

No. 729,210.

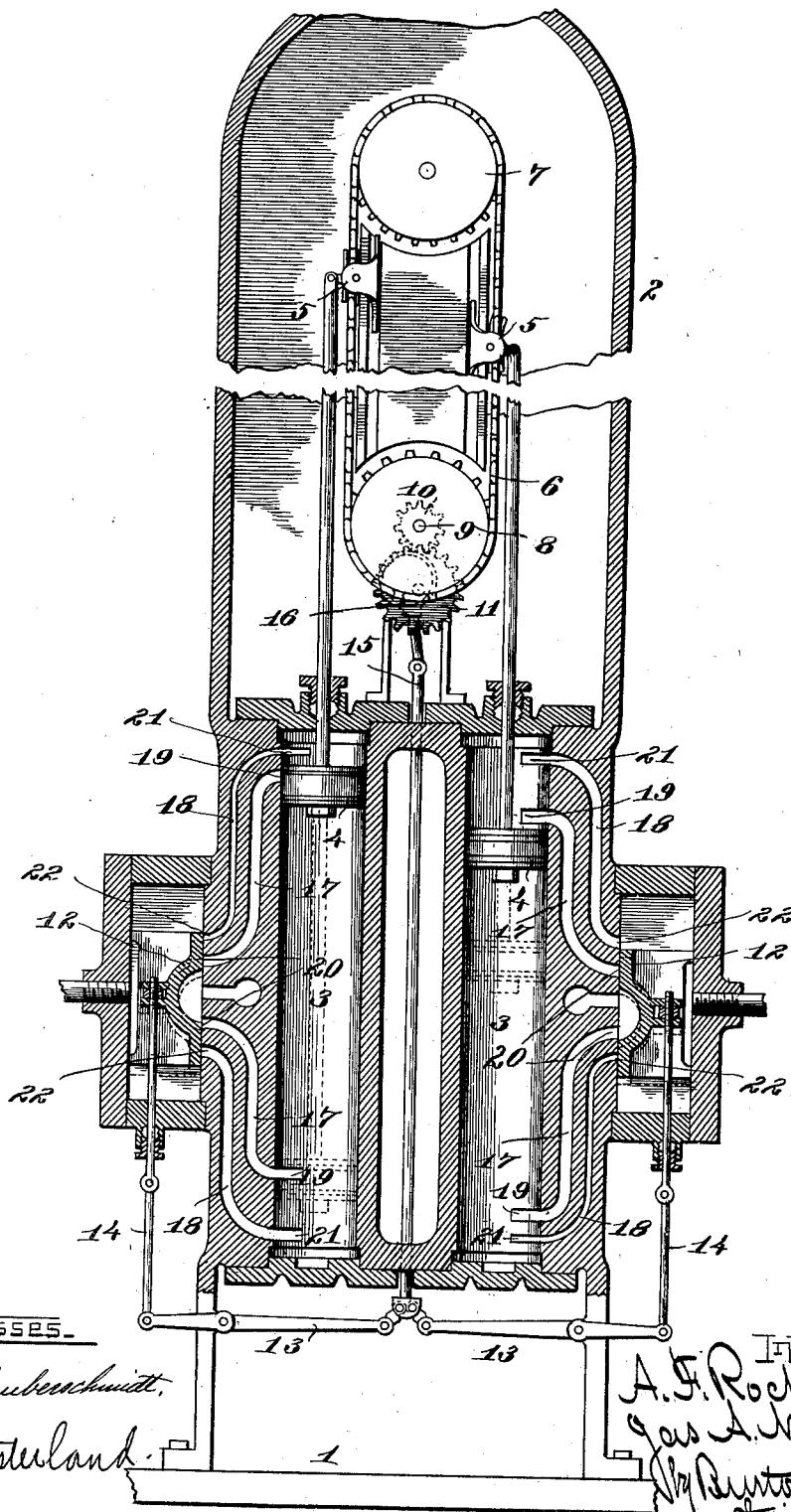
PATENTED MAY 26, 1903.

J. A. NORTON & A. F. ROCKWELL.

EXPANSIVE FLUID MOTOR.

APPLICATION FILED APR. 5, 1902.

NO MODEL.



WITNESSES.

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UNITED STATES PATENT OFFICE.

JAMES A. NORTON, OF ODEBOLT, AND ALBERT F. ROCKWELL, OF SIOUX CITY, IOWA; SAID ROCKWELL ASSIGNOR TO SAID NORTON.

