W. T. SEARS.

HYDRAULIC INTENSIFIER.

APPLICATION FILED MAY 2, 1910.

966,059.

Patented Aug. 2, 1910.

2 SHEETS—SHEET 1.

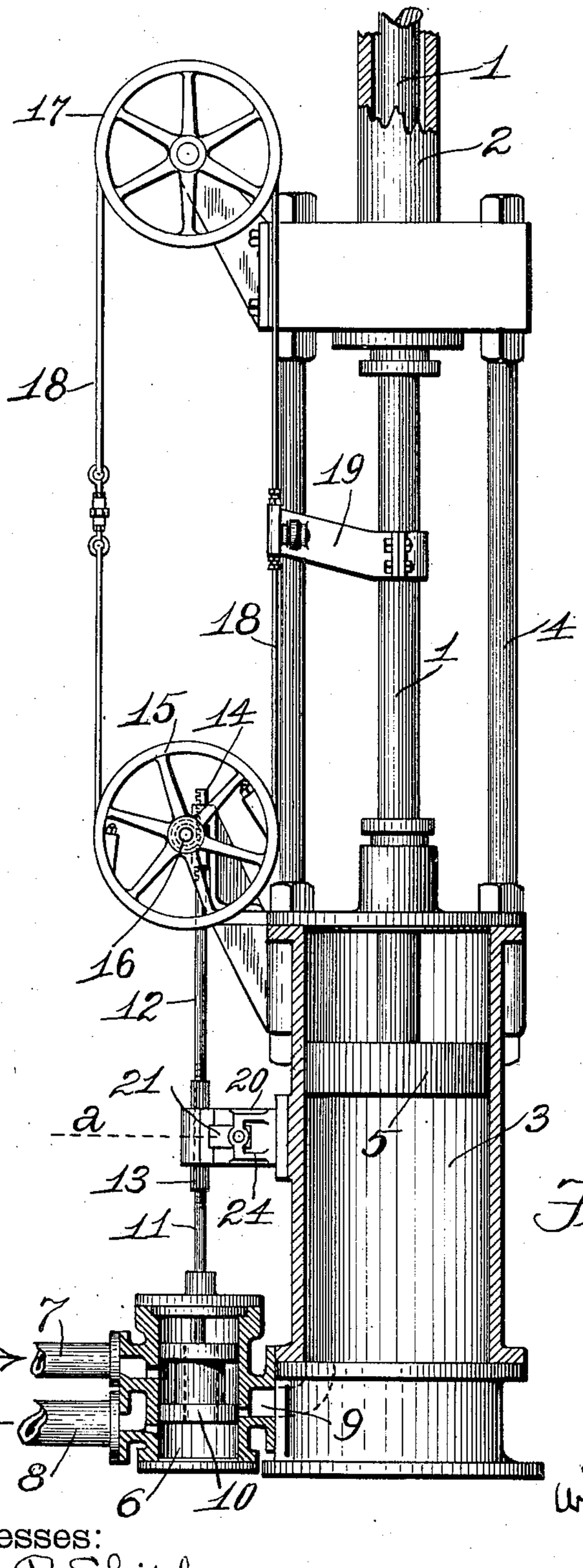

Fig 1.

