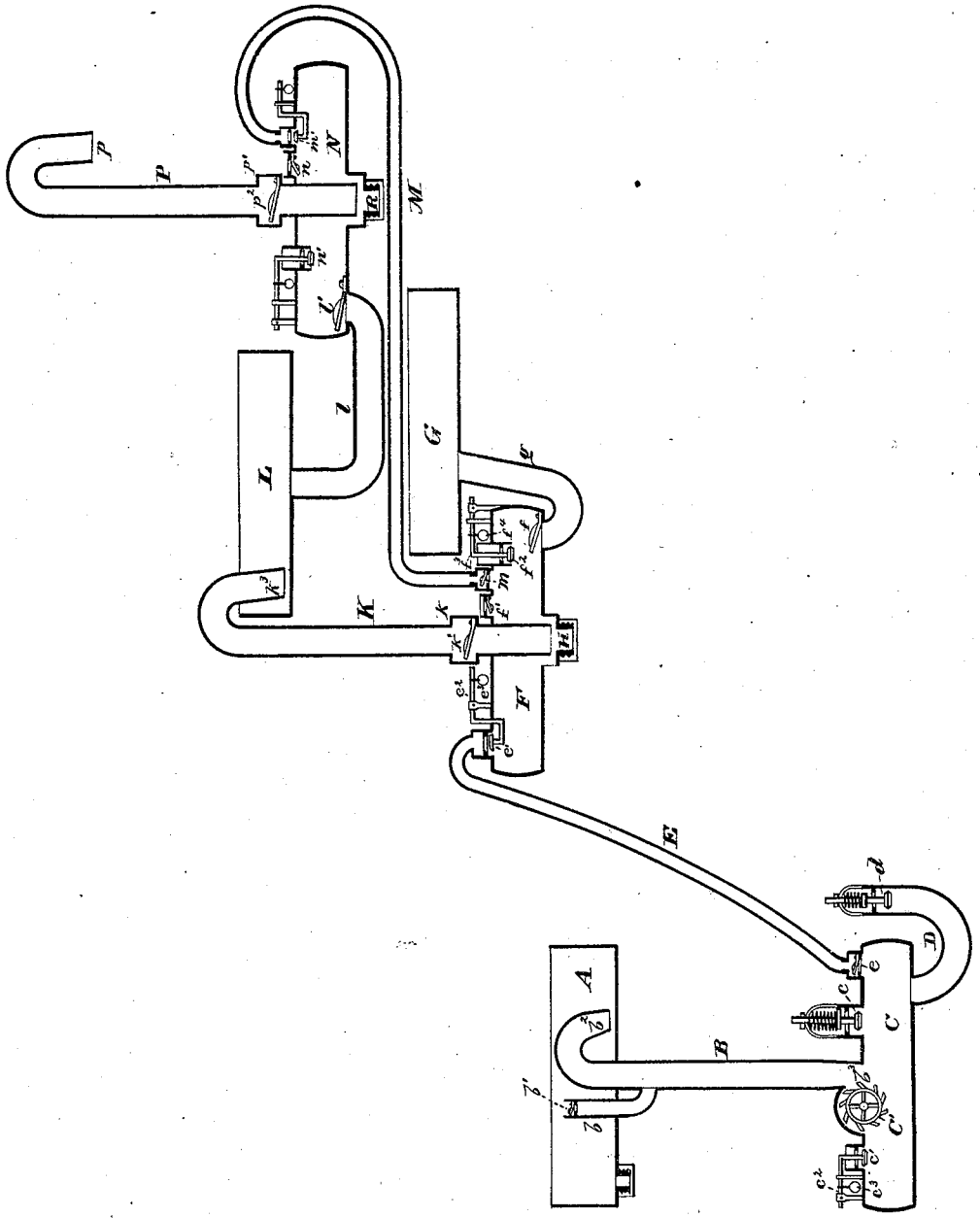
J. M. BOIS.

Hydraulic Motor.

No. 200,245. Patented Feb. 12, 1878.



WITNESSES

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JAMES M. BOIS, OF SALAMANCA, NEW YORK.

IMPROVEMENT IN HYDRAULIC MOTORS.

Specification forming part of Letters Patent No. **200,245**, dated February 12, 1878; application filed December 17, 1877.

To all whom it may concern:

Be it known that I, JAMES M. BOIS, of Salamanca, in the county of Cattaraugus and State of New York, have invented certain new and useful Improvements in Hydraulic Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawing, which forms part of this specification.

My invention relates to hydraulic motors, and is designed to provide an improved mechanical system for actuating any desired connecting machinery by the fall of water, which latter is raised to a suitable height preparatory to such fall.

