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HYDRAULIC POWER GENERATING APPARATUS.

APPLICATION FILED SEPT. 6, 1905.

Fig. 1.

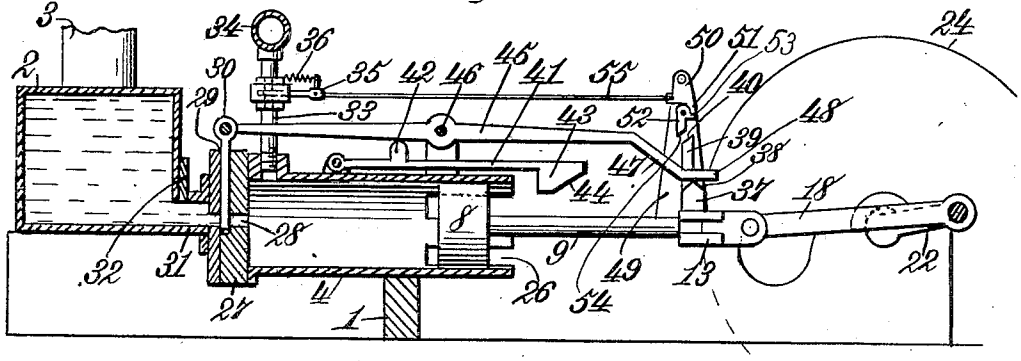
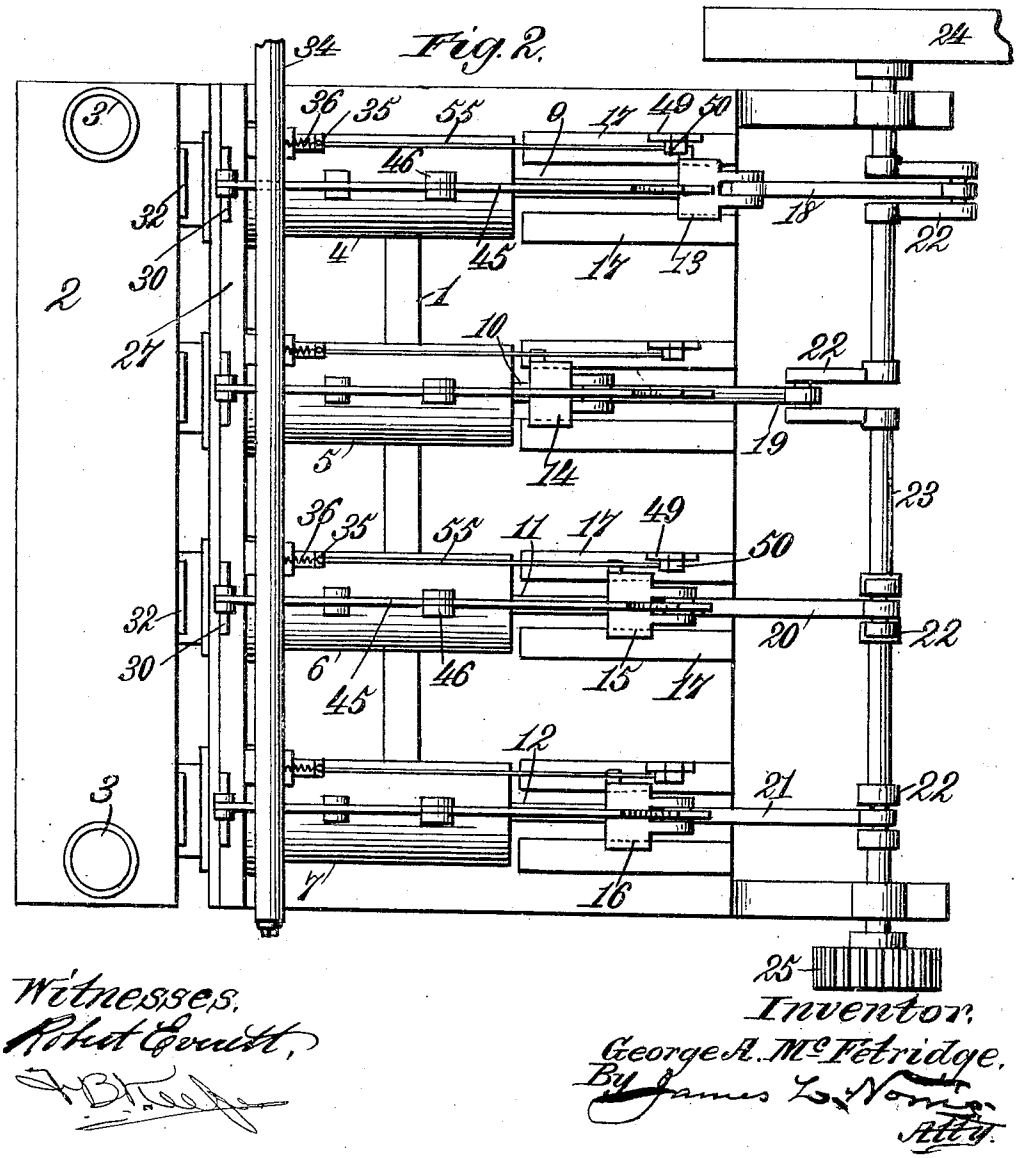


