2 Sheets-Sheet 1.

Hansbrow & Redding,

Hydraulic Engine.

No. 46,795. Patented Mar. 14, 1865.

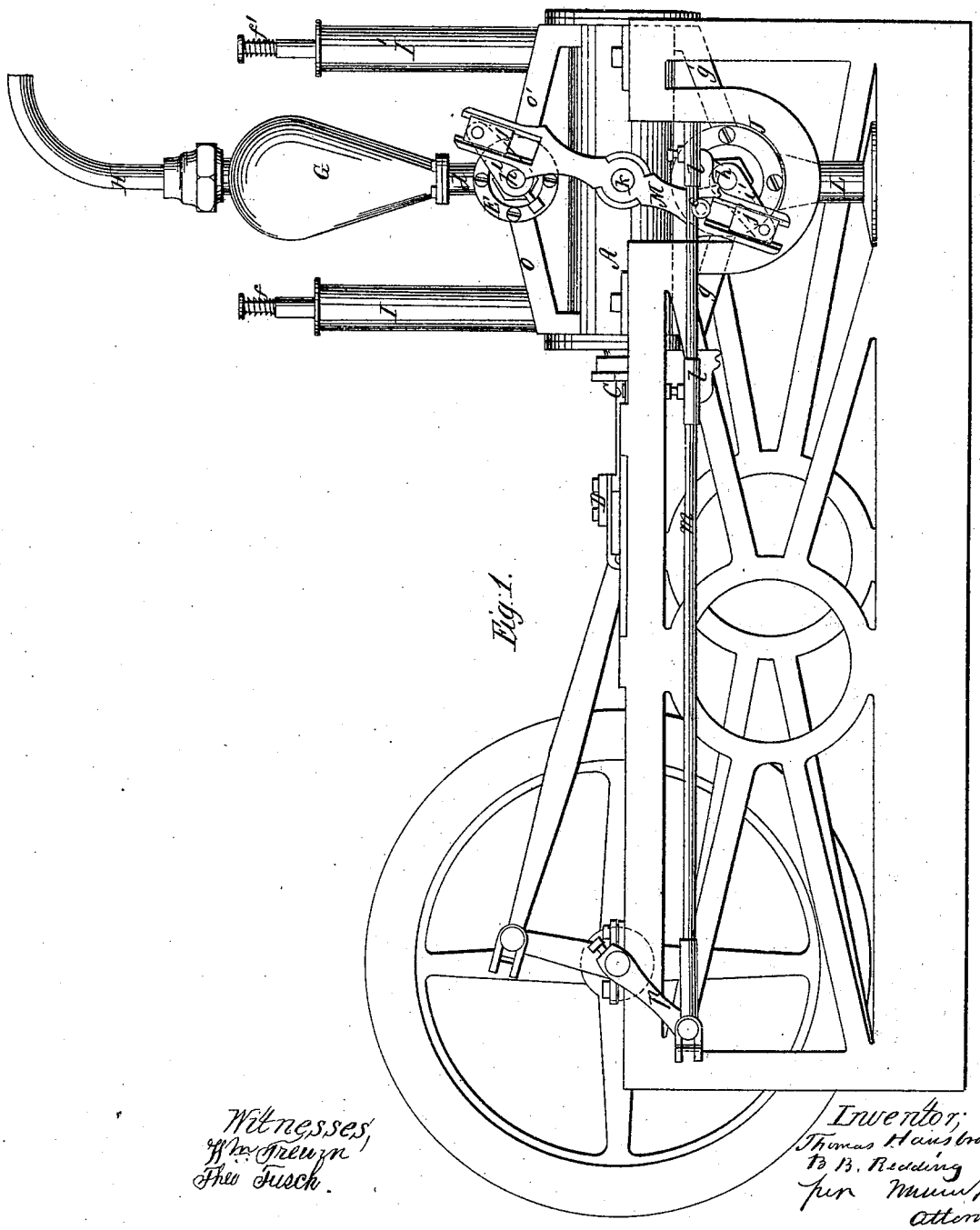

Fig. 1.

Witnesses,
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Theo Tusch.

