H. J. THOMAS.

HYDRAULIC PRESS FOR SIZING TURBINE BLADES.

APPLICATION FILED DEC. 31, 1918.

1,311,540. Patented July 29, 1919.

3 SHEETS—SHEET 1.

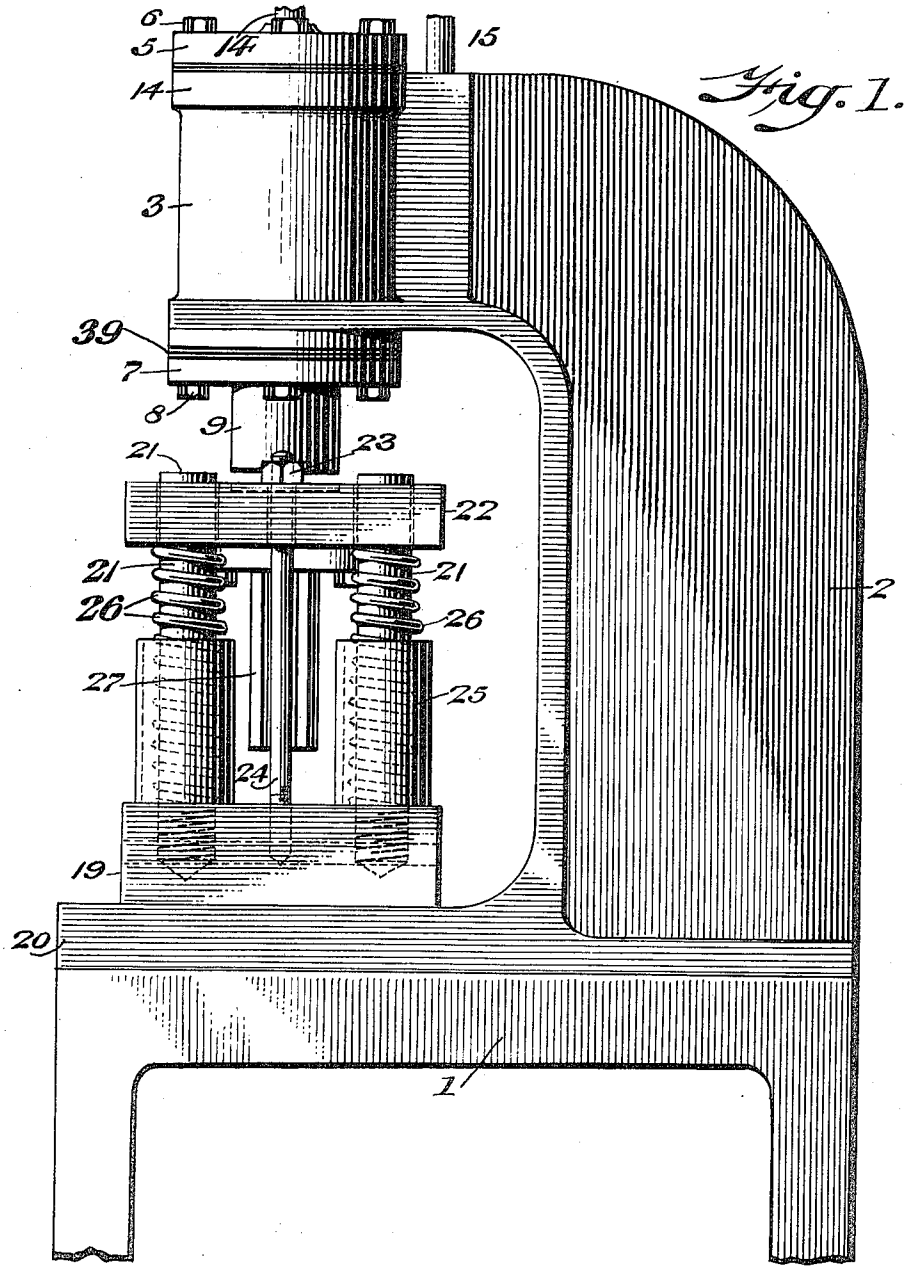


Fig. 1.

