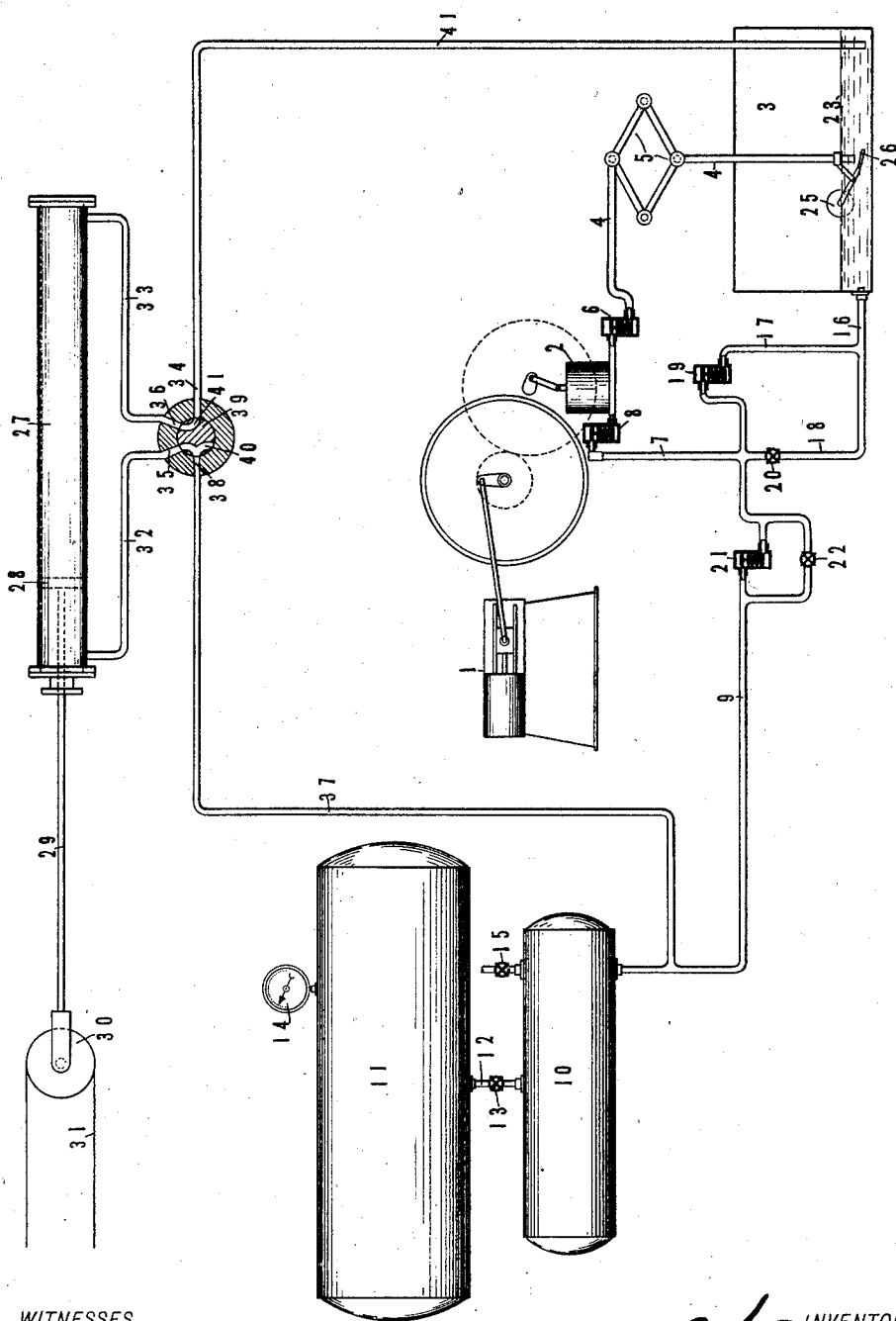


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 ENERGY STORING AND USING SYSTEM.
 APPLICATION FILED JAN. 8, 1907. RENEWED APR. 12, 1910.

958,853.

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To all whom it may concern:

Be it known that I, GEORGE W. BULLEY, residing at New York, in the county of Kings and State of New York, have invented certain new and useful Improvements in Energy Storing and Using Systems, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates broadly to improvements in apparatus for continuously accumulating energy and adapted to periodically utilize such energy at a rate momentarily exceeding the average rate of accumulation. Since, however, it more particularly concerns improvements in apparatus of the foregoing nature which is peculiarly adapted for actuating the operative features of an excavator in which the bucket will be raised and lowered at different speeds, it will be conducive to clearness to disclose an embodiment particularly adapted for that purpose.

One object residing within the contemplation of this invention is to provide a system in which a source of low power is caused to continuously store energy through the instrumentality of a suitable fluid, such as oil, and in which relatively large amounts of the stored energy may be periodically withdrawn for the purpose of operating the hoisting mechanism of an excavator.