The invention is an improvement upon that set forth in Letters Patent of the United States numbered 190,700, and granted me on the 15th day of May, 1877, by reference to which patent the invention here presented will the better be understood.

Referring to the drawing, the view shows a central vertical section of an apparatus embodying my invention.

The reservoir A is supplied with water from any suitable source, which is, however, of such relative feed, as compared with the discharge through siphon B, that the said siphon shall intermittingly empty the reservoir-contents into the air-pressure chamber C. The latter chamber has its curved waste-pipe D provided with a spring-valve, *d*, opening inwardly, while the top of the chamber has the spring-valve *c*, also opening inwardly. The object of valve *c* is to allow air to enter chamber C as the pressure is removed therefrom by the cessation of flow through the siphon; and to further aid in thus releasing both the chamber and the siphon from the pressure of air at such time, the pipe *b* is made to connect the longer leg of the siphon with the atmosphere above the reservoir A. This pipe *b* reaches nearly to the top of the siphon, and is provided with the downwardly-closing valve b^1. The compressed air is thus allowed to escape from the air-chamber C at the time when the siphon has emptied the reservoir A of water, and by cause of the lowering of water in the long leg of the siphon the pressure of water upon the compressed air in said chamber is diminished. The compressed air, passing from the chamber C up through the long leg of the siphon, finds ready exit out through the pipe *b* by raising the valve b^1.

The capacity of the chamber C is equal to the volume of water discharged through the siphon at one operation of its intermittent emptyings of reservoir A, so that at the time the reservoir commences to refill the air previously contained in chamber C is entirely displaced and driven out of it, so that the only pressure upon the valve *d* is that of the natural weight of the water. This allows the said valve *d* to open and discharge all the water from out chamber C during the time that reservoir A is refilling.

The object of spring-valve *d* is to cause the opening governed thereby to be held constantly open, whether the chamber C is filled with water or not, the only provision for closing the opening of the waste-pipe D consisting in the pressure induced in chamber C by the inflow of water from the siphon; and for this purpose I may provide the said opening with two or more valves, if desired, instead of one only, as shown at *d*. The construction of this valve is such as to tend to remove it from its valve-seat, and allow the opening governed thereby to be continually open, and hence its controlling-spring is made of such strength or tension relative to the simple pressure of water contained in chamber C that the valve-port will still be unclosed until the pressure of the discharge from the siphon is induced in said chamber—that is, that while the said spring-valve will be held upon its seat, so as to prevent the escape of water from chamber C during the time that the siphon is in operation, yet, upon the stoppage of such discharge from the siphon and the opening of the valves b^1 and *c*, as described, the spring-valve *d* will automatically open and allow the waste of water through pipe D.

The discharging end of the long leg of the siphon should be reduced in size according to the length of the siphon, as the longer the siphon is the greater will be the velocity of the discharge, and the receiving-mouth b^2 of the short arm of the siphon should be equal in capacity to the said discharging-mouth b^3

of the long arm. Suitably connected with chamber C is the water-wheel C′, which is arranged, as shown, so as to receive the fall of the water from the siphon, and which is turned with a velocity and power equal to the discharge of water from the long leg of the siphon. The chamber C is further provided with the upwardly-closing valve c^1, which has a spring-lever stem, c^2, provided with a weight, c^3, which latter may be moved to any point upon the said lever-stem, and be there secured by a set-screw or similar fastening. This valve c^1 can thus be adjustably weighted, so as to require any predetermined pressure upon it before it will close, and upon the withdrawal of such pressure the valve will open.

The air-pipe E leads from the upper body portion of chamber C to the upper portion of the water-pressure chamber F, so that the discharge of water through the siphon will force air up into the said water-chamber F, and cause it to bear downward upon the volume of water therein contained. This chamber obtains its supply of water from the second reservoir G, which latter is placed in a horizontal plane above the chamber, and connects therewith by the pipe *g*. The valve *f*, which seats over this connection, and is within the chamber F, opens inwardly into the said chamber, and thus makes and closes communication between the latter and reservoir G, according as the air-pressure of said chamber controls it.

The air-pipe E is provided at its lower extremity with the upwardly-opening valve *e*, and at its opposite extremity with the upwardly-closing valve e^1. The latter has an angular lever-stem, e^2, provided with a weight, e^3, which latter is adjustable upon the said lever-stem, and determines the amount of air-pressure within the pipe E which shall be necessary to unseat the valve and allow of the discharge of air from said pipe.

