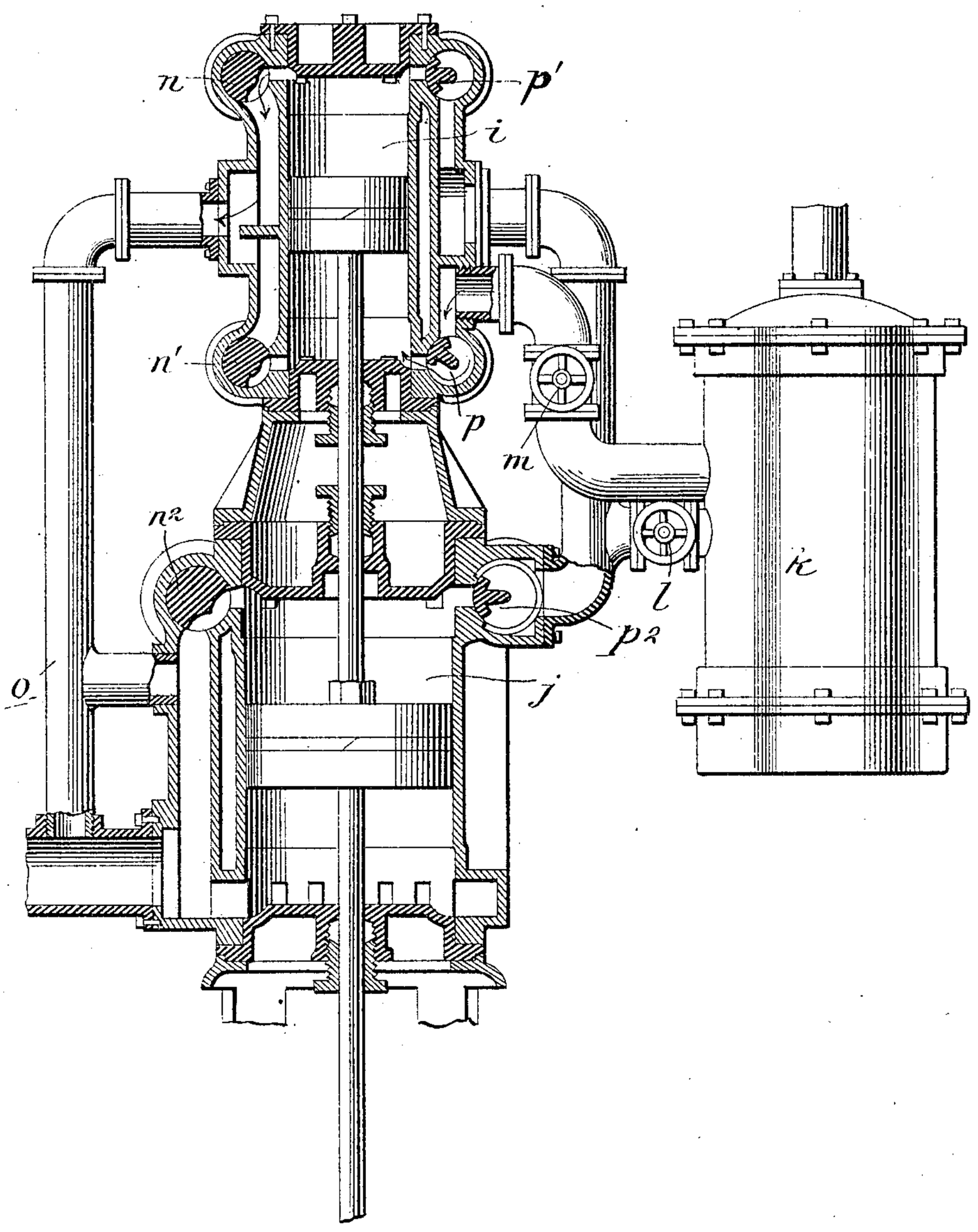
No. 812,151. PATENTED FEB. 6, 1906.

B. V. NORDBERG.

FLUID OPERATED ENGINE.

APPLICATION FILED NOV. 29, 1904.



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UNITED STATES PATENT OFFICE.

BRUNO V. NORDBERG, OF MILWAUKEE, WISCONSIN.

FLUID-OPERATED ENGINE.

No. 812,151. Specification of Letters Patent. Patented Feb. 6, 1906.

Original application filed September 18, 1903, Serial No. 173,691. Divided and this application filed November 29, 1904. Serial No. 234,757.

To all whom it may concern:

Be it known that I, BRUNO V. NORDBERG, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Fluid-Operated Engines, of which the following is a specification.

My present invention relates to fluid-operated engines, and more particularly to those adapted to deliver a blow—such, for instance, as ore-stamps, power-hammers, and the like.

The invention is illustrated in the accompanying drawing, which is a vertical sectional view of the engine, comprising a combination of two low-pressure cylinders and connections for admitting steam from a common source (a receiver) to the upper ends of both cylinders and for admitting steam to the under face of one of the pistons on the upstroke.