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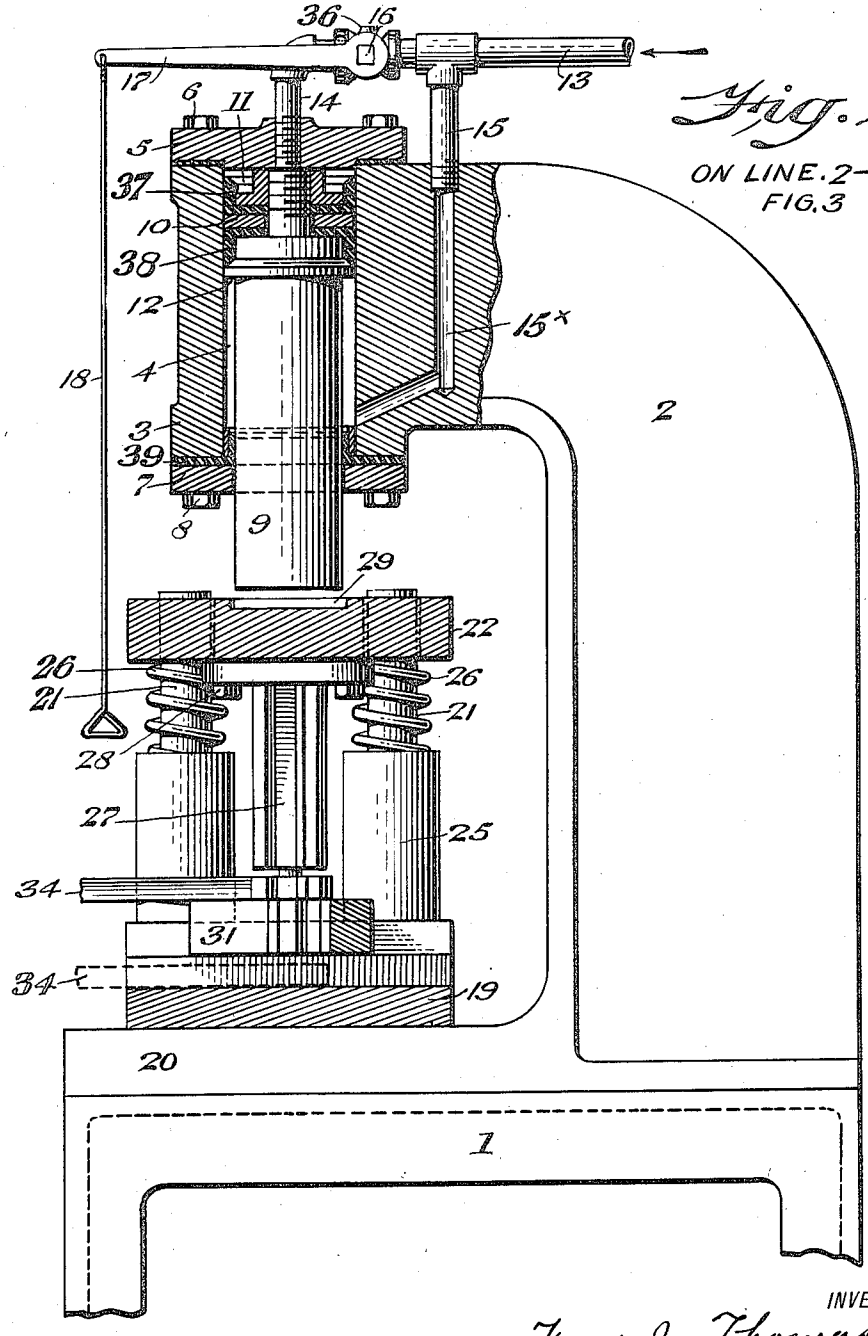


Fig. 2.

ON LINE. 2-2
FIG. 3

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3 SHEETS—SHEET 3.

Fig. 3.