The object and utility of these two valves, which govern communication of the air-pipe E respectively with chambers C and F, consist in holding the compressed air within the said pipe when the latter extends a long distance—for instance, presuming the discharge of water from the siphon creates a pressure of fifty pounds to the square inch within the air-chamber, the same being sufficient to raise valve *e*, and, passing up through the air-pipe, opens valve e^1. The compressed air thus introduced within the chamber F forces the water therein contained up and out through pipe K until, the siphon-discharge becoming less, the air-pressure within chamber C is not equal to said fifty pounds to the square inch, or is not sufficient to press the valve *e* open. This valve then closes, and the compressed air within the pipe E is not strong enough in force to keep the discharge-valve e^1 open, so that as both these valves are closed the compressed air is retained in pipe E until the next intermittent operation of the siphon. Chamber F is provided with the inwardly-opening valve f^1, which connects it directly with the open air, and is further provided with the upwardly-closing valve f^2, made similar to the valve c^1 of the chamber C. This valve f^2, having the spring-lever stem f^3 and weight f^4 thereon, is adapted, by adjusting said weight, to require more pressure to keep it closed than is necessary to keep valve e^1 closed, so that the valve f^2 must open first, which allows the compressed air to escape from chamber F, and thus release the combined pressure of water and air upon the valve *f*. As the heavy pressure of air upon the water within this chamber F is thus released by the opening of valve f^1, the gravity of the water from the second reservoir G serves to open valve *f*, and water from this reservoir is allowed to pass into and refill chamber F.

The connections of pipes and valves are such as to permit them to be readily disconnected, if desired.

An opening, H, is provided in the bottom of chamber F for the discharge of its contents when desired. A screw-plug, cock, or other suitable cap may be used to close this opening. From the chamber leads the water-discharge pipe K, which may be extended up any desired distance, and empties into the third reservoir L. An enlargement of the cross dimensions of the pipe is formed just above its connection with the chamber, as shown at *k*, and a downwardly-closing valve, k^1, is therein seated. The object of this latter valve is to maintain a column of water in the pipe K when the discharge has ceased from its exit-opening k^3 by reason of the air-pressure having ceased within chamber F. An air-pipe, M, leads from the top of this chamber F to the top of the second water-chamber N, and through this pipe atmospheric pressure is conducted in continuation from chamber F. This water-chamber N is built the same as chamber F, and all its connecting apparatus is the duplicate of the respectively corresponding parts operating with said chamber F. Thus it is in a horizontal plane below its feed-reservoir L, and connects therewith by pipe *l*, having valve *l′*. It has also the upwardly-closing valve *n*, operating the same in reference to this chamber as does valve f^1 operate in relation to chamber F.

The air-pipe M is provided with valves *m* and *m′*, the same in construction and operation as pipe E, provided with valves *e* and e^1. The weighted valve *n′* also bears the same relation to chamber N as does the valve f^2 to chamber F.

The discharge-pipe P leads up from this chamber N for any suitable distance, and is provided with the curved exit *p*. An enlargement, p^1, is formed in the lower portion of this pipe, and a valve, p^2, is seated therein, all the same as is the case in the first discharge-pipe K. So, also, an opening, R, is provided in the bottom of chamber N, the same as shown at H in instance of chamber F.

This construction provides a mechanical sys-

tem which is suitable to conduct water to such an altitude in elevation above the device to be operated that a very heavy fall can be obtained, and the water-wheel which is to be actuated thereby will be turned with a degree of speed and force equivalent to the volume of water thus discharged, the same being correspondingly affected by the distance of such fall. I do not show or describe any particular mechanical device to be operated by this fall of water, as the same may be of any desired character, and I do not limit my invention thereby.

In putting my apparatus in use, the three reservoirs A, G, and L are first filled with water, and the two, A and G, should be so provided with water-connections that they may constantly be provided with sufficient feed to keep the apparatus in operation. As water fills the reservoir A to a depth such as to carry the water over the joint connecting the two legs of the siphon, it is evident that a continuous flow will be thereby obtained from out of the reservoir, through the siphon, and into the air-chamber C. The latter, being provided with the valve mechanism described, is, of course, full of atmospheric air, which latter is forced against the valves by the incoming volume of water, and the chamber readily and automatically closes its outer air-ports, and makes itself air-tight. The body of air thus held confined within this chamber is caused to be packed or crowded out therefrom into the air-connecting pipe E, accordingly as it is displaced by a corresponding volume of water emptied into the chamber from the siphon. The air thus displaced passes into the water-chamber F, and is there forced down upon the surface of the body of water therein. This pressure serves to close the outer air-valves, and to force the water up through discharge-pipe K and out therefrom into reservoir L; but by means of the air-pipe M the atmospheric pressure thus conducted into chamber F is also passed into the second water-chamber N, and it there exerts an effect similar to that produced in chamber F—that is, the outer air-valves are closed and the body of water, previously emptied into the chamber from reservoir L is forced up through discharge-pipe P and out therefrom in its fall upon the power-actuating device suitably placed below.

