(No Model.)

A. HIGGINSON.

TRANSMITTING POWER.

No. 376,383. Patented Jan. 10, 1888.

Fig. 1.

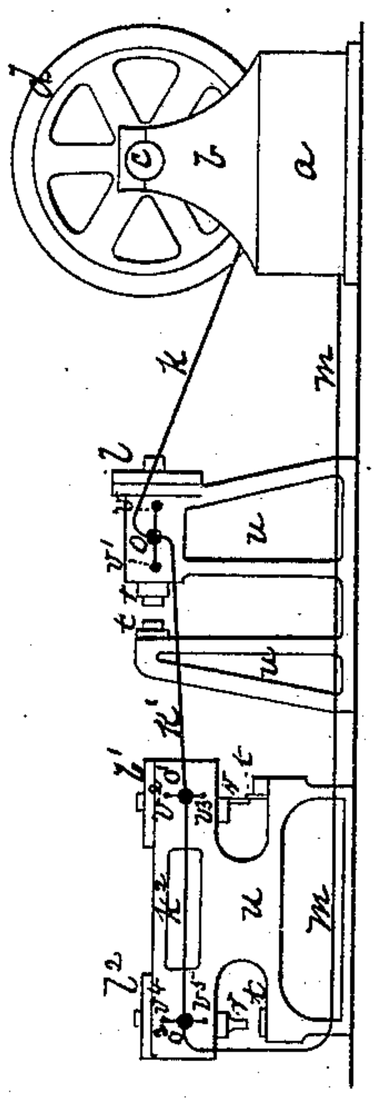


Fig. 4.

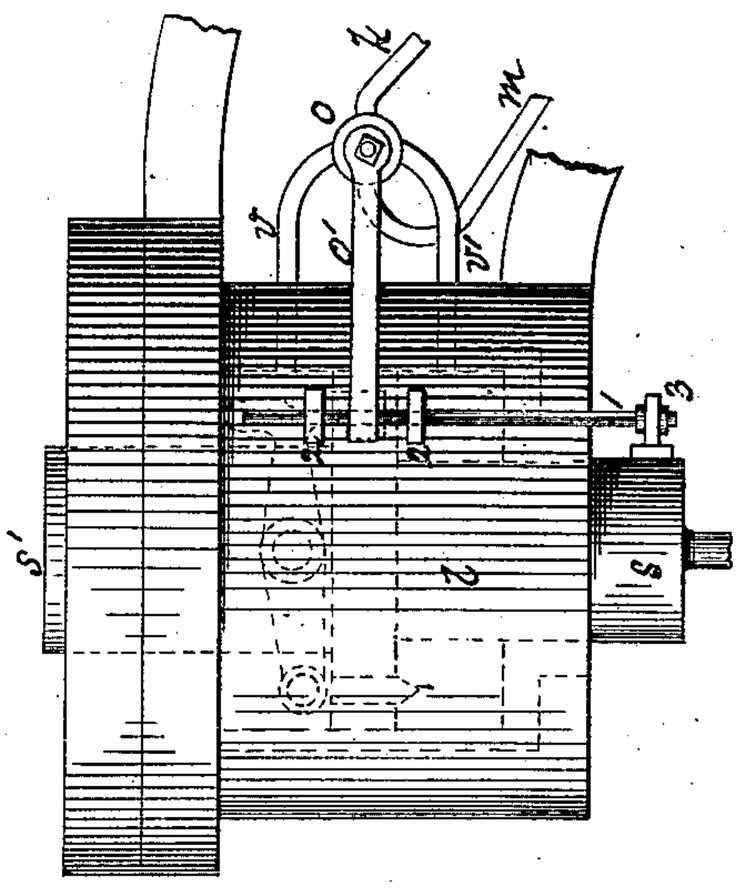


Fig. 7.

