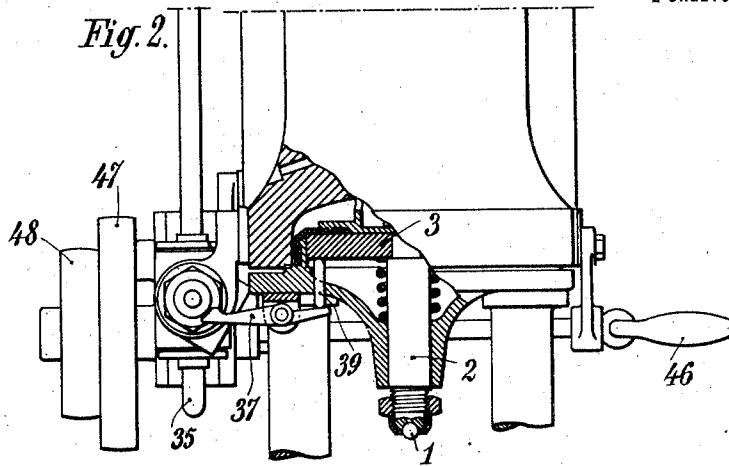


Fig. 3.

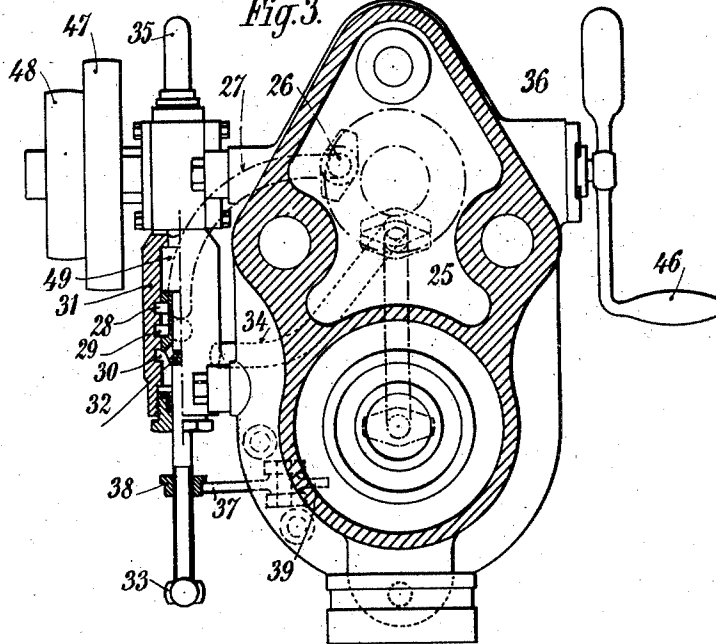
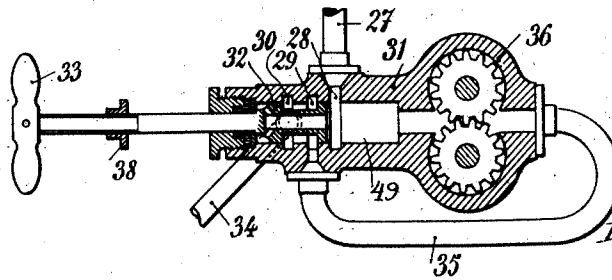


Fig. 4.



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APPARATUS FOR MAKING RAPID TESTS OF THE HARDNESS OF METALS.

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Specification of Letters Patent.

Patented Feb. 1, 1921.

Application filed June 10, 1918. Serial No. 239,239.

To all whom it may concern:

Be it known that I, RENÉ GUILLERY, a citizen of the French Republic, residing at No. 103 Avenue de la Republique, Aubervilliers, France, have invented certain new and useful Improvements in Apparatus for Making Rapid Tests of the Hardness of Metals, of which the following is a specification.

10 In making tests of the hardness of metals by the penetration of a spherical ball as proposed by Brinell the engineer, the final result is a function of the duration of the action of the imposed load. It is therefore
15 necessary to take this duration of action into consideration if it is desired to have a result. This method of proceeding however entails a great loss of time which may be very inconvenient in cases where it is desired
20 to make a large number of tests within a comparatively short period of time.

The present invention has for its object to provide an improved apparatus which will allow of obtaining, in the case where the
25 time function varies within certain limits, a corresponding variation of the other function, namely, the load function, which is produced automatically and inversely in such a manner that the impression produced
30 in the metal which is a function of the load and of the time, will be constant irrespectively of the time duration.

In studying the influence of the time function upon the variations of the load which
35 is necessary to produce an impression similar to the standard impression, it has been found that in the case of a ball subjected to a progressive and limited pressure, and then to said pressure limited during a half
40 second, the increase in the load which is necessary to produce the standard impression is 72 kilograms in the initial case of a ball of 10 millimeters subjected to a pressure of 3000 kgs. during 20 seconds.