Inventor,
Thomas Hansbrow
B. B. Redding
per Munn & Co
Attorneys

2 Sheets-Sheet 2

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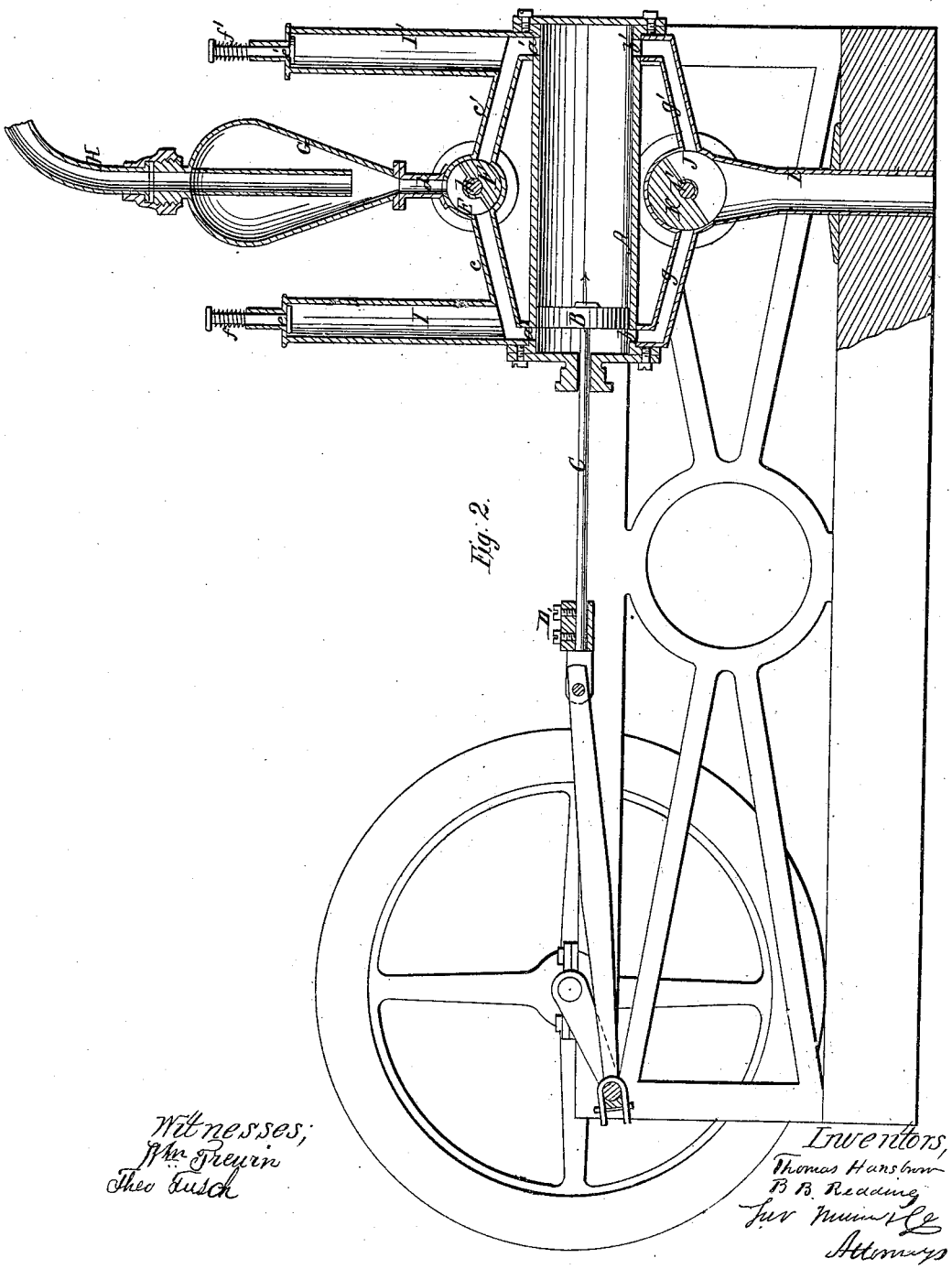

Fig. 2.

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UNITED STATES PATENT OFFICE.

THOMAS HANSBROW AND B. B. REDDING, OF SACRAMENTO, CALIFORNIA.

IMPROVEMENT IN HYDROSTATIC ENGINES.

Specification forming part of Letters Patent No. **46,795**, dated March 14, 1865.

To all whom it may concern:

Be it known that we, THOMAS HANSBROW and B. B. REDDING, of Sacramento, in the county of Sacramento and State of California, have invented a new and Improved Hydrostatic Engine; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 represents a side elevation of this invention. Fig. 2 is a longitudinal vertical section of the same.

Similar letters of reference indicate like parts.

This invention relates to an improvement in that class of engines which are operated by the pressure of a column of water.

The invention consists in the application of air-cushions to the cylinder of a water-pressure engine in such a manner that the water pressing against the piston is prevented from acting as a solid and the engine is enabled to turn the centers as rapidly and as readily as it would with steam, gas, or other elastic agent, and furthermore at the moment of the change of the position of the valves the water which has just performed its work in the cylinder is expelled by the compressed air before it can be followed by the piston on the return stroke. Suitable valves connected with the cylinder and opening inward serve to admit a fresh supply of air and to prevent the possibility of the forming of a vacuum behind the piston. An air-vessel connecting with the cylinder of this water-pressure engine prevents the shock which otherwise would be produced every time the valves are on the center.