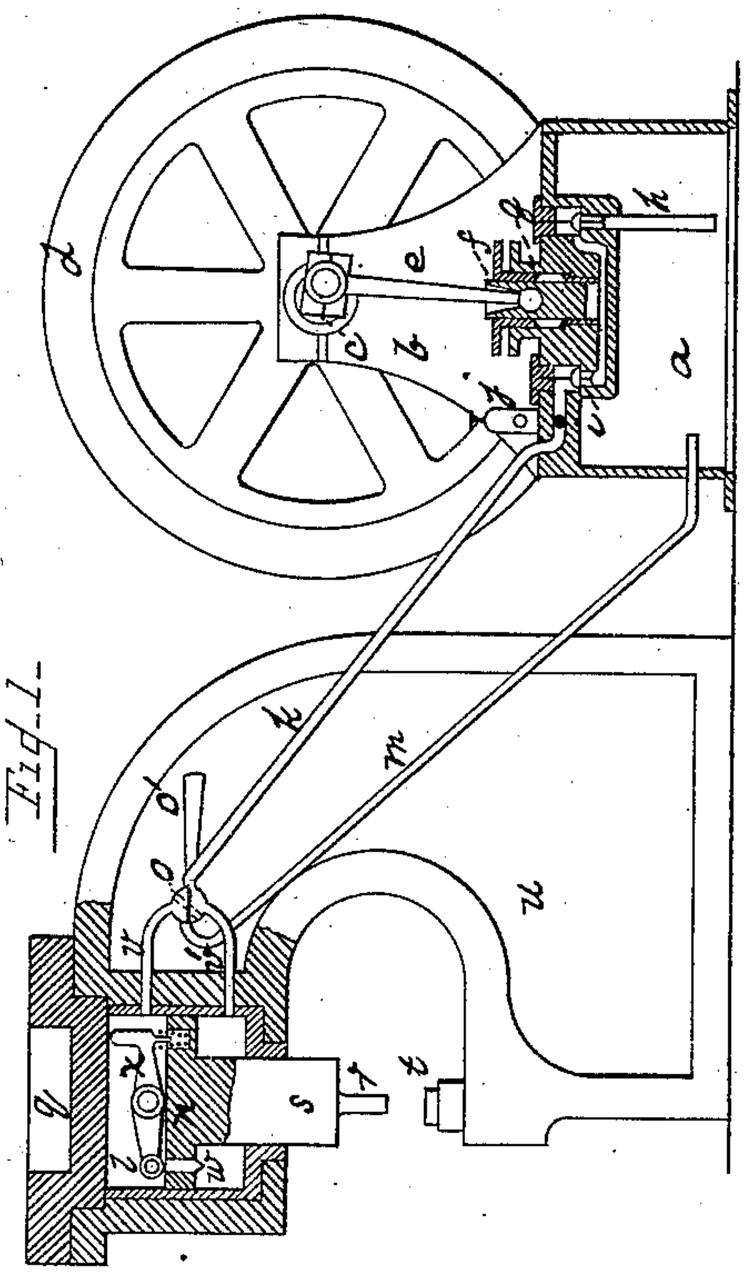
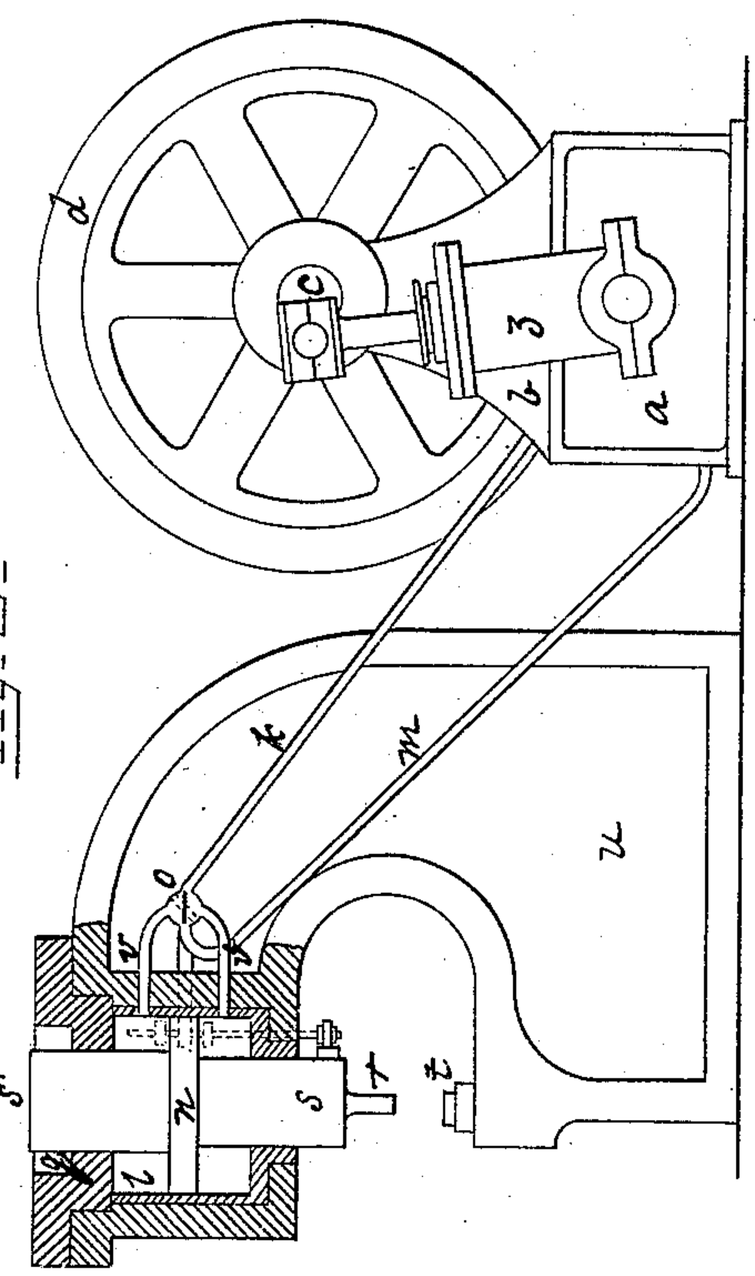