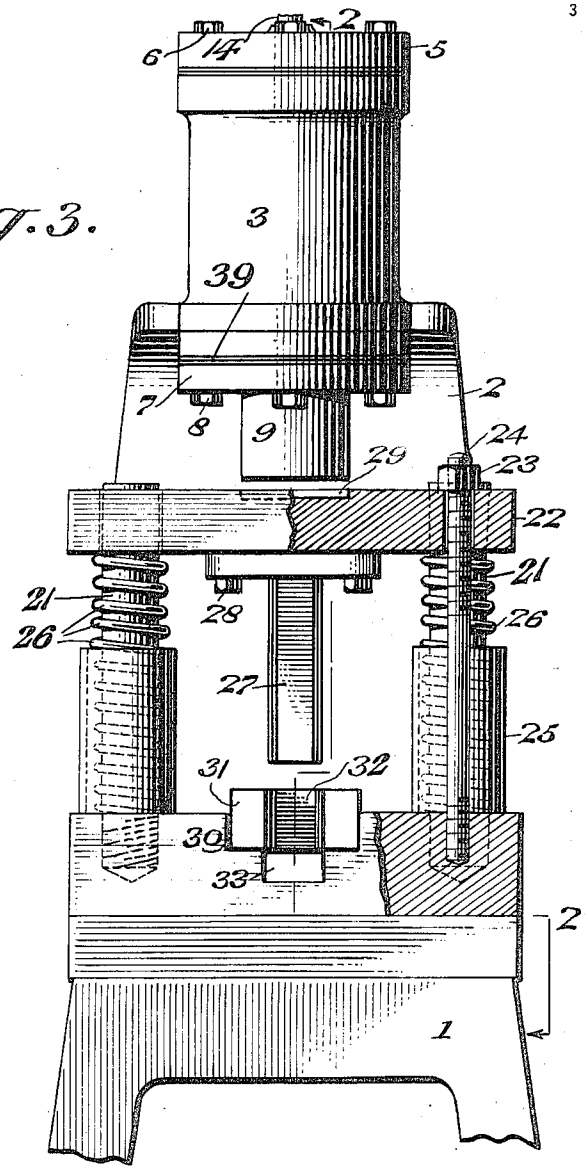


Fig. 5.

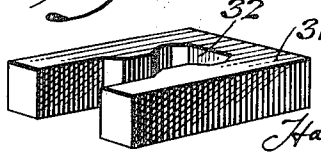
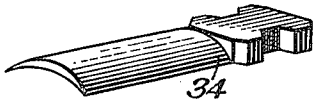


Fig. 4.



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UNITED STATES PATENT OFFICE.

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HYDRAULIC PRESS FOR SIZING TURBINE-BLADES.

1,311,540. Specification of Letters Patent. Patented July 29, 1919.

Application filed December 31, 1918. Serial No. 269,151.

To all whom it may concern:

Be it known that I, HARRY JOHN THOMAS, a citizen of the United States, residing at San Francisco, county of San Francisco, State of California, have invented a new and useful Hydraulic Press for Sizing Turbine-Blades, of which the following is a specification.

My invention relates to a hydraulic press which is especially designed for the sizing of turbine blades in order that the time requisite for the sizing of the blades will be reduced to a minimum.

To the above ends my invention consists of a novel construction of a hydraulic press.

It further consists of a novel construction and arrangement of a hydraulic press wherein the male die is carried by a head which is entirely disconnected from the ram. The head is movably connected to a detachable base plate supported on the frame of the press and provision is made for limiting the movement of the head in either direction and for effecting a quick return of the head after a sizing operation has been completed, due to the power stroke of the ram.

Other novel features of construction and advantage will hereinafter more clearly appear in the detailed description of my invention.

For the purpose of illustrating my invention, I have shown in the accompanying drawings a typical embodiment thereof which is at present preferred by me, since the said embodiment will be found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents, in side elevation, a hydraulic press for sizing turbine blades embodying my invention.

Fig. 2 represents a section on line 2—2 of Fig. 3.

Fig. 3 represents a press in front elevation.

Fig. 4 represents in perspective a view of a turbine blade.

Fig. 5 represents in perspective one of the dies.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings,

1 designates a stand or foundation on which is supported a frame 2 which extends upwardly and laterally and preferably has formed integrally with it a cylinder 3, which is provided with a bore forming a piston chamber 4, the upper end of which is closed by a head or cap 5 secured to it by means of fastening devices 6. The lower end of the piston chamber 4 is closed by means of a head 7 secured to the cylinder by means of fastening devices 8. The head 7 has the ram 9 passing through it and said ram is connected to a piston 10 having differential pressure areas 11 and 12. 13 designates a motive fluid inlet conduit which leads from a source of motive fluid supply and communicates by means of a conduit 14 with the top of the piston chamber 4 to admit motive fluid to the greater differential pressure area 11. The inlet conduit 13 communicates by means of a conduit 15 and passage 15^{x} with the lower end of the piston chamber 4. The conduit 14 is controlled by a three-way valve 16 which is provided with an arm 17 to which is connected a manually actuated handle 18 which extends into a position accessible to the operator of the press. 19 designates a base plate which is mounted on a base 20 of the frame 2, and this base plate has secured to it in any desired manner a plurality of vertically disposed guides 21, four of which are shown in the drawings. The guides 21 are shown as being in threaded engagement with the base plate.