45 In the improved apparatus forming the subject matter of the present invention, recourse is had for obtaining this result, to the use of a hydraulic pressure that is limited by the action of a special adjustable
50 pressure determining valve when the said pressure has reached a desired intensity. This special valve which is arranged in the path of the circulation of the liquid acting in the hydraulic cylinder, creates or is sub-
55 jected to the load that is imposed on the test

piece. This valve is loaded by means of a spring of adjustable tension acting to allow of a cataract when the pressure of the liquid in the hydraulic cylinder reaches the limit value corresponding to the test; but according to the greater or smaller speed of the establishment of this pressure, the quantity of liquid which is to flow within a determined time, is greater or less, and consequently produces a corresponding lift of
60 the cataract valve. It is merely necessary to arrange the spring and to make the dimensions of the valve in such a manner that the increase in the elastic force of the spring produces in the hydraulic cylinder an in-
65 crease in pressure that compensates the loss of time in the test, if the speed increases, so that the impression produced upon the test piece shall always be the same, irrespectively of the duration of the action.

75 The accompanying drawings illustrate by way of example a constructional form of the improved apparatus of the hydraulic type provided with a valve in which the flow of the liquid, for instance glycerin, gives a
80 constant result with a speed of action varying from once to twice the said speed.

In these drawings:

Figure 1 is a vertical section of a press constructed according to this invention.

85 Fig. 2 is a part side elevation of the said press, some of the parts being broken away.

Fig. 3 is a horizontal section on the line A A of Fig. 1.

Fig. 4 is a horizontal section showing
90 more particularly the distributing device employed in this form of apparatus.

In the improved apparatus as shown, the ball 1 which is intended to make an impression in the test metal, is carried at the
95 end of a stem 2 which is fixed to a piston 3 working with a tight joint in the cylindrical portion of a dish-shaped chamber 4 in which it works with a minimum of friction.

This joint is constituted by an annular
100 rubber diaphragm 5 fixed to the piston 3 by means of a washer 6 and tightly pressed against the internal circumferential surface 7 of the edge of the dish-shaped chamber 4 by means of a ring 8. The elasticity of the
105 rubber 5 allows the piston 3 to move relatively to the cover of the dish-shaped chamber. Likewise the arrangement of the diaphragm 5 pressed tightly against the corresponding surfaces of the piston 3 and the
110

cylindrical chamber wall by the surrounding pressure prevents all leakage.

The dish shaped cover 4 is connected firmly to the flanged solid end 9 of the cylinder 10 and incloses a chamber therein the upper part of which is formed concave and in which is inserted centrally a cylinder 11 of small diameter. In the latter there works a piston 12 of corresponding diameter fixed to another piston 13 of larger diameter working in the cylinder 10. This cylinder is closed at the top by a cover 14 and communicates through a pipe 15 with one of the vertical ducts 16 of a circular valve box 17. The latter is provided at its lower part with a narrow-edged seat 18 against which bears a valve 19. This valve beds on its seat which is made as narrow as possible, and is maintained against its seat by the action of a spring 20 contained in a central sheath 21. The tension of this spring can be adjusted by means of a screw 22 rotating with slight friction upon the top of the sheath 21 and adapted to be screwed from the outside into a nut 23 to which one end of the spring 20 is attached.

The valve box 17 and sheath 21 are mounted together as a whole in the middle of a cover 24 that covers a reservoir 25 containing a certain quantity of oil.

The circular box 17 of the valve 19 communicates through another vertical passage 26 (Fig. 3) and through a pipe 27 with an internal groove 28 formed with other grooves 29 and 30 in a distributing box 31, in the interior of which a slide valve 32 is adapted to work. This slide valve can be operated from the outside by means of an operating handle 33. The groove 30 cut off from the groove 28, communicates through a pipe 34 with the bottom of the oil reservoir 25.

The middle groove 29 communicates through a pipe 35 with the suction outlet of a geared pump 36, the delivery orifice of which communicates with the chamber of the slide valve 32 and through the groove 28 and the pipe 27 with the box 17 of the valve 19 in the position shown in Fig. 4. This pump 36 serves to generate the pressure acting upon the piston 3 of the ball 1. It may be driven by hand by means of the hand crank 46, or from an engine by means of a belt passing around one or the other of the stepped pulleys 47, 48 mounted on the shaft of the pump at the end farthest from the hand crank 46.

To the underside of the dish-shaped chamber 4 there is pivoted a rocking beam 37 (Figs. 2 and 3) one end of which constitutes a catch and coöperates with a ring 38 carried by the rod of the distributing valve 32, while the other end of this rocking beam 37 is shorter and therefore lighter and bears constantly up against a pin 39

which extends freely through the dish shaped chamber cover 4 and bears in its turn against the underside of the piston 3.