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

ANDREW HIGGINSON, OF LIVERPOOL, COUNTY OF LANCASTER, ENGLAND.

TRANSMITTING POWER.

SPECIFICATION forming part of Letters Patent No. 376,383, dated January 10, 1888.

Application filed November 8, 1883. Serial No. 111,185. (No model.) Patented in England May 31, 1883, No. 2,701; in France September 6, 1883, No. 157,409; in Germany September 6, 1883, No. 26,435, and in Belgium September 7, 1883, No. 62,580.

To all whom it may concern:

Be it known that I, ANDREW HIGGINSON, a subject of the Queen of Great Britain, residing at Liverpool, in the county of Lancaster, England, have invented a new and useful Improvement in Transmitting Power, (for which I have received the following Letters Patent: In Great Britain, No. 2,701, dated May 31, 1883; in France, No. 157,409, dated September 6, 1883; in Belgium, No. 62,580, dated September 7, 1883, and in Germany, No. 26,435, dated September 6, 1883, and nowhere else;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to transmitting power, through the agency of water or other suitable liquid, for actuating punching, riveting, shearing, and like machinery or apparatus where great power is required to act during short intervals of time. Heretofore such machinery or apparatus, whether actuated by hydraulic power or otherwise, has absorbed energy greatly in excess of the requirements of the work to be done.

Now the objects of my invention are to transmit the power or energy stored or accumulated in a rapidly-revolving fly-wheel in the proper quantity required to effect the punching, riveting, shearing, or like work without appreciable loss or waste; to allow of the use of simple, durable, and efficient machinery; to avoid the use of accumulators, and to obviate the necessity for maintaining the parts containing the water under a constant heavy pressure.