Another object is to provide a system in which oil or other fluid is pumped from a reservoir into a pressure tank, and which will automatically prevent the entire depletion of the oil from such reservoir.

Another object is to operate a pump by a gas engine in an apparatus of the foregoing nature, and in which the supply of oil may be automatically cut off at predetermined intervals without interfering with the continuous operation of the gas engine, and without permitting air to enter the pipes.

Another object is to provide a plunger and one or more suitable control valves therefor, whereby said plunger may be rapidly and freely moved in one direction to permit a corresponding quick action of the excavating bucket, and whereby said plunger may be more slowly and powerfully moved in an opposite direction to cause a corresponding reverse action of said bucket.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the

features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, wherein is illustrated one of various possible embodiments of my invention, the figure diametrically illustrates a simple arrangement of the various parts comprising this invention.

Preliminary to a detailed description of my disclosed instrumentality, it will be conducive to clearness to point out that excavators have heretofore been operated through the agency of various types of what may be termed high power motors. These motors have been so arranged as to be capable of being thrown into engagement with the hoisting mechanism whenever it has been desired to operate the latter. Since, however, the hoisting mechanism is usually so designed as to intermittently operate it has been necessary to provide motors of such power as will overcome the maximum working resistance of such mechanism, but such resistance is encountered during only a small part of the entire operation of the mechanism, and therefore a great loss of energy has been unavoidable owing to the idle operations of the motor. Furthermore, motors of high power are always of an expensive and complex character, not to speak of their high cost of maintenance.

This invention proposes, on the contrary, to utilize a continuously operating, relatively lower power gas engine; (engines of this type being ordinarily preferable because of their simplicity and cheapness) to effectuate an accumulation of immediately available energy as aforesaid, and in this way to conserve and subsequently completely utilize in actual work all of the energy of the engine.

Referring now to the accompanying drawing, 1 denotes a small engine which will preferably be of the type known as "fluid pressure", and 2 denotes a small pump of any approved type which is being continuously operated by means of said gas engine. This pump draws oil from a reservoir 3 through the agency of a pipe 4, and to provide for different settings of the end of the pipe in the reservoir a flexible elbow 5 may be interposed. Also a valve may be interposed at 6 for the purpose of controlling the flow of oil, which, after being ejected from the

pump, enters a pipe 7, passes through a valve 8, and then into a pipe 9 which leads to a pressure tank 10. This tank is in turn in communication with an air tank 11 through a connection 12 having a hand valve 13. The air tank may be provided with an indicator 14 to denote the degree of pressure, and the pressure tank 10 may also be provided with an inlet valve 15 for allowing the inlet of air, as will be hereinafter described.

Leading from the reservoir 3 is a pipe 16 which spreads in two branches 17 and 18 and connects with pipe 7. In each of these branches, I provide valves 19 and 20 respectively. A like branch is interposed in pipe 9, and provides valves 21 and 22 whose purpose will presently appear.

The lower end of pipe 4 is provided with a device for automatically cutting off the admission of oil before the surface 23 of the latter sinks below the admission orifice of pipe 4, and this device comprises a float 25 operating a flap 26, which as will be observed is spaced away from the orifice of pipe 4 when the oil is at an appreciable height, and which effects a closure of said orifice when the oil sinks to a level near the end of the said pipe.

The means for utilizing the accumulated power may now be described. This consists of a cylinder 27 having an interfitting plunger 28 which is connected by means of a reciprocatory shaft 29 with the hoisting mechanism, as, for example, through the instrumentality of a pulley 30 around which the hoisting rope 31 may be passed. Pipes 32 and 33 lead to a valve casing 34 and terminate in ports 35 and 36. Similarly, a pipe 37 is in communication with pressure tank 10, and terminates in valve casing 34 in a port 38. In such valve casing is mounted a manually operatable valve 39 providing a 3-way port 40 and a 2-way port 41.

With the valve 39 in the position shown on the drawing, pipe 32 is in communication with the pressure tank 10 and consequently the plunger 28 is being urged to the right under the heavy pressure of the oil, and the rod 29 with its accompanying pulley 30 will be withdrawn so as to operate the excavating mechanism and raise the loaded bucket. This movement can readily take place for the reason that pipe 33 is in communication with pipe 41 which leads to the oil reservoir 3, thus allowing the oil to the right of the plunger to freely flow into said reservoir.

Now upon turning the valve 39 so that the 3-way port establishes communication between each of pipes 32, 33 and 37, it will be observed that the oil at both the right and left hand sides of the plunger is under the same pressure, but inasmuch as rod 29 extends to the plunger 28 from the left hand

side this pressure will have the effect of rapidly ejecting said rod 29 with its plunger, by the consumption of an amount of oil equal only to the volume of such portion of the rod 29 as is within the cylinder 27. This rapid movement can be used to operate the hoisting mechanism at that period of the same in which a rapid operation would accomplish the best effect; that is to say, this movement of the plunger may be coincidental with the descent of the excavating buckets.

