STEAM HYDRAULIC INTENSIFIER.

To all whom it may concern:

Be it known that I, THOMAS EDMUND HOLMES, engineer and chief draftsman, a subject of the King of Great Britain, residing at
63 Sheldon road, Nether Edge, Sheffield, Eng-land, have invented certain new and useful Improvements in Steam Hydraulic Intensi-
fiers, of which the following is a specification.

In hydraulic presses, hammers, shears, and
the like constructed on the "steam-intensi-
fier" system the main controlling -valve (whereby steam is distributed to the main or
pressure-producing cylinder and the retract-
ing cylinders, respectively) has heretofore
usually been operated by means of a hand-
lever, which being connected directly to the
valve-stem has (more particularly in the
cases of heavy plants) of necessity been
movable through an arc of such length as to
render its manipulation laborious when work-
ing the press at maximum speed. Moreover,
the device for preventing excessive travel of
the main steam-piston has heretofore been
arranged to operate directly on the stem of
the main controlling-valve so that when, for
example, the resistance of the pressure of the
main ram has happened to be suddenly or
accidentally withdrawn the hand-lever has
received so violent a shock as to be apt to es-
cape from the control of the operator, while
the momentum maintained by the main steam-
piston up to the end of its active stroke has even been liable to cause said piston
to strike against and break the cylinder-
cover.

The present invention is designed to ob-
viate these defects without in any way inter-
ferring with the ordinary mode of working the press; and to this end the invention consists,

essentially, in providing (for the purpose of
effecting the automatic cut off of the steam-
supply) mechanism in the nature of a "hunt-
ing-gear," which, on the one hand, is connect-
ed to the main controlling-valve and its ac-
tuating-lever and, on the other hand, is adapt-
ed to be controlled automatically by the
main steam-piston, the said actuating-lever
being controlled either directly by hand or by
a steam or other power relay, which in turn
is manually controlled through the medium of
hunting-gear.

In the accompanying drawings, Figure 1 is
an elevation, partly in section, showing in an
elementary or diagrammatic manner the ap-
plication of the invention to a hydraulic press
of the type referred to; and Fig. 2 is a partial
view of the same, showing the application of
a power-relay for actuating the controlling-
lever of the main steam-valve.

The same numerals of reference denote like parts in both figures.

1 is the main ram of the press, fitted to
work in the cylinder 2, the press-head 3 being
coupled by the rods 4 to the lifting or re-
tracting pistons 5, which are fitted to work in 65
steam-cylinders 6. The main cylinder 2 of
the press is connected by the high-pressure
pipe 7 with the intensifier-cylinder 8 and also
with the air vessel 9 through the low-pres-
sure pipe 10, which communicates with the
cylinders 2 and 8 through the valves 11 and
12, respectively, the arrangement being as
usual.

The intensifier-ram 13 is integral with the
piston-rod 14 of the piston 15, which is fitted
to work in the main steam-cylinder 16.

17 is the main controlling-valve, (consist-
ing of a balanced piston-valve, as usual,) whereby motive fluid may be admitted from
the main steam-pipe 18 either to the main
steam-cylinder 16 through the pipe 19 or to
the lifting-cylinders 6 through the pipe 20
alternatively or may be discharged from
either of said cylinders to the exhaust 21, as
usual. In both figures the valve 17 is shown
closed, the press being understood to be at
rest.