A represents a cylinder, bored out to receive the piston B, the rod C of which connects with a cross-head, D, precisely in the same manner as the piston-rod of an ordinary reciprocating steam-engine. The cylinder A is provided with inlet-ports *a a'* and exhaust-ports *b b'*, situated at the opposite ends of the cylinder and on opposite sides of the same, as clearly shown in Fig. 2 of the drawings. The inlet-ports *a a'* connect by inclined channels *c c'* with the valve-chest E, which contains the semi-cylindrical balance-plug valve F, that is so arranged in relation to the openings leading from the valve-chest to the channels *c c'* that by turning said valve either of the openings can be opened or closed, or both openings may be closed simultaneously if desired. The valve-chest E communicates by a short pipe, *d*, with the air-vessel G, and the water-supply pipe H passes down through the top of said air-vessel to within a short distance of its bottom. From the lowest end of the channels *c c'* rise two air-cylinders, I I', which are open at the bottom and closed at the top by valves *e e'*, opening inward. Small springs *f f* keep these valves closed when the engine is not in operation.

The exhaust-ports *b b'* communicate through channels *g g'* with a valve-chest, J, which contains the semi-cylindrical plug-valve K, and which is in direct communication with the exhaust-pipe L. The valve is arranged in such relation to the channels *g g'* and to the exhaust-pipe L that either of said channels can be brought in communication with the exhaust-pipe.

The two valves F and K are secured to spindles *h h'*, that pass through suitable stuffing-boxes, and mounted on their ends are cranks *i i'*, the wrist-pins of which have their bearing in boxes *j j'*, that are fitted into the forked ends of the arm or beam M. Said boxes slide back and forth in the forked ends of the beam, so that they can accommodate themselves to the variable positions of the crank-pin, and the beam M has its fulcrum on a stud, *k*, which extends from the side of the cylinder A. (See Fig. 1.) The required oscillating motion is imparted to the beam M by the action of two tappets, *l*, which are adjustable on a rod, *m*, and which act on a pin, *o*, that is secured in the beam. The rod *m* is connected at one end to a crank or eccentric, *p*, on the fly-wheel shaft and its opposite end rests loosely on a pin, *o*, and as the fly-wheel shaft revolves the tappets *l* are alternately brought in contact with said pin, and by the motion thereby imparted to the beam M the valves F and K are changed instantaneously.

By adjusting the tappets *l* on the rod *m* the time when the change of the valves takes place can be regulated. The pin *o* is also adjustable, in order to regulate the relative times when the valve opens.

In the position shown in Fig. 2 of the drawings the inlet-port *a* and exhaust-port *b'* are open and the ports *a' b* are closed. The water

in rushing in through the channel *c* compresses the air in the air-cylinder I, and at the same time forces the piston B in the direction of the arrow marked near it in said figure. As the piston approaches the end of its stroke, the valves F K are suddenly changed, the ports *a'* and *b* are opened, and the ports *a* and *b'* are closed. The air previously compressed in the cylinder I expels the water behind the piston instantaneouly, and the water rushing through port *a'* compresses the air in the air-cylinder I' and causes the piston to complete its return-stroke. In order to prevent the forming of a vacuum when the engine works rapidly, and to keep up a constant supply of air, the valves *e e'* are applied and by the use of the air-vessel G such shocks are avoided, which would inevitably follow whenever the valve F closes both inlet-channels *c c'*, if no such air-vessel were used.

It must be remarked that the air-cushions could be replaced by pistons working within the cylinders I I' and subjected to the action of springs. This or other similar arrangement we consider mechanical equivalents of the air-cushions.

By the use of the air-cushions and air-vessel the engine can be worked at a very high speed, and the piston passes the centers with the same facility as it does when exposed to the action of steam or other elastic agent. An ordinary water-pressure engine without the air-cushion can be worked with a velocity of not more than ten strokes a minute, whereas our engine under a head of one hundred and twenty feet has made over four hundred revolutions per minute.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The application of cushions to the cylinder of a water-pressure engine, substantially as and for the purpose set forth.

2. The air-valves *e*, applied in combination with the air-cylinders I and main cylinder A, in the manner and for the purpose substantially as set forth.

3. The vibratory beam M, in combination with the rod *m*, adjustable tappets *l*, valves F K, and ports *a a' b b'* in the cylinder A, all constructed and operating in the manner and for the purpose substantially as specified.

THOMAS HANSBROW.
B. B. REDDING.

Witnesses:
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L. H. FOOTE.