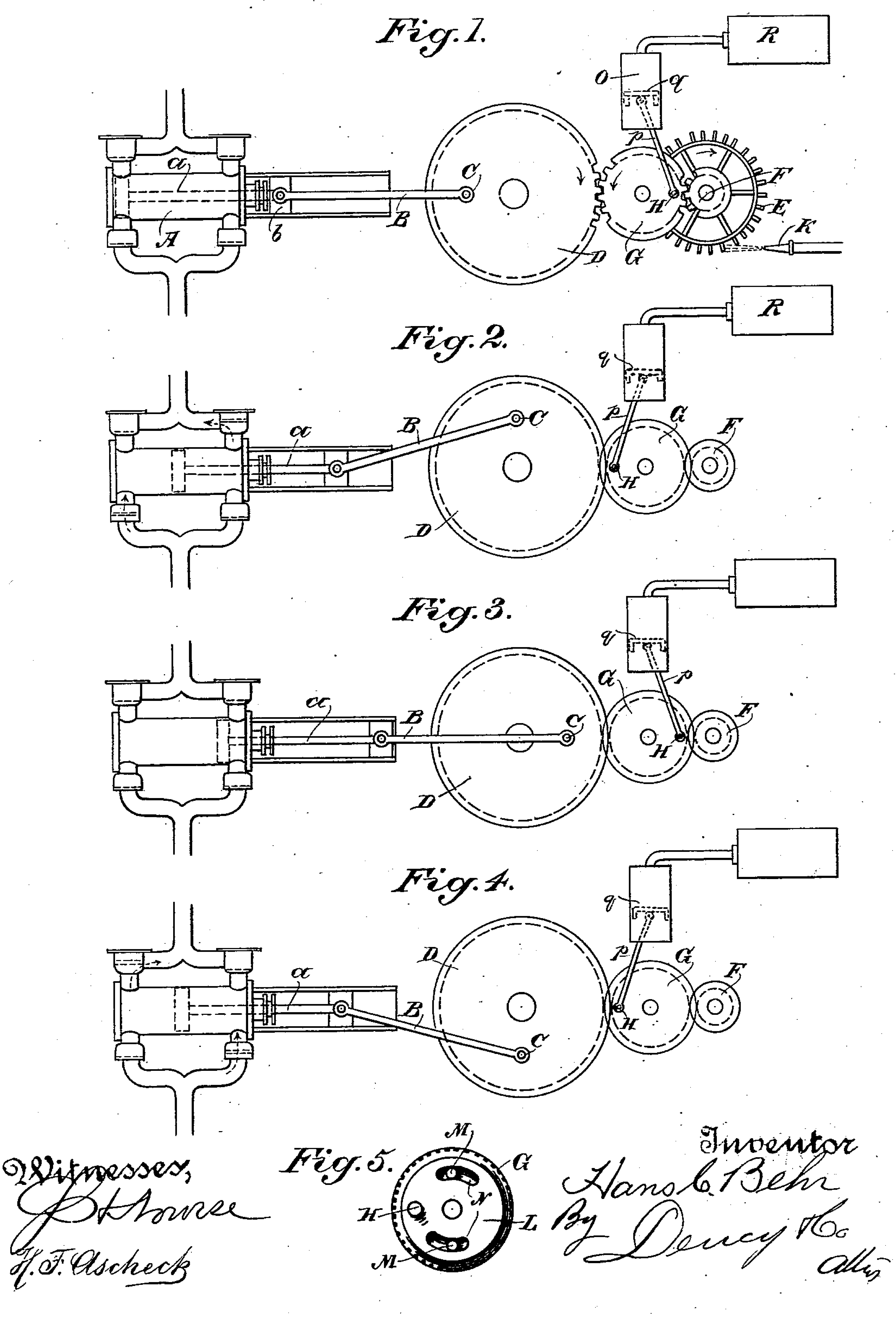
(No Model.)

H. C. BEHR.

PUMP OPERATING MECHANISM.

No. 563,007. Patented June 30, 1896.



UNITED STATES PATENT OFFICE.

HANS C. BEHR, OF SAN FRANCISCO, CALIFORNIA.

PUMP-OPERATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 563,007, dated June 30, 1896.

Application filed August 8, 1895. Serial No. 558,655. (No model.)

To all whom it may concern:

Be it known that I, HANS C. BEHR, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Pump-Operating Mechanisms; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of pumping machinery wherein a double-acting reciprocating pump or a single-acting pump counterbalanced so as to equalize or distribute the work over the two strokes, is operated from a crank and suitable driving connections, usually toothed gears and a motor.

The objects of my improvement are, first, to prevent acceleration in speed at the dead-points of the pump stroke without the use of excessive weights, previously suggested for similar purposes, and, second, to enable adjustments which will cause, if desired, even a decrease in speed at the dead-points, for the purpose of obtaining more quiet action of the pump-valves, thereby permitting a greater number of strokes per minute of the pump than could otherwise be practicable, and thus, also, increasing the capacity of the pump.

My improvements consist in a proportion of toothed gears, such as have been suggested in connection with a weight, tending alternately to accelerate and retard the motion of the smaller gear, which said smaller gear I connect with a cylinder having a piston subjected continuously on one face to the pressure of compressed air or other gas or vapor, so as to act in the same manner as a weight, but without the drawback of the excessive mass; also, in means for varying the angle of the crank on which the piston acts, in order to enable adjustment of period or maximum effect on piston in relation to period of maximum pump resistance, the object of this being to compensate for the effect of the reciprocating masses of the pump and parts moving coincidently with it, which effect is different at different speeds and requires adjustment to suit the latter.