Inasmuch as the successful operation of the aforesaid parts in a great measure depends upon the maintenance of a high uniform pressure of oil, I will now proceed to describe the manner in which this is accomplished, and in which the apparatus is made ready for use. Assume tanks 10 and 11 to be entirely empty and reservoir 3 full of oil. Valve 15 will then be closed and the engine started in its continuous movement. Oil will now be pumped through pipes 4, 7 and 9 into tank 10 until the latter is full and all the air therein has been forced into tank 11. This will probably not provide a sufficient pressure, and to store more air in tank 11, hand valve 13 may be closed and valves 15, 20 and 22 will be opened, thereby establishing a free communication between reservoir 3 and tank 10, whereupon the oil will all drain from tank 10 into reservoir 3. It will be comprehended that this drainage need not interfere with the continuous operations of the pump for the reason that the delivery of the latter will follow the path of least resistance, that is to say the pumped oil will be returned to the reservoir 3 through pipes 18 and 16 which are of sufficient capacity to easily accommodate the pumped oil plus the draining oil. Check valves 6 and 8 will, of course, intermittently operate in the usual manner during this draining operation. As soon as tank 10 has been emptied, hand valves 15, 20 and 22 will be closed and valve 13 will be opened, thereby again filling tank 10 with oil and forcing the air that was therein into the air tank 11. This very simple and easily understood operation will then be repeated until the air in tank 11 has acquired the desired degree of pressure. The air tank having been filled in this manner with air until the desired pressure has been attained and hand valves 15, 20 and 22 being closed and valve 13 being open, the engine and pump will be allowed to continuously operate. As a result, oil will be pumped into tank 10 so long as the entrance to pipe 4 is open, but as soon as it is automatically closed, the pump will be working under a more or less complete vacuum and no more oil will be forced into tank 10. To prevent any undue pressure in said tank, a safety valve 19 in by-pass pipe 17 may be used. Upon operating valve 39, the plunger

28 will be reciprocated as aforesaid, and quantities of oil will be returned to the reservoir through pipe 41, thereby raising float 25 and allowing oil to again enter pipe 4 and be returned to tank 10. This action, as will be readily perceived, is entirely automatic.

It will thus be seen that this invention is one well adapted to accomplish the ends and objects aforesaid.

10 The apparatus in its practical application will occupy very little space, and the component parts of the same are such as may be readily purchased and substituted in case of damage.

15 The operation, while being sufficiently positive to secure good results, is at the same time sufficiently yielding and elastic as to lend itself to the various irregularities accruing to commercial and practical excavating.

20 As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

30 It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

40 1. An apparatus of the nature disclosed comprising in combination, a pressure tank adapted to contain operating fluid under pressure, a reservoir, a conduit leading from said reservoir to said pressure tank, a continuously operating pump for forcing operating fluid from said reservoir through said conduit into said pressure tank, an air tank adapted to contain air under pressure, a normally opened conduit leading from said air tank to said pressure tank whereby the air may be used expansively to maintain a pressure upon the operating fluid in said

pressure tank, means for manually closing said normally opened conduit at the end of the operation of filling said air tank with air by forcing fluid into said pressure tank, and a valve adapted to be opened when said conduit is closed to enable a fresh supply of air to enter said pressure tank when the fluid is being drawn therefrom, whereby said air tank may be filled with air at any desired pressure by repeating said operations.

2. In apparatus of the class described, in combination, a reservoir, a pressure tank, means for effecting a transference of fluid from the former to the latter, means controlled from the reservoir for automatically preventing such transference prior to a complete depletion of the fluid in said reservoir, means for returning fluid from said pressure tank to said reservoir for the purpose of utilizing the returning fluid thereof and means adapted to accumulate air compressed within said pressure tank.

3. In apparatus of the class described, in combination, a reservoir adapted to contain fluid, a pressure tank in communication therewith, a plunger operated from said pressure tank and arranged to exhaust into said reservoir, a pump interposed between and connected to said pressure tank and reservoir, and a cut off valve on the suction side of said pump automatically controlled by the fluid in said reservoir for maintaining predetermined amounts of fluid in said reservoir and tank respectively.

4. In apparatus of the class described, in combination, a reservoir, a pressure tank, a low-power pumping means adapted to continuously operate to maintain predetermined amounts of oil in said reservoir and pressure tank respectively, a cut off valve on the suction side of said pump controlled from said reservoir, means connected with said pressure tank adapted to periodically operate to utilize relatively large amounts of energy, and a return from said latter means to said reservoir.

In testimony whereof I affix my signature, in the presence of two witnesses.

GEORGE W. BULLEY.

Witnesses:

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