A pressure gage 40 is connected to a duct 41 opening into the interior of the chamber 42 wherein the pressure is exerted. This pressure gage allows of ascertaining whether the pressure corresponds to the speed of the operation which is being performed.

The apparatus is completed by a strong screw 43 mounted in the base 44 of the apparatus and provided with a hand wheel 45 by means of which the said screw and with it the plate upon which the test piece is placed can be raised.

The operation is as follows:

The test piece having been placed either directly upon the end of the screw 43 or upon a plate carried by said screw, the latter is caused to rise by operating the hand wheel 45 until the test piece is in contact with the ball 1.

From this moment onward, the pump 36 is operated either by hand or by power, after having first fully pulled out the handle 33 of the distributing slide valve 32, so as to connect the two grooves 29, 30 in order to establish communication between the oil reservoir 25 and the suction pipe 35 of the pump 36, whereupon the latter will communicate through the internal valve chamber 49, the slide valve 32, groove 28, pipe 27 and duct 26, with the circular chamber 17 of the valve 19.

The spring 20 of this valve having been previously adjusted to a determined tension chosen according to the duration and pressure of the test which is to be made, the said valve 19 will remain closed so long as the pressure produced by the pump does not balance the said tension. The oil delivered by the pump then passes through duct 16 and pipe 15 into the cylinder 10 where it acts upon the large piston 13. The intensity of the pressure which thus acts upon the piston 13 is multiplied to a certain degree by the small piston 12 which moving with the piston 13 as in one piece therewith, acts in its turn upon the glycerin contained in the chamber 42, and consequently upon the tight piston 3.

The pressure thus generated has the result of causing the ball 1 to make an impression in the test piece, said impression being as regards its value, a function of the load imposed during a period of time that is limited by the sudden opening of the valve 19, when the pressure exerted upon the oil by the pump 36 exceeds the pressure exerted by the spring 20 upon the said valve 19. As soon as the valve 19 has opened, the oil flows into the reservoir 25 and prevents further increase of pressure in the cylinder 10 and in the cavity 42.

The test being finished, the handle 33 is

manually operated and the slide valve 32 is brought to the position shown in Fig. 2, thus short circuiting the pump and connecting the cylinder 10 and oil reservoir 25. The slide valve 32 can only be brought into its initial position for making a test when all the oil contained in the cylinder shall have returned into the reservoir 25, and the piston 3 with the ball 1 shall have risen again into their initial position. This result is effected by the action of the rocking beam 37 against which the pin 39 bears when the piston 3 is at the bottom of its stroke. This rocking beam 37 has thus come into the path of the ring 38, so that the slide valve 32 cannot make its full stroke but will assume an intermediate position wherein it establishes communication between the two grooves 28 and 29 (Fig. 3) and consequently short-circuits the pump 36 because its suction orifice is in communication with a cavity of constant volume.

When the pressure has completely fallen in the cavity 42, the spring 50 will raise the piston 3 and the rocking beam 37 will rock so as to disengage its catch from the ring 38, and allow the slide valve to move to the end of its stroke, that is to say, to move into a position in which it establishes communication between the two grooves 29 and 30, and thus connects the pump 36 with the oil reservoir 25 and the pipe admitting the oil into the cylinder 10.

A fresh test piece can then be placed upon the plate of the screw 43 for the purpose of making another test.

The improved apparatus thus comprises a means of regulating the reaction upon the ball, as well as the device for supplying the necessary active pressure, without the operator having to do work other than that which is useful for operating the pump when the latter is actuated by hand.

What I claim is:—

1. An apparatus for making a rapid test of the hardness of metals by the Brinell ball method, comprising the combination of a hydraulic press; a force pump for working the hydraulic press; a piston having a stem from which is carried the testing ball; a testing ball with engaging means adapted to be attached to the said piston stem, and upon which the pressure exerted is a function of the speed with which the pressure is generated; a pressure determining valve adapted to be adjustably regulated, and arranged in the path of the circulating liquid used in actuating the hydraulic press; a circular valve box provided with a valve seat and combined with a receptacle for containing adjustable pressure resisting means; a reservoir containing oil employed as the agent for transmitting the hydraulic pressure; a distributing valve establishing communication between the force pump, the oil

reservoir and the hydraulic press; and for short circuiting said pump; a catch mechanism operating to permit the oil to be returned into the oil reservoir; and means for raising the test piece into position for being operated upon.