In order that my invention may be better understood, I have appended a sheet of drawings containing four views of machinery or apparatus illustrative of the manner in which the continuously-moving column of water, or hydrostatic column, is caused to transmit power in any desired quantity.

Figure 1 is a view, partly in section, of apparatus in which a valve is used to automatically avert the motion of the column of water from the piston when the work is effected. Fig. 2 is a view, partly in section, showing a modified form of the automatic valve, and an engine, Z, acting directly on the crank-shaft by which the pumps are driven. Fig. 3 shows machines for punching, shearing, and riveting metals connected to one circulating system of pipes. Fig. 4 is an enlarged detail view of the form of automatic valve and its mechanism shown in Fig. 2.

Like letters refer to like parts wherever they occur.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

a is a trough or tank bed or foundation; *b*, standards bolted or secured thereto; *c*, crank-shaft carried by bearings in the said standards; *d*, fly-wheel secured to the crank-shaft; *e*, connecting-rod; *f*, plunger; *g*, pump-barrel; (two or three pumps operated by the same shaft may be used with advantage;) *h*, suction way and valve; *i*, delivery way and valve; *j*, safety and pressure-regulating valve.

Motion is given to the crank-shaft, fly-wheel, and pumps by means of an engine coupled to the said crank-shaft, either directly or through belting or gearing.

k is the outflow-circulation pipe leading from the delivery-way to the cylinder *l* of the piston to be actuated. *m* is the inflow-circulation pipe leading from the said cylinder back to the trough *a*. *o* is a stop-valve; *q*, the cylinder-cover; *r*, rivet-die secured to the piston-rod *s*; *t*, rivet-die secured to the frame *u* carrying the cylinder *l*.

A punch and punching-die or other tools may be used in place of the rivet-dies above mentioned.

The pipes *k* and *m* both communicate directly with the valve *o*, and pipes *v v'* are led one to each end of the said cylinders. However, if preferred, the pipes *l* and *m* may lead directly to opposite ends of the cylinder *l*, and the valve *o* may be located on the pipe *m* only.

w is a valve projecting through and closing an orifice through the piston *n*, and *x* is a lever and spring for opening and closing the valve at the desired times. This valve *w*, or its equivalent, under certain conditions is automatically actuated to permit the circulation of the fluid without actuating the piston.

The action of the devices is as follows: A column of water or liquid is caused to circulate from the trough or tank *a* through the ways *h i*, pipe *k*, cylinder *l*, past the valve *o*, and through the pipe *m* back to the tank *a*. When not in use, the valve *o* is in position shown, and the column of water or fluid circulates from the pump through *k*, past valve *o*, and back through the pipe *m* to the trough or tank *a*. The pipes *v v'* and both ends of the cylinder are filled with water or fluid. The back of the piston being of larger area than the front, its natural position is at the front end of the cylinder unless held back by a spring, or in the manner hereinafter described in connection with Figs. 2 and 4.

When it is desired to punch a hole, the valve *o* is moved into the position shown by the dotted lines, and the column of water or fluid flows through the pipes *k v'* into the front of the cylinder and forces the cistern toward the back. The water or fluid at the back of the piston flows by the pipes *v m* to the tank or trough *a*. When the piston reaches the limit of its stroke, the tail of the lever *x* strikes against the cylinder-cover and opens the valve *w*, allowing the column of water to continue its motion through the orifice in the piston. When the plate to be punched has been placed in position, the valve *o* is turned at right angles to the direction shown by the dotted lines, and the water or liquid is caused to flow through the pipes *k v* at the back of the piston and force it forward until the hole is punched. The water or fluid in front of the piston flows through the pipes *v'* into the tank or trough *a*. When the hole is punched, the valve *o* is turned back to its original position, as shown in the drawings, and the water or liquid circulates through the pipes *k m* without flowing through the cylinder.