Referring to the accompanying drawings, Figures 1, 2, 3, and 4 illustrate my improved equalizing mechanism in four different positions of one double pump stroke or one full revolution of the pump crank-pin. Fig. 5 shows the adjustable feature of the crank-pin.

A is a double-acting pump having a piston-rod a and a cross-head b, coupled by the connecting-rod B to the crank-pin C, set in the side of the gear D.

E is a motor, in this illustration a water-wheel driven by a jet from nozzle K and having upon its shaft a pinion F, which drives the gear D through an intermediate gear G, having one-half the number of teeth which D has, and, therefore, making twice the number of revolutions. A crank-pin H is fixed on the side of gear G, to which a piston q, moving in a cylinder O, is connected by means of a rod p. One side of the piston is in communication with a reservoir R, containing compressed air or gas or vapor. The function of the piston q is, by virtue of its attachment to gear G, to substitute resistance work where that of the pump is lacking, and to aid in overcoming the pump resistance when this is in excess.

In Fig. 1 the pump-piston is at the end of its stroke and affords no resistance to the motion of the pump-crank, gearing, and motor, assuming rotation in the direction of the arrows. For this position the piston q is being moved against the pressure, and is at its maximum leverage opposing the motion of the motor.

In Fig. 2 the resistance on pump-crank, due to pump work, is at its maximum. The pump-gear D has made one-fourth revolution while the intermediate gear G has made one-half revolution, and brought the rod p on the other side of the gear-axle, so that the piston is now being forced in the opposite direction to that in which it formerly moved, thus aiding in overcoming the excess of resistance due to the pump.

In Fig. 3 the pump-crank is at its other dead-point, the pump-gear has made one-half revolution, while the intermediate gear G has made a full revolution, and the piston q is being again moved against the pressure, and substituting resistance when that of the pump is lacking.

Fig. 4, again, shows the piston being moved oppositely by the pressure and overcoming the excess of resistance due to the pump.

If a weight equal to the pressure on the piston is attached to the crank-pin on the intermediate gear, as has been suggested in this line, the reciprocating masses of the entire pump-driving mechanism are increased thereby, and less speed would be admissible, because the work stored in the reciprocating masses produces shocks at the ends of their strokes at higher speeds.

It has been shown in the foregoing that what was stated as desirable in a gear-driven pump, namely, preventing acceleration at the dead-points by reduction in amount of variation of resistance without increase of reciprocating masses and reduction in duration of each variation, is accomplished by the contrivance described.

The figures shown in reference to the relative positions of the crank-pins on large and small gears are for a case where the reciprocating masses operating or moving with the pump are small and where the speed is low. Where these masses are important and the speed great, greater resistance will be introduced at the beginning of each stroke by the work necessary to accelerate these masses. This work will be again given out by the masses during the latter part of the stroke. In such cases I propose to place the pin on which the piston q acts not in such a position that the extreme resistance due to q will occur when the pump-crank is at its dead-points, but at such a point, determined by experiment, that the maximum resistance due to q will occur when the combined resistance due to the pump and to the work stored in the reciprocating masses, moving coincident with the pump, is at a minimum; in other words, that the part of the work stored in the moving masses and not absorbed by the pump work will be absorbed by the compressed air and again given out at the beginning of the next stroke.

To make the mechanism easily adjustable in this respect, so as to meet a wide range of speeds, the construction of gear G (shown in Fig. 5) can be used. There the crank-pin H is mounted on a plate L, clamped by bolts M to the gear G. The holes N for the bolts are slotted circumferentially, so that the disk can be rotated relative to the gear G, so as to adjust H into different angles.

It is obvious that as it is merely the relative tangential adjustment of the crank-pin C in gear D and the crank-pin H in gear G which is desired to be accomplished the pin C could be made adjustable on D instead of H on G and in the same manner.

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

1. In pump-driving mechanism involving a crank and connections for operating it, two intermeshing gears, one having twice as many teeth as the other, and a cylinder with piston and connections for exerting a force by means of compressed air or other gas or vapor upon the smaller gear tending to advance and retard it alternately in the direction of its rotation.

2. In pump-driving mechanism involving a crank and a gear through which said crank is operated, a second gear meshing with said crank-operating gear and having but one-half the number of teeth thereof, and a means operated by compressed air or other gas or vapor, for exerting a force upon the second gear tending to advance and retard it alternately in the direction of its rotation.

3. In pump-driving mechanism involving a crank and connections for operating it, two intermeshing gears, one having twice as many teeth as the other, a crank of said smaller gear, and means, operated by compressed air or other gas or vapor, acting through said crank for exerting a force upon the smaller gear tending to advance and retard it alternately in the direction of its rotation.

4. In pump-driving mechanism, the combination of two cranks, the one rotating at twice the angular velocity of the other, the slower-moving one operating the pump, means for adjusting them in the direction of their paths relatively to each other, and a means for exerting a force on the faster-moving crank, tending to advance and retard it alternately in the direction of its rotation.

5. In pump-driving mechanism, the combination of a gear having a crank connected with the pump-piston, a second gear driven by the motor, said second gear having but one-half the number of teeth of the first gear and meshing therewith, a crank of said second gear, means for adjusting the relative positions of the two cranks in the direction of their paths and a means for exerting a force on the smaller gear tending to advance and retard it alternately in the direction of its rotation.

In witness whereof I have hereunto set my hand.

HANS C. BEHR.

Witnesses:
S. H. NOURSE,
JESSIE C. BRODIE.