Witnesses:
Elmer R. Shipley.
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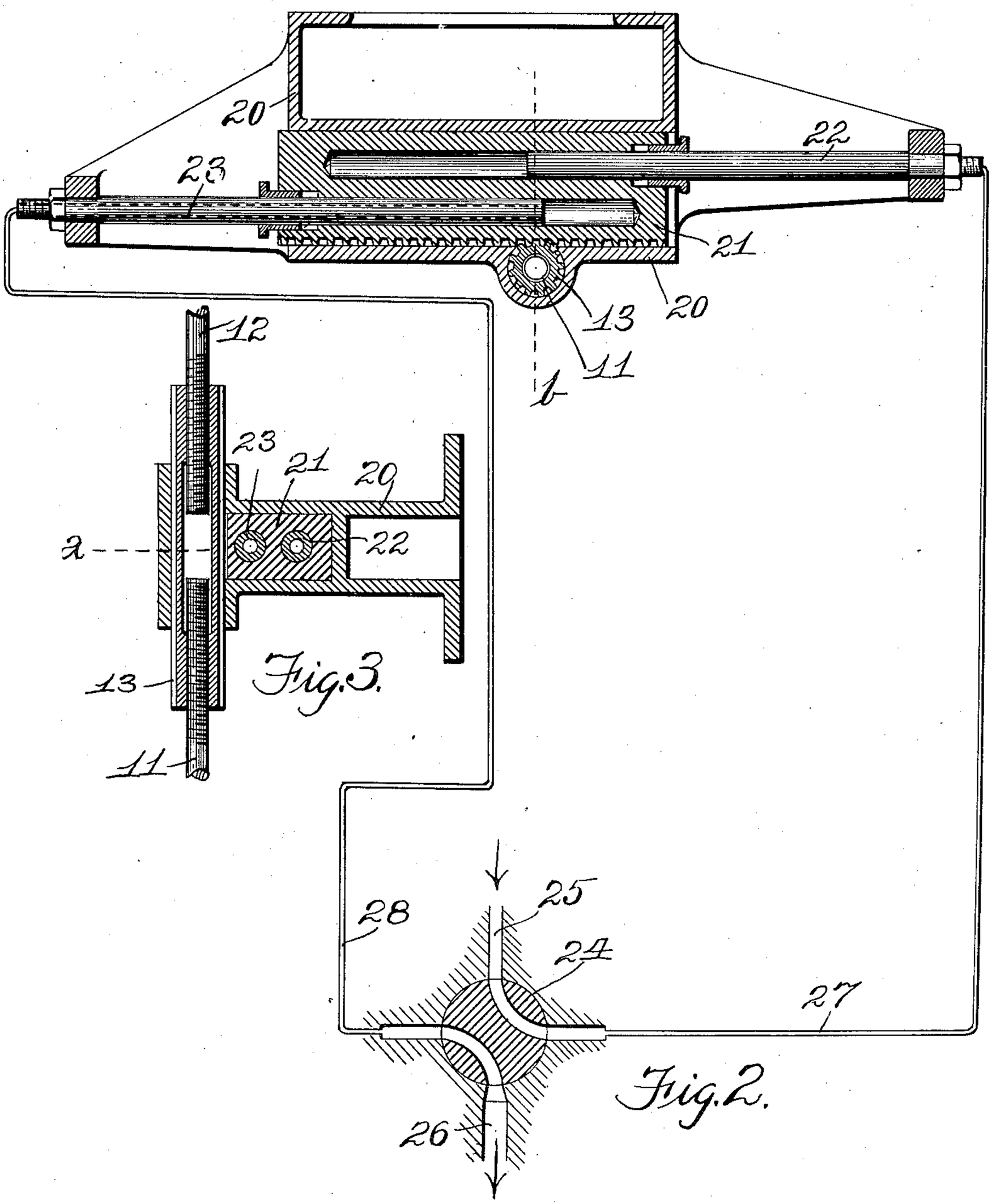

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC INTENSIFIER.

966,059. Specification of Letters Patent. Patented Aug. 2, 1910.

Application filed May 2, 1910. Serial No. 558,886.

To all whom it may concern:

Be it known that I, WILLARD T. SEARS, a citizen of the United States, residing at Philadelphia, Philadelphia county, Pennsylvania, have invented certain new and useful Improvements in Hydraulic Intensifiers, of which the following is a specification.

This invention relates to hydraulic intensifiers, or apparatus designed to cause steam or other fluid at comparatively low pressure to produce a high pressure of water or other liquid for use in hydraulic presses, forging machines etc., and the invention will be readily understood from the following description taken in connection with the accompanying drawings in which:—

Figure 1 is a side elevation, part central vertical section, of a hydraulic intensifier embodying my invention. Fig. 2 a horizontal section, partly diagrammatic, the section being taken in the plane of line *a* of Figs. 1 and 3: and Fig. 3 a vertical section of the valve-adjusting device, taken in the plane of line *b* of Fig. 2.