Referring to Fig. 1, it will be seen that the
hand-lever 22, which works on a fixed ful-
crum 23, actuates the stem 24 of the main
valve 17 not directly, as usual, but through
the medium of a "floating" lever 25, which
is pivoted at a point 26 about midway in its
length to the valve-stem 24 and is coupled by
one of its ends 27 to the hand-lever 22 through
a link 28, the opposite end 29 of the floating
lever being likewise coupled by a link 30 to
the automatic controlling-gear. This gear
(in its preferred form, as shown on the draw-
ings) comprises a movable bar 31, extending
preferably alongside of the intensifier-ram 13
between the cylinders 8 and 16 and at a
slight angle to their common axis, so as to be
adapted to be acted upon by a cam stud and
roller 32, (or equivalent device,) carried by
the ram 13 or reciprocated thereby in any
convenient manner. The inner or lower end
of the bar 31 is supported by being pivoted to
one arm 33 of a three-armed bell-crank lever, which is fulcrumed at a fixed point 34, another arm 35 of this lever being coupled, through the link 30, to the floating lever 25. The outer or upper end of the bar 31 is pivotally attached to one arm 36 of a second three-armed bell-crank lever, which is fulcrumed at a fixed point 37, the lever-arms 33 and 36 normally extending in the same direction and approximately parallel to the bar 31. The two bell-crank levers are caused to act in union by arms 38 and 39 on the lower and upper levers, respectively, being coupled together by means of a rod 40, while the upper lever (by the pressure of a spring or of a weight 41, suspended from its third arm 42, as shown) is constantly forced in a direction to cause the bar 31 to bear against the roller 32.

The action of the automatic controlling-gear is as follows: Assuming the main ram 1 and press-head 3 to have been raised in the ordinary course of operations and that it is required to bring the press-head down upon the work, then on moving the hand-lever 22 to the dotted position 22a the floating lever 25 (owing to the resistance exerted by the weight 41 through lever-arms 42 39, rod 40, lever-arms 33 35, and link 30) will turn about the point 29 as a fulcrum, and consequently the valve-stem 24 will be depressed, so as to cause the valve 17 to admit motive fluid to the main steam-cylinder 16 and exhaust it from the lifting-cylinders 6. The piston 15 will therefore be raised and by forcing water from cylinder 8 into cylinder 2 will cause the main ram 1 to descend in the usual manner.

As the piston 15 rises the roller 32 will likewise ascend, and in so doing will force the upper end of the bar 31 toward the left in opposition to the weight 41. Consequently the gear will be caused to move so as to gradually raise the arm 35 of the lower bell-crank lever, and with it the end 29 of the floating lever 25, which will now (owing to the resistance offered by the hand of the operator on the hand-lever 22) turn about the point 27 as a fulcrum, and thus the valve-stem 24 will be raised, so as to return the valve 17 to a position wherein steam is cut off from the cylinder 16. By this means steam will be cut off from cylinder 16 gradually and automatically at a point in the stroke of piston 15 corresponding to the position to which lever 22 had been moved, the cut off in any case occurring so far before the piston 15 reaches the upper or outer end of its active stroke (the exact point of ultimate cut off being determined by the preliminary adjustment of the controlling-gear) that any possibility of excessive travel of the piston will be eliminated. At the same time the hand-lever 22 will not necessarily be moved back until after the valve 17 has been returned to the closed position and will in any case be returned to normal position without shock, and therefore without liability of escaping from the control of the operator. When the ram 1 and press-head 3 are to be raised, the hand-lever 22 is moved in the opposite direction to that mentioned before—i.e., to the position 22b—thus causing the floating lever 25 to turn about the point 29 as a fixed fulcrum, so as to raise the valve spindle 24 and bring the valve 17 to a position wherein it admits motive fluid from the main steam-pipe 18 to the lifting-cylinder 6 by way of the pipe 20. During the lifting movement of the press the automatic controlling-gear is not required to come into action, since the main steam-piston remains at the bottom of its travel, while the point 29, forming the fulcrum of lever 25, is held stationary by the weight 41.