Fig. 2.



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HYDRAULIC POWER-GENERATING APPARATUS.

No. 835,310. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed September 6, 1905. Serial No. 277,206.

To all whom it may concern:

Be it known that I, GEORGE A. McFETRIDGE, a citizen of the United States, residing at Norwalk, in the county of Fairfield and State of Connecticut, have invented new and useful Improvements in Hydraulic Power-Generating Apparatus, of which the following is a specification.

This invention relates to a hydraulic power-generating apparatus embodying a plurality of cylinders and pistons, the latter being connected at regular intervals to a power-shaft and automatically actuating by their movement a simple organization of elements controlling the admission of water into the cylinders to operate the pistons and to relieve the said cylinders by additional pressure means of the successive charges of water. The pistons are so connected to the power-shaft as to overcome any tendency to dead-center and by their interval connection with said shaft will impart an unceasing rotation to the latter so long as the charges of water are admitted to the cylinders. Through the medium of the improved mechanism the natural pressure of waterfalls or sources of water-supply at an elevation with respect to the mechanism may be utilized with advantage, or in certain applications of the machine the water-pressure established with respect to a municipal water system may be employed. The simple parts of the improved apparatus have such positive operation that close attention thereto by operatives is unnecessary, and thus the expense of running the apparatus is materially reduced. In fact, driving power may be produced by the improved apparatus at a minimum expense, particularly when the water under pressure for actuating the pistons is obtained from a natural source.

The accompanying drawings illustrate a preferred embodiment of the apparatus, but are subject to modifications in the proportions, dimensions, and minor details within the scope of the invention, and in the drawings—

Figure 1 is a longitudinal vertical section through the apparatus and illustrating one of the cylinders and pistons and the automatic operating means for controlling the inlet and discharge of the charges of water with respect to the cylinder. Fig. 2 is a top plan view of the apparatus, showing the use of four cylinders and a corresponding number of pistons which are connected at regular intervals to a power-shaft.

Similar numerals of reference are employed to indicate corresponding parts in the views.

The numeral 1 designates a suitable bed having at one end an elongated tank or reservoir 2, with pipe connections 3 communicating with the top thereof and extending away to any suitable source of supply. On the bed 1 at suitable spaced intervals are a plurality of cylinders 4, 5, 6, and 7, having therein similarly-arranged pistons 8, the pistons of the respective cylinders being provided with piston-rods 9, 10, 11, and 12, connected to cross-heads 13, 14, 15, and 16, slidable on suitable guides 17. The cross-heads 13, 14, 15, and 16 are attached by connecting-rods 18, 19, 20, and 21 to cranks 22 of a power-shaft 23, having a fly or balance wheel 24 on one end and a power-transmitting wheel or gear 25 on the opposite end. The cranks 22 of the shaft 23 are arranged to project in four directions from the latter, or have a quadrant relation to the said shaft, so that driving power is continuously imparted to the shaft at some point by one of the connecting-rods between the cross-heads and the cranks. This disposition of the cranks will be carried out irrespective of the number thereof and to overcome dead-center, and the number of cranks, connecting-rods, pistons, and cylinders may be increased in the same multiple, and the mimimum number which may be used is three with practical effect.

The rear end of each cylinder 4, 5, 6, and 7 is formed with longitudinally-extending exhaust slots or passages 26, and the opposite end of each cylinder has a head 27, provided with a central contracted inlet port or opening 28, intersected by a vertical slot 29 for a gate-valve 30.