In the drawings, giving present attention to Fig. 1:—1, indicates the intensifier plunger which by forceful entrance into the intensifier cylinder is to produce the high pressure of liquid to be dealt with: 2, the intensifier cylinder in which the plunger works: 3, the motor cylinder, in axial alinement with the intensifier cylinder: 4, tie-rods coupling the two cylinders together: 5, piston of the motor cylinder, the same being connected with the intensifier plunger: 6, the steam-chest of the motor cylinder: 7, steam inlet to the steam chest: 8, steam exhaust from the steam chest: 9, port placing the steam-chest in communication with the lower part of the motor cylinder: 10, the steam valve working in the steam chest and adapted to place the lower part of the motor cylinder in communication, selectively, with the steam inlet or steam exhaust: 11, the lower portion of the stem of valve 10: 12, the upper portion of the valve stem, the contiguous ends of the two stem-portions being separated from each other and reversely threaded: 13, a turnbuckle connecting the contiguous ends of the two portions of the valve-stem, the exterior of this turnbuckle being cylindrical and longitudinally toothed so as to form a pinion of considerable length: 14, a rack on the upper end of the upper portion of the valve-stem: 15, a sheave having its shaft mounted in a fixed bearing contiguous to rack 14: 16, a pinion fast on the shaft of sheave 15 and engaging the rack of the valve-stem: 17, an upper sheave, the two sheaves being separated from each other a distance not less than the maximum travel of the motor piston: 18, a cable or chain having both its ends in wrapping connection with and fastened to the lower sheave, the intermediate portion of the cable passing over the upper sheave and the cable being kept taut, whereby upward or downward motion of one side of the cable will enforce rotation of the lower sheave and consequent rising or falling of the valve-stem and steam-valve: 19, an arm projecting from the combined piston-rod and intensifier plunger and having its outer portion secured to one side of the cable so that that side of the cable moves up or down with the motor piston: 20, a rigidly supported bracket provided with a bearing in which the toothed turnbuckle 13 may rotate and slide: 21, a block sliding in bracket 20 at right angles to the valve-stem, one of the longitudinal faces of this block being toothed and engaged with the teeth of the turnbuckle, the block being provided also with two cylindrical bores, one opening at one end of the block and the other at the other end: 22, a stationary tubular plunger engaging one of the bores in the block: 23, a similar plunger engaging the other bore, the outer ends of the two plungers being rigidly supported to prevent endwise motion of the plungers: 24, a typical controlling valve for controlling the motions of the rack-block: 25, inlet for controlling liquid to the casing of this controlling valve: 26, outlet for liquid from the casing of this controlling valve: 27, a conduit placing the controlling valve in communication, through plunger 22, with the block bore working in that plunger: and 28, a conduit placing the controlling valve in communication with the block-bore of the other plunger.

With the controlling valve in the position seen in Fig. 2 the controlling liquid, under pressure, may go to the block-bore for plunger 22, with the effect of forcing the rack-block to the left and turning the turnbuckle in one direction, the controlling valve at this time placing the block-bore for the other plunger in communication with the liquid exhaust through the valve. If, on the other hand, the controlling-valve be given a

quarter turn the liquid acting on the block will move the block to the right and turn the turnbuckle in the opposite direction. If, while the rack-block is moving in either direction the valve be placed on lap liquid can neither enter nor leave the rack-block and the rack-block will be locked in adjusted longitudinal position and the turnbuckle will be locked in adjusted angular position. By this means the turnbuckle may be turned in either direction and held against rotation.

Turning to Fig. 1, the steam valve is on lap. If, now, by properly shifting rack-block 21 in proper direction, the turnbuckle be turned in such direction as to lengthen the valve-stem, the steam-valve will be lowered and additional steam will enter the steam cylinder and move the steam piston and the intensifier plunger upward and increase the hydraulic pressure in the intensifier cylinder. As the motor piston rises it causes, through the cable and rack and pinion, an upward movement of the valve-stem and valve and promptly puts the steam-valve again on lap, the steam-piston and intensifier plunger then coming to rest until the rack-block is again moved to still further lengthen the valve-stem and again admit steam to the motor cylinder, and so on throughout the stroke of the intensifier plunger, the adjustment of the turnbuckle for the opening of the steam valve for admission being followed by the closure of the valve. And, similarly, when the rack-block is moved in the opposite direction so as to permit steam to exhaust from the motor cylinder, the exhaust quickly closing, and further movement of the motor piston and intensifier plunger calling for a pilot action on the part of the rack-block.