2. An apparatus for making a rapid test of hardness of metals by the Brinell ball method, comprising the combination of a hydraulic press having a main large bore cylinder and oil reservoir formed integrally and each having an open end adapted to be covered in and a solid end, the solid end of said main cylinder being bushed with a small open ended cylinder; a large piston formed integral with a small piston and working fluid tight respectively in the said cylinders; a chamber of large diameter formed in outer portion of the solid end of main cylinder and communicating with small cylinder; a piston, working fluid tight in cylindrical portion of a chamber to which said piston is attached a stem, the lower end of which is chambered to receive a testing ball and screwed to receive means for retaining the testing ball in position; a dished cover covering in the chamber and forming a guide for the piston stem; a testing ball and engaging means adapted to be attached to the piston stem; a pump for forcing the hydraulic liquid into main cylinder and withdrawing the liquid therefrom when test is completed; a manually operated distributing slide valve; a catch mechanism coöperating with the slide valve to allow of the oil returning to the oil reservoir; a circular valve box, forming a cover for the oil reservoir and provided with a valve seat and valve spindle guide; an adjustably regulated pressure determining valve, adapted to be held fluid tight, by covered in spring means, against the valve seat until the test pressure is attained; and manually operated means for raising test piece into position for being operated on.

3. An apparatus for making a rapid test of hardness of metals by the Brinell ball method, comprising the combination of a hydraulic press including a main cylinder, a cover therefor, a circular valve box, means for establishing communication between the cylinder and valve box, a chamber of comparatively small capacity, a chamber cover provided with a seating, a spring coacting with the seating, a set pin, a piston in the chamber having a stem surrounded at its upper part by the spring which pushes the piston into position for commencing operations, while the lower part of the stem is provided with a slot engaging with the set pin to prevent rotation of the piston and stem, an oil reservoir into which the valve box depends, a pump communicating with the oil reservoir, a distributing valve chest in the pump and communicating with the

valve box and the oil reservoir, a valve spindle having a stop ring fixed thereon, a manually operated slide valve in the chest and attached to the valve spindle, a rocking lever, a tappet fixed in the chamber piston to engage with the stop ring for operating the rocking lever, a sheath fixedly mounted on the valve box, a tension spring in the sheath, an adjustable pressure determining valve provided with a spindle communicating with the lower end of the spring which operates to hold the valve upon its seat, and manually operated means for raising the test piece into position for being operated on by the testing ball.

4. An apparatus for making a rapid test of hardness of metals by the Brinell ball method, comprising the combination of a hydraulic press, a main cylinder, annular chambers formed in the bottom of the cylinder and provided with draining ducts, a flanged and dished cover inclosing the chamber, an exterior chamber, a pressure gage on the cylinder, means for establishing communication between the exterior chamber and the pressure gage, supporting standards, an oil reservoir the solid end of which is attached to the standards, a distributing valve chest in communication with the solid end of the reservoir and provided with grooves, a distributing slide valve cooperating with the grooves to permit the hydraulic fluid to circulate in the apparatus where and when required, a catch mechanism including a pivotally mounted rocking lever mounted on the dished cover, a circular valve box, a sheath thereon, a spring within the sheath, screw-means operable from the exterior and adapted to engage within the sheath with the end of the spring, the tension of which may thereby be regulated, an adjustable pressure determining valve extending into the oil reservoir when the test pressure and time duration thereof has been completed, and manually operated screw-means for insuring of the adjusting of the test piece to the required height.

5. An apparatus for making a rapid test

of hardness of metals by the Brinell ball method comprising the combination of a hydraulic press having cylinders of differential diameters and corresponding pistons; an inclosed small chamber of large diameter containing glycerin and communicating with a cylinder of small diameter; an independent piston working in the inclosed small chamber to transmit the pressure obtained in the main cylinder to the test ball; a spherical testing ball; a pump for forcing hydraulic fluid drawn from an oil reservoir into the main cylinder and thence back to the oil reservoir when the test pressure has been attained; an inclosed valve chest, a manually operated slide valve working in the inclosed valve chest for regulating the flow of the hydraulic fluid; a spindle for the valve, a circular valve box having two ducts whereby the hydraulic fluid is transmitted by one of the said ducts from the pump to the valve box and thence by the other duct to the main cylinder, the latter duct also forming a means whereby when the test pressure is attained the hydraulic fluid returns through the valve box and pressure determining valve to the oil reservoir; a pressure determining valve adjustably regulated to enable it to operate in such a manner that the impression produced in the test piece, which is a function of the load and of the time, will be constant irrespective of the time duration, the said valve operating to prevent increase of pressure beyond a predetermined degree; a sheath inclosing a spring regulatable as to tension and connected to the pressure determining valve; catch means including a pivotally mounted lever arranged so that the long arm thereof will engage with or be disengaged from the stop ring on the slide valve spindle, a main base plate for the apparatus, standards thereon for supporting the oil reservoir, and manually operated screw-means including a nut fixed in the base plate.

In testimony whereof I have signed my name to this specification.

RENÉ GUILLERY.