A feed-coupling or tubular member 31 is interposed between each head 27 and the tank or reservoir 2, and coöperating with the feed-couplings or tubular members are shut-off valves 32, by means of which any one of the cylinders may be cut out or the entire number of said devices relieved of the operating pressure of the water in the tank or reservoir 2 when it is desired to have the apparatus cease operation. Each cylinder adjacent to its head 27 has a compressed-air-feeding pipe 33 communicating with the upper portion thereof and connected to a compressed-air conduit 34, which may be in communication with any suitable air-compressing mechanism. The flow of air through the

pipe 33 is controlled by a valve 35, which is normally held closed by a spring 36, connected to the outer extremity thereof and to a portion of the seat for said valve. The water and compressed air are admitted to the several cylinders in alternation by automatically - operating means having properly-timed actuation, and so that one cylinder and piston at least will always be applying driving power to the shaft 23.

Rising from the center of each cross-head is a striker 37, having an upper reversely-beveled end 38, and at one side of the cross-head is a vertical tappet-arm 39, rising above the said striker and formed with an upper inclined end 40. On the center of the upper portion of each cylinder a controlling-lever 41 is pivotally mounted at its forward end and has an upwardly-projecting lug 42. The lever 41 has its rear end free to move and projected rearwardly beyond the end of the cylinder and formed or provided with a cam-head 43, having a lower inclined face 44 for engagement by the striker 37. A rock-lever 45 is also pivotally held on the center of the cylinder above the lever 41 and fulcrumed at an intermediate point, as at 46, the lug 42 engaging said rock-lever in advance of its fulcrum-point. The front end of the rock-lever is movably attached to the center of the upper edge of the gate-valve 30, and its rear extremity is formed with a downwardly-inclined trip member 47, continuing into a horizontal foot 48, which normally bears on the pointed end of the striker 37.

A fixed upright 49 rises from one side of the guide 17, and on the inner side of the upper extremity thereof an oscillating element 50 is pivotally attached and formed with a rear depending projection 51, which is normally engaged by the upper extremity of a tappet 52, the latter having a rearwardly-projecting arm 53, which contacts with the projection 51. The lower free end of the tappet 52, as at 54, is inclined reversely to the upper inclined end of the tappet-arm 39, so that the latter arm may pass the lower end of the tappet in the forward movement of the cross-head, but will strike against the front edge of the tappet in the reverse movement of the cross-head and throw the member 50 rearwardly. The member 50 is attached to the valve 35, controlling the admission of compressed air to the cylinder by a rod or analogous device 55, and when the said member is thrown rearwardly by the tappet 52 the valve 35 is opened and compressed air admitted to the forward extremity of the cylinder. All of the cylinders will be equipped with mechanism similar to that just described, and the explanation of the operation of one cylinder and its automatic controlling mechanism will suffice for all.

Presuming that a charge of water has been admitted to the cylinder 4 and the piston 8 forced backward and the cylinder cleared to allow the piston to have unobstructed forward movement through the medium of the operation of the remaining cylinders, the piston 8 of the cylinder 4 will continue to advance toward the tank or reservoir 2 to a point slightly in rear of the connection of the compressed-air pipe 33 with the said cylinder, and at such time the striker 37 will have engaged the inclined cam face or edge 44 of the head 43 and elevate the controlling-lever 41, the latter, through the lug 42, forcing the forward portion of the rock-lever upwardly and opening the gate-valve 30, thereby clearing the port or inlet opening 28 and permitting the water under pressure to enter the cylinder 4 from the tank or reservoir 2. When the cross-head 13 has moved forwardly in the operation just explained and as hereinbefore noted, the tappet-arm 39 passes the tappet 52, and when the valve 30 has been opened the rock-lever 45 remains with its forward member elevated and the rear member depressed. The entrance of the charge of water to the cylinder forces the piston-rod 9 and cross-head 13 rearwardly and disengages the striker 37 from the head 43. In its rearward movement the striker 37 contacts with the inclined edge of the cam extension 47, raises the rearward extremity of the rock-lever 45, and forces the forward extremity thereof downwardly, and at the same time closes the gate-valve 30. Immediately subsequent to the closing of the gate-valve 30 the tappet-arm 39 will engage the forward edge of the tappet 52 and force the latter rearwardly and likewise impart a similar movement to the member 50, thus drawing rearwardly on the rod 55 and opening the valve 35 against the resistance of the spring 36 to admit air under pressure into the cylinder and force out the charge of water from the latter, the air being admitted to the cylinder just about the time that the piston 8 clears the exhaust slots or passages 26. After the tappet-arm 39 passes the lower extremity of the tappet 52 the valve 35 is closed by the spring 36 and the striker 37 passes under the foot 48, thus fully closing the gate-valve and preventing any liability of leakage into the cylinder of the water from the tank or reservoir 2. The gate-valve 30 remains closed until the successive forward stroke of the piston 8 and striker 37, as heretofore explained. This operation becomes regularly successive in all of the cylinders at timed intervals, and the shaft 23 is continuously rotated so long as the water from the tank or reservoir is admitted to the several cylinders.