The system provides for a very facile and positive control of the intensifier plunger and, by the use of a hydraulic system for the movement of the rack-block, the motion of the intensifier plunger may be brought under the stated control from a distance, and without moving transmitting mechanism, and by simple apparatus.

A study of Fig. 1 will develop the fact that, through the medium of arm 19 and wrapping connector 18, the movement of the motor piston becomes transmitted to wheel 15 at equal rate of speed precisely as though the motion were transmitted through rack and gear, and that the pinion 16 engaging the rack of the valve-stem, serves in greatly reducing the rate of motion between the motor piston and the valve. In the drawings I have illustrated the turnbuckle as double-ended, that is to say, it is screwed at both ends, but it will be obvious that the same effect would be gotten if the turnbuckle were swiveled to one part of the valve-stem and screwed to the other. In any event the turnbuckle is to be taken as a portion of the valve-stem which, when rotated in one direction or the other, serves to alter the effective length of the valve-stem or the distance between the valve and the mechanism which operates it.

The motor has been referred to as a steam motor, and such would be the practical preference, though other motive fluid might be employed in the motor, hence in the claims steam is to be considered as merely an exemplifying motive fluid. Similarly, water has been referred to as liquid in the intensifier, and in the valve-adjusting part of the device, but water is to be considered as merely an exemplifying liquid.

I claim:—

1. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a valve stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, and means for manually adjusting the effective length of the valve-stem, combined substantially as set forth.

2. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a valve stem connected with the steam valve, a rack connected with the valve stem, a pinion engaging the rack, mechanism connecting the intensifier plunger with the pinion to cause the valve-stem to move in harmony with the plunger but at reduced rate of travel, and means for manually adjusting the effective length of the valve-stem, combined substantially as set forth.

3. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a valve stem connected with the steam valve, a rack connected with the valve stem, a pinion engaging the rack, a wheel mounted on the pinion, a second wheel, a wrapping connector engaging the two wheels and connected positively with the first-mentioned wheel, a connection between the intensifier plunger and the wrapping connector to cause the wrapping connector to move with the plunger, and means for manually adjusting the effective length of the valve-stem, combined substantially as set forth.

4. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger,

a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a turnbuckle connecting the two parts of the valve-stem, and means for manually rotating the turnbuckle for adjusting the effective length of the valve-stem, combined substantially as set forth.

5. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a turnbuckle connecting the two parts of the valve-stem, a pinion carried by the turnbuckle, a rack engaging the pinion, and means for manually adjusting the rack endwise, combined substantially as set forth.

6. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve-stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a turnbuckle connecting the two parts of the valve stem and having its periphery toothed to form a long pinion, a rack engaging the pinion, and means for manually adjusting the rack endwise, combined substantially as set forth.

7. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a turnbuckle connecting the two parts of the valve-stem, a pinion carried by the turnbuckle, a reciprocating block having a plunger-bore in each of its ends, a rack carried by the block and engaging the pinion, a fixed hollow plunger engaging each bore of the block, water connections to each of the plungers, and a valvular device for controlling the flow of water to and from the plungers, combined substantially as set forth.

8. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a turnbuckle connecting the two parts of the valve-stem, a pinion carried by the turnbuckle, a rack engaging the pinion, and manually controlled hydraulic mechanism for adjusting the rack endwise, combined substantially as set forth.

9. A hydraulic intensifier comprising, an intensifier cylinder, an intensifier plunger, a steam cylinder, a piston therein connected with the intensifier plunger, a steam valve adapted to control the flow of steam to and from below the steam piston, a two-part valve-stem connected with the steam valve, mechanism connecting the intensifier plunger and the valve-stem to cause the plunger to move the stem in harmony with it but at reduced rate of travel, a rotary member connected with the valve-stem and serving by its rotation to lessen or increase the effective length of the stem, and means for manually adjusting the angular position of said rotary member, combined substantially as set forth.

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