Should the attendant neglect to turn the valve *o* into the proper position after the hole has been punched, the piston travels forward until the valve *w* strikes against the front of the cylinder and is opened. The water then passes through the orifice in the piston so opened, and the circulation of the column is continued through the piston and pipes *v' m* to the tank or trough *a*. Thus any undue strain or waste of power is avoided.

Figs. 2 and 4 are views of a modification of machinery or apparatus, in which the pumps are shown driven by an engine, Z, acting directly on the crank-shaft *c*, and in which the automatic circulation of the water, column of water or liquid, at each end of the stroke is obtained in the following manner: A rod, 1, and tappets 2 are attached to the piston-rod *s* by the arm 3. The said tappets 2 are adjustable on the rod 1, and act on the lever or handle *o'*, which gives motion to the valve *o*, so as to move it into the position shown at each end of the stroke and allow the column of water to circulate directly through the pipes *k m*.

In order that the apparatus may in its normal condition be in position for punching, riveting, or doing equivalent work, the piston-rod *s* is continued through the cylinder-cover, as at *s'*, and is of slightly greater diameter at the back than in the front of the piston, so that the area of the piston acted upon by the water in the front of the cylinder is greater than at the back.

Fig. 3 shows machines for punching, shearing, and riveting metals connected to one circulating system of pipes, the column of water flowing past the several valves *o o' o²* through the pipes *k k' k²*, and back from the last valve *o²* through the pipe *m* to the tank or trough *a*. Pipes *v v' v² v³ v⁴ v⁵* lead from the valves *o o' o²*, respectively, to the cylinders *l l' l²*. The pistons are provided with automatic circulation-valve appliances operating substantially in the manner hereinbefore described, or an equivalent thereof, and the piston areas of the pistons at the back are less than in front.

With machinery or apparatus constructed and arranged as herein last set forth any one machine may be used without the circulation of the column of water being interrupted, and, provided the energy stored in the fly-wheel is sufficient, two or more machines may be in action at once.

Instead of a pipe being used to convey the column of water after it has done its work back to a tank, it may be allowed to run to waste if there is a plentiful supply, as when the suction-pipe can be led into a river or stream.

I am aware that water has been used as the agent for conveying power from place to place; but such water has been either continuously in motion, so as to impart only the initial power imparted to it, less the loss by friction, or at rest when not in use, and has been maintained under a pressure sufficient to effect the desired work at any given time. Now, under my invention the water is constantly in motion at a very low pressure—say a pressure of from two to three pounds to the square inch, quite inadequate to effect punching and like operations—and the power is acquired by retardation, the pressure rising as the speed of motion of the water is reduced by resistance applied to the column at a distance from the fly-wheel, which is done by directing the fluid in the circuit against a suitable piston. Where a single mechanism is operated by the fluid in circuit, the circulating-valve acts as a relief, while in case there are several driven mechanisms arranged in series in the circuit the circulation-valve permits the initial force to operate the first machine, then pass through said machine and operate the second and third machines in succession without material loss of power; or any one of the series may be cut out of the circuit or may remain in the circuit though not operating, according to the will of the user.

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

1. In a device for transmitting power, the combination of a hydraulic circuit, a prime motor for causing the circulation of fluid in the circuit, a fly-wheel for accumulating or storing the power or energy of the prime motor, power-receiving mechanism actuated by the fluid in the circuit, a valve for directing the flow of the fluid in the circuit to apply the accumulated power to the driven mechanism, and an automatic circulating-valve, substantially as and for the purpose specified.

2. The combination of a hydraulic circuit, a prime motor for causing the circulation of the fluid in said circuit, a fly-wheel for accumulating or storing the power or energy of the prime motor, two or more power-driven mechanisms arranged in series in said circuit, each of which is provided with an automatic circulating-valve, and a single discharge-pipe leading from the last mechanism in the series, substantially as and for the purposes specified.

ANDREW HIGGINSON.

Witnesses:
J. KING,
J. JOHNSON.