22 designates a head loosely mounted on the guides and the upward movement of the head is limited by means of a nut 23 carried by a rod 24 the lower end of which is screwed into the base plate 19. The downward movement of the head 22 is limited by means of tubes 25 mounted on the vertical guides 21 and between the upper end of these tubes and the head 22 are interposed springs 26 which effect a quick return of the head 22. 27 designates a male die or former secured to the under face of the head 22 by means of fastening devices 28. The upper face of the head 22 is recessed as at 29 to receive the impact of the ram 9. The face plate 19 is recessed as at 30 to receive

the female die 31 through the opening 32 of which the turbine blade 34 is to be pressed. A recess 33 is provided in the base plate through which a turbine blade can be withdrawn after it has been properly sized. The valve 16 has an exhaust port 36 whereby exhaust is permitted from the upper portion of the piston chamber 4 during the travel of the ram 9 upwardly into the position seen in Fig. 2.

I have deemed it unnecessary to describe in detail the internal construction of the valve 16, since it will be apparent that any suitable form of valve, which permits the inlet of motive fluid through the pipe 14 in order to drive the ram 9 downwardly will answer for the purpose, it only being essential that a suitable valve controlled exhaust port be provided for the pipe 14, to permit the automatic or manually controlled escape of the motive fluid during the period when the ram is moving upwardly into the position seen in Fig. 2, wherein I have shown the piston 10 as provided with suitable upper and lower packings, as indicated at 37 and 38, and the lower end of the ram packed by means of the packing or gland 39, which is held in position by the lower head 7.

It will be apparent that the head 22 is capable of a free vertical up and down movement upon the vertical guides 21 and that after said head has been depressed by the downward travel of the ram, the springs 26 will be compressed whereupon the tension of said springs will tend to quickly elevate said head 22, the male die or former 27 carried thereby, an upward pressure being simultaneously exerted upon the bottom of the ram 9. The extent of the upward movement of the head 22 will be limited by the nuts 23 on the rods 24 which are preferably two in number while the downward travel of the head 22 and the male die or former 27 will be limited or arrested by the contact of said head with the top of the tubes 25 surrounding the vertical guides 21. While I have shown one form of male die or former which may be employed in sizing turbine blades of the character seen in Fig. 4, it will be evident that the contour of the male and female dies or formers may be changed from that shown and that the broad principle of my invention is applicable to the sizing of turbine blades of different or other contours from that shown. While my invention is especially adapted for sizing turbine blades, it will be evident that it is adapted to a variety of other operations in which great pressure and rapidity of action may be required with movements controlled manually or automatically, such as forging, coining, stamping, punching or shearing.

The operation is as follows:—

The parts normally appear as seen in Fig. 2, the ram 9 and its piston being in elevated position and the head 22 carrying the male die 27 being also in elevated position and supported upon the springs 26, the upward movement of said head being limited by the nuts 23 of the rods 24. By the proper manipulation of the valve 16 the motive fluid is admitted simultaneously through the pipes 14 and 15 and by reason of the preponderance of pressure upon the larger differential area 11 of the piston 10, it will be apparent that the ram will be forced downwardly and will thrust against the head 22, the continued downward movement of said ram depressing said head 22 and the male die 27 carried thereby, whereby through the instrumentality of said male die and the lower female die 31, the turbine blade 34 or other article which is placed upon said female die is sized to the desired extent.

The operator next manipulates the arm or lever 17 so as to permit the exhaust through the exhaust port 36, whereupon the preponderance of pressure admitted through the pipe 15 and passage $15^{\times}$ exerted upon the under or smaller differential area 12 of the piston 10 will elevate the ram 9, the upward movement thereof being slightly accelerated by reason of the tension of the springs 26, whereupon the parts assume the position seen in Fig. 2 and the turbine blade or other article 34 which has been sized is withdrawn and another blade placed in position, the position of a turbine blade after sizing being shown in dotted lines at the bottom of Fig. 2.