The object of the invention is to so construct the parts that the danger of breakage due to the weight and sudden stoppage of the piston of the engine in the act of delivering a blow will be minimized.

The present application is a division of my application, filed on or about the 18th day of September, 1903, Serial No. 173,691, wherein the present construction is shown as one of a series of engines for operating stamps and the like.

The low-pressure pistons in engines or stamps of the character shown and described in the aforesaid application may attain such proportions that there will be danger of breaking the parts when the blow is delivered. When a blow is struck by the stamp, the movement of the piston is suddenly arrested, and it is therefore apparent that under such circumstances and when the piston is quite large and heavy there will be danger of breaking the hub away from the body of the piston. To prevent this and also in order to produce a high degree of steam economy, I employ the arrangement shown in the accompanying drawing. Under such construction instead of employing one large cylinder two smaller cylinders *i* and *j* are used, the aggregate area of the two smaller cylinders being equal to the area of a single large cylinder, and a blow equal in effect to that delivered by the piston of a single large cylinder or engine may be given. These two cylinders are piped in the following manner: The lower end of cylinder *j* is in constant communication with the condenser or with the atmosphere, the arrangement being in these respects similar to that used in a tandem compound stamp such as is shown and claimed in United States Letters Patent No. 741,536, granted to me and dated October 13, 1903. Both pistons are connected to a single rod, as is usual, and any valve mechanism—such, for instance, as that shown in the parent application heretofore referred to—may be employed.

The upper end of each of the cylinders is connected with the receiver *k*, a valve *l* being provided in the connection between the receiver and the cylinders, whereby the strength of the blow to be delivered can be regulated as desired.

The inlet-valve to the lower end of cylinder *i* is provided with a regulating-valve *m*, through the operation of which the lift exerted by the steam acting upon the lower face of the piston working in cylinder *i* can be regulated. The three exhaust-valves *n*, *n'*, and n^2 are connected by a pipe *o* to the condenser or the atmosphere.

On the upstroke of the pistons the exhaust-valves *n* and n^2 are open and the inlet-valve *p* at the lower end of the cylinder *i* is also open. Thus there is the vacuum of the condenser or the atmospheric pressure above both pistons and below the lower piston and a certain amount of receiver-pressure (determined by the position of the regulating-valve *m*) under the upper piston, which pressure lifts the stamp.

When the stamp strikes its blow, the exhaust-valves *n* and n^2 are closed and the exhaust-valve *n'* is open. The two inlet-valves *p'* and p^2 at the upper ends of the two cylinders are also open and steam at receiver-pressure is admitted upon the upper face of both pistons, while steam from the lower end of the upper cylinder is exhausted into the condenser or directly to the atmosphere. The vacuum of the condenser or atmospheric pressure exists constantly under the lower piston. The advantage of this arrangement is that having a very perfect vacuum under one of the pistons a stronger blow is secured than would result if a single large piston with a less direct vacuum acting upon it were employed, as would be the case when the ex-

haust upon the under side of the piston expands to the vacuum existing in the condenser. It is clear that if both cylinders were made smaller, taking steam upon both ends, the resistance caused by the exhausting steam would be a still greater detriment to the strength of the blow. It is also evident that by this arrangement the bad effect of clearance is greatly reduced, as there will be clearance only at the lower end of one of the cylinders, while it is entirely eliminated in the lower end of the other cylinder. It is of course unnecessary to have both pistons present the same surface area, though they may be so constructed, if desired.

Having thus described my invention, what I claim is—

1. In an engine adapted to deliver a blow, the combination of two cylinders; a piston working in each of said cylinders; a piston-rod common to said pistons; means for admitting steam simultaneously and at the same pressure to the upper face of each of said pistons; and means for admitting steam to the under face of one of said pistons while steam is exhausted from the opposite face of each of said pistons.

2. In an engine, the combination of a pair of cylinders; a piston working in each of said cylinders; a piston-rod common to said pistons; a receiver; means for delivering steam simultaneously from said receiver to the corresponding end of both cylinders; and means for admitting steam to the opposite end of one of said cylinders while the pistons are moving in the opposite direction.

3. In an engine, the combination of a pair of cylinders; a piston working in each of said cylinders; a piston-rod common to said pistons; a receiver; means for admitting steam from said receiver to the upper end of each of said cylinders; means for admitting steam from said receiver to the lower end of the upper cylinder; and a condenser connected to the lower end of the lower cylinder.

4. In an engine, the combination of a pair of cylinders; a piston working in each of said cylinders; a piston-rod common to said pistons; a receiver; means for admitting steam from said receiver to the upper end of each of said cylinders; means for admitting steam from said receiver to the lower end of the upper cylinder; a condenser connected to the lower end of the lower cylinder and in communication therewith at all times; a valved port affording communication between the lower end of the upper cylinder and the condenser; and a valved port affording communication between the upper end of the lower cylinder and the condenser.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BRUNO V. NORDBERG.

Witnesses:
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