The construction of the cross-head, connecting-rod, and crank of each cylinder may be of any approved form and which may be found best adapted for the purpose. The water liberated from the rear ends of the cylinders may pass off through any suitable

duct means. (Not shown.) In other applications the water may be conveyed away from the cylinders and used for other purposes.

Having thus described the invention, what is claimed as new is—

1. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons with rods, a reservoir having liquid therein under pressure and communicating with said cylinders, a power-shaft to which the pistons of the cylinders are connected, operating means for shutting off communication between the cylinders and reservoir at intervals, projections coöperating with the rods of the pistons to engage a part of the said operating means to control communication with the cylinders and reservoir, and means for admitting compressed air to the cylinders at intervals and provided with devices for automatically controlling the flow thereof into the cylinders.

2. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods, a power-shaft to which the said piston-rods are connected, a reservoir containing liquid under pressure and having communication with the cylinders, means for controlling communication between the cylinders and reservoir, means coöperating with the piston-rods for closing the said controlling means, and means for admitting compressed air to the cylinders at intervals.

3. In an apparatus of the class set forth, the combination of a plurality of cylinders, a power-shaft, pistons in the cylinders having piston-rods connected to the said shaft, a reservoir containing liquid under pressure and having communication with the cylinders, means for shutting off communication of the cylinders from the reservoir, and means for admitting compressed air to the cylinders and provided with devices for automatically controlling the flow thereof into the said cylinders.

4. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods, a power-shaft to which the piston-rods are connected, a reservoir having communication with the several cylinders, vertically-movable valves between the reservoir and cylinders, means operated by the movement of the pistons and piston-rods for automatically controlling the valves and the supply of liquid to the cylinders, and means for admitting compressed air to the cylinders at regular intervals and provided with devices for automatically controlling the flow thereof into the cylinders.

5. In an apparatus of the class set forth, the combination of a plurality of cylinders, means for supplying liquid under pressure to the cylinders, pistons in the cylinders having piston-rods, a power-shaft to which the piston-rods are connected, and means for admitting compressed air to the cylinders at intervals and provided with devices for automatically controlling the flow thereof into the cylinders.

6. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods, a power-shaft to which the piston-rods are connected at intervals, a reservoir containing liquid under pressure having communication with the cylinders, means for admitting compressed air to the cylinders at intervals, and slide means automatically operated by the movement of the pistons and piston-rods for automatically controlling the supply of liquid and air to the cylinders.

7. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods, a power-shaft to which the piston-rods are connected, a reservoir containing liquid under pressure having communication with the cylinders, compressed-air connections for the cylinders, and means operative by the pistons and piston-rods to automatically control the supply of compressed air to the cylinders.

8. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods, a power-shaft to which the piston-rods are connected, a reservoir having liquid therein under pressure in communication with the several cylinders, valves in the cylinders controlling the entrance of the liquid thereto, compressed-air conduits connected with the cylinders, and means operative by the movement of the pistons and piston-rods for automatically controlling the admission and cut-off of the liquid and compressed air with respect to the cylinders.

9. In an apparatus of the class set forth, the combination of a plurality of cylinders having pistons and piston-rods coöperating therewith, a power-shaft to which the piston-rods are connected, means for supplying the several cylinders with liquid under pressure, valves controlling the admission of the liquid to the cylinders, compressed-air conduits connected to the several cylinders and provided with valves, and means carried by portions of the piston-rods and the cylinders for operating the said valves to control the open and closed condition of the latter and the admission and cut-off of the liquid and air to the cylinders.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORGE A. McFETRIDGE.

Witnesses:
LODEMA ADAMS,
JOHN KEOGH.