It will be apparent that by the employment of the springs 26 the head 22 and its adjuncts, that the upward movement of said head and male die 27 carried thereby, will be greatly accelerated on each upward stroke following the sizing operation and that the upward movement of the ram 9 will also be somewhat accelerated by the employment of the springs 26 so that a considerable amount of time will be saved in the sizing of turbine blades by my device which is durably constructed and is not liable to get out of order.

In case it is desired to remove the head 22, this can be readily effected by manipulating the nuts 23 which can be readily done when it is desired to replace the springs 26 or for other purposes and both the male and female dies or formers 27 and 31 are readily accessible at all times for the purposes of inspection or repairs.

While I have shown the guides 21 as being threaded or screwed into their support or base plate it will be apparent that they may be secured in position in any other convenient manner. It will be evident that any suitable form of cock or valve 16 may be employed which will permit the proper inlet and exhaust of the motive fluid at a

predetermined period either manually or automatically through the pipe 14, as will be apparent to those skilled in the art.

It will now be apparent that I have devised a novel and useful construction of a hydraulic press for sizing turbine blades which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described preferred embodiments thereof which will be found in practice to give satisfactory and reliable results, it is to be understood that such embodiments are susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

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

1. In a hydraulic press for sizing turbine blades, a base plate, guides supported thereon, a head movable on said guides, a former carried by said head, means for limiting the upward and downward movement of said head, and means for accelerating the upward movement of said head after the completion of the sizing operation.

2. In a hydraulic press for sizing turbine blades, a base plate, guides supported thereon, a head movable on said guides, a former carried by said head, means for limiting the upward and downward movement of said head, and means for accelerating the upward movement of said head after the completion of the sizing operation, in combination with a ram in vertical alinement with said head and adapted to thrust against the latter.

3. In a hydraulic press for sizing turbine blades, a base plate, vertical guides supported thereon, a head movable on said guides, tubes surrounding said guides for limiting the downward movement of said head, springs on said guides located between the tops of said tubes and the bottom of said head, means for limiting the upward movement of said head, and a ram adapted to thrust against said head to depress the latter.

4. In a hydraulic press for sizing turbine blades, a frame, a cylinder therefor, a ram movable in said cylinder, a vertically movable head, a base plate, vertical guides supported on the latter, openings in said head in which said vertical guides are located, tubes surrounding said guides for limiting the downward travel of said heads, springs interposed between the tops of said tubes and the underside of said head, and a former secured to the under side of said head.

5. In a hydraulic press for sizing turbine blades, a frame, a cylinder therefor, a ram movable in said cylinder, a vertically movable head, a base plate, vertical guides supported on the latter, openings in said head in which said vertical guides are located, tubes surrounding said guides for limiting the downward travel of said heads, springs interposed between the tops of said tubes and the underside of said head, and a former secured to the underside of said head, in combination with means for limiting the upward movement of said head.

6. In a hydraulic press for sizing turbine blades, a base plate, guides supported thereon, a head movable on said guides, a former carried by said head, means for limiting the upward and downward movement of said head, means for accelerating the upward movement of said head after the completion of the turbine blade sizing operation, a hydraulic ram adapted to thrust against said head and provided with a differential piston on its upper end, and means for conducting fluid pressure to opposite sides of said piston.

7. In a hydraulic press for sizing turbine blades, a base plate, guides supported thereon, a head movable on said guides, a former carried by said head, means for limiting the upward and downward movement of said head, means for accelerating the upward movement of said head after the completion of the turbine blade sizing operation, a hydraulic ram adapted to thrust against said head and provided with a differential piston on its upper end, and means for conducting fluid pressure to opposite sides of said piston, in combination with a female die supported in a recess in said base plate and coacting with said former.

8. In a hydraulic press for sizing turbine blades, a base plate, guides supported thereon, a head movable on said guides, a former carried by said head, means for limiting the upward and downward movement of said head and former, means for accelerating the upward movement of said head after the completion of the turbine blade sizing operation, a female die supported in a recess in said base plate, and a hydraulic ram adapted to thrust against said head.

HARRY JOHN THOMAS.

Witnesses:
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A. W. STIDSTON.