In cases—such, for example, as those of installations of heavy plant—where the direct manual actuation of the lever 22 might be laborious this lever may be worked by a steam or other power relay under the control of an easily-moved valve actuated directly by hand under the automatic control of a second hunting-gear. Such an arrangement is illustrated in Fig. 2, wherein the lever 22 is coupled to a piston 43, fitted to reciprocate in a steam or other cylinder 44 under the control of a slide-valve 45, adapted to be initially set by a movement in either direction, as required, by means of a hand-lever 46, so as to admit motive fluid on the one and exhaust it from the other side of the piston 43. The lever 46 is connected to one end of a floating lever 47, whereof the opposite end is coupled by a link 48 to the lever 22, the slide-valve 45 being connected to an intermediate point, as at 49, in the length of the floating lever, so that the valve 45 will always be automatically returned to normal position when or before the piston 43 reaches the end of its stroke. In either case means are provided whereby, when it is required to work the press rapidly with short strokes a permanent cushion of live steam may be maintained beneath the lifting-pistons 5, said means consisting, as usual, of a cock 51, (controlled by a lever 50,) on a by-pass 52 from the main steam-pipe 18 to the pipe 20 and lifting-cylinders 6; the arrangement being such that when the lever 50 is shifted to the position 50a steam is admitted to the lifting-cylinders 6 independently of the valve 17.

In order to enable water to be withdrawn from the system, means are provided whereby on the lever 22 being moved beyond the normal distance in the direction to admit motive fluid to the lifting-cylinders 6 the valve 12 will be positively opened against the spring-pressure by which it is normally held closed, so that water may then be passed out of the high-pressure system, as usual. For this purpose the lever 22 when moved beyond the position 22c to 22d is arranged to encoun-
and raise the free end 53 of a sway-bar 54, pivoted at a fixed point 55, the other end 56 of said bar being connected to the rod 57, whose upper end is attached to a lever 58, fulcrumed at 59, so as to bear upon the stem of the valve 12 in the direction to cause said valve to open. By this means on the lever 22 being moved to the position 22° the lever 58 will be depressed and the valve 12 caused to open against its spring.

Where a power-relay is employed to operate lever 22, as in Fig. 2, the movement of the hand-lever 46 to the positions 46°, 46°, and 46° will obviously produce the same results as the movement of lever 22 to the positions 22°, 22°, and 22° directly by hand, as already explained with reference to Fig. 1.

It is to be understood that instead of steam any other suitable motive fluid—such, for example, as compressed air—may be employed in the cylinders 6 and 16.

I claim—

1. In a hydraulic press working on the steam-intensifier system, the combination with the steam-piston of the intensifier, the valve for controlling the supply of steam to said piston, and a hand-lever whereby said valve is initially set, of mechanism including a movable bar, a reciprocatory device in contact therewith, and an intermediate resistance connected to said valve and hand-lever and controlled automatically by the steam-piston in such manner that the movement of said piston in performing its working stroke will cause the supply of steam to be cut off in accordance with the position to which the hand-lever has been set.

3. In a hydraulic press, working on a steam-intensifier system, the combination with the steam-piston of the intensifier, of a valve for controlling the supply of steam to the piston, a hand-lever, a floating lever pivoted to the stem of the main valve and coupled by one end to the hand-lever, a movable bar connected to the other end of the floating lever, and means whereby the steam-piston may actuate the movable bar during its working stroke to close the steam-valve, substantially as described.

4. In a hydraulic press, the combination with the steam-piston of the intensifier of a so-called floating lever pivoted to the stem of the main steam-valve, and another lever to which one end of the floating lever is coupled, a movable bar connected to the other end of the floating lever, adapted to be acted upon by the steam-piston during its working stroke, to cause the main steam-valve to be closed in correspondence with the position to which the second-mentioned lever has been set, a double-acting piston coupled to said second-mentioned lever, a reciprocatory piston within the cylinder, a slide-valve adapted to admit fluid to the one side and exhaust it from the other side of said piston, alternately a coupling-rod attached to the said second-mentioned lever, and another so-called floating lever pivotally attached at its ends to the second-mentioned lever and said coupling-rod coupled at an intermediate point to the said slide-valve, to cause the piston to be arrested at that point in its travel, corresponding to the position to which the said hand-lever has been set.

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Witnesses:
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