Since the flow of water through siphon B is, as conditioned, greater than the continuous flow into reservoir A, it is apparent that the reservoir will, at a certain time, have a less depth of water therein than is sufficient to make connection with the shorter leg of the siphon. In such case the discharge of the siphon must await the refilling of the reservoir to the horizontal line of the joint-connection of the two legs of the siphon, and during this interval the spring-valve *d* opens, since its tension against its seat was only maintained by the pressure of the siphonic inflow of water, and the water is emptied out through waste-pipe D. At the same time the outer air-valves automatically open upon such release of pressure, and simultaneously therewith air passes through the longer leg of the siphon, out through pipe *b*. This release of pressure also affects both the water-chambers F and N. Air passes into them, respectively, through the ports governed by the outer air-valves, and connection with their respective reservoirs G and L is opened by the rising of the valves *f* and *l'*. At the same time, since there is no pressure exerted from below to maintain the columns of water in the respective discharge-pipes K and P, their tendency is to fall back into their connecting-chambers F and N. But this result is provided against by the valves k^1 and p^2, which close downward upon their seats and hold the water in the said pipes.

Upon the refilling of reservoir A by its constant-supply source, the second reservoir G will also have become refilled from its respective connecting-supply, and the apparatus will repeat its former operation. Thus a series of intermittent operations of the mechanical system will obtain, and the wheel or other power-actuating device placed in connection therewith will be periodically set in working force.

It is evident that the parts here described may be indefinitely duplicated as regards the water-chambers F and N, respectively, together with their connecting devices—that is, in order to obtain a greater altitude in the fall of water, there may be any number or series of water-pressure chambers and connections, each similar, in all respects, to chamber F or chamber N.

The character of construction of such a continuing series I have shown by the connection of chamber F with chamber N, since, in order to obtain an operative system of mechanical parts, it was not necessary to have introduced the chamber N with its air-pipe, reservoir-connections, and final discharge.

By omitting all such parts, removing reservoir L, and allowing the discharge-opening k^3 to empty its contents down upon a water-wheel placed suitably below the same, it is evident that the same kind of result would have followed as in the former-described instance, the difference between the two being only in the degree of force or power occasioned by the difference in the elevation of the fall of water. So it is manifest that by continuing other series of water-chambers, air-connecting pipes, feed-reservoirs, and final discharges, in further extension above chamber N, any desired height of fall of water may be obtained.

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

1. In a hydraulic motor, the combination, with the air-pressure chamber, formed with air-valve mechanism in its top, and the waste-

pipe, having a spring discharge-valve, of one or more water-pressure chambers, the latter being provided with the several valves respectively controlling communication with the open air, the compressed-air-feeding connection, and the water-feeding connection, substantially as set forth.

2. In a hydraulic motor, the combination, with the water-pressure chamber, made with the several valves which respectively control connection with the open air, the compressed air, and the water-feed of the upright discharge-pipe, the latter being formed with an enlargement near its base connection with said chamber, in which a suitable check-valve is seated, substantially as set forth.

3. In a hydraulic motor, the combination, with the air-pressure chamber, of the siphon, formed with the air-connecting pipe near its top, substantially as set forth.

4. In a hydraulic motor, the combination, with the long leg of the siphon, of the air-pipe b, made to extend nearly to the top of the siphon, and provided with the upwardly-opening valve b^1, substantially as set forth.

5. In a hydraulic motor, the combination, with the reservoir A and siphon B, of the air-pressure chamber C, the same being constructed as described, whereby the said chamber C has a capacity equal to the volume of water discharged at one of the intermittent operations of the siphon, substantially as set forth.

6. In a hydraulic motor, the combination, with reservoir A and chamber C, of the siphon B, the latter having its receiving and discharging mouths b^2 b^3 of the same relative size, and of less diameter than the body of the siphon, substantially as set forth.

7. In a hydraulic motor, the combination, with reservoir A, siphon B, and air-pressure chamber C, of the water-wheel C′, substantially as set forth.

8. In the described hydraulic motor, the combination, with the air-pressure chamber C, of spring-valves c and d and the weighted valve c^1, all made and adapted to operate substantially as set forth.

9. In a hydraulic motor, the combination, with air-pressure chamber C and water-pressure chamber F, both made and provided with the respective valve mechanism, as described, of the connecting air-pipe E, having valves e and e^1, substantially as set forth.

10. In a hydraulic motor, the combination, with the water-pressure chamber F and air-connecting pipe E, of the weighted valves e^1 and f^2, the two being adapted to operate as described, whereby said valve f^2 will open before valve e^1 opens, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 19th day of November, 1877.

JAMES M. BOIS.

Witnesses:
C. D. DAVIS,
A. HASLEY.