EXPANSIVE-FLUID MOTOR.

SPECIFICATION forming part of Letters Patent No. 729,210, dated May 26, 1903.

Application filed April 5, 1902. Serial No. 101,606. (No model.)

To all whom it may concern:

Be it known that we, JAMES A. NORTON, residing at Odebolt, in the county of Sac, and ALBERT F. ROCKWELL, residing at Sioux City, in the county of Woodbury, State of Iowa, citizens of the United States, have invented certain new and useful Improvements in Engine-Valves and Steam-Passages, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

The purpose of this invention is in an expansive-fluid motor in which there are two pistons having each a working and an idle stroke and arranged to engage the motor-shaft-operating means each in the stroke in one direction and not in the opposite direction, to provide means by which the idle stroke of the piston may be performed at a speed independent of the working speed of the motor, thus permitting it to be performed quickly as is possible in view of the fact that it is idle and not resisted by the work being done by the motor, and to prevent the inequality in the time occupied by the two strokes from making necessary like inequality in the action of the valves, so that the latter may be moved regularly corresponding to the working speed of the motor.

It consists also in features of construction by which the spent motive fluid is imprisoned in the cylinder in front of the piston making its idle stroke, so as to cushion that stroke independently of the closing of the exhaust-passage by the valve.

It consists, further, in specific construction of the valves to give a later opening and earlier closing of the inlet for admitting the motive fluid to give the piston its idle stroke than for the admission which gives it its working stroke and in mechanism for operating the valves consistently with such structure.

The drawing is a partly-sectional elevation of a motor embodying our invention, section being made axially through the two cylinders.

The general character of the motor herein shown is substantially that of the motor shown in application for patent of James A. Norton, filed in the Patent Office August 28, 1901, Serial No. 73,516, and now pending. It com-

prises two cylinders and pistons therein, an endless chain and wheels encompassed by it, pistons having clutch connections with the two plies of the chain, respectively, one being adapted to drive the chain by its stroke in one direction and the other driving it by its stroke in the other direction, each stroke thus giving the chain the same direction of travel around the wheels, the clutch engagement permitting the pistons to be retracted along the chain in an idle stroke after having given movement to the chain in the working stroke. The details of the connection of the pistons to the chain are not material to my invention and will be only briefly described.

The frame 1 of the motor is constructed for an upright or vertical engine comprising a shell or cage 2, inclosing the endless chain mentioned.

3 3 are two similar cylinders side by side. 4 4 are the pistons operating therein, connected by the clutches 5 5 to the opposite plies of the chain 6, which encompasses the wheels 7 and 8, suitably journaled in the frame. On the shaft 9 of the wheel 8 is a pinion 10, which meshes with a gear 11, the relative sizes of the pinion and gear being such that the gear makes one revolution for each working stroke of both pistons—that is, a half-revolution for each working stroke of each piston. This fact simply means that the stroke of the piston is equal to the circumference of the wheel 8 and the distance between the wheels—that is, the length of the ply of the chain which can be moved in the working stroke from wheel to wheel without releasing the clasp of the clutch will be also equal to the circumference of the wheel 8, and the gear 11 will in that case be made double the size of the pinion, making one revolution for each two revolutions of the latter.

12 12 are slide-valves, which are of the customary D form with detailed modifications, as hereinafter explained. They are operated by levers 13 13, suitably connected to them, respectively, by jointed rods 14 14, and said levers are actuated by short link connections from a rod 15, reciprocated, by means of an eccentric 16, on the shaft of the gear 11. Each piston as soon as it has completed its working stroke is free to return idly—that is,

without doing any work—and the means for this return consists of a charge of the motive fluid admitted to the cylinder at the proper side of the piston to cause such return stroke.

5 Manifestly only a very light charge of the motive fluid will be required for this idle stroke, and the cut-off for it should be very short, and even when it is thus short the stroke itself is likely to be made very quickly—that is, the piston would be thrown, as by a blow, from the end reached by its working stroke to the opposite end of the cylinder. The action of the valves being most desirably controlled, as illustrated, by positive connections with the motor-shaft and being therefore governed by the working speed of the motor and not by the speed of the idle piston will not have made their stroke after closing the exhaust-port at the end toward 10 which the idle piston is moving by the time the piston reaches that end in its quick run, and it would therefore find no cushion for same unless special provision were made for that purpose. This difficulty we overcome 25 by providing the cylinders with separate inlet and exhaust passages at the end toward which the piston makes its return or idle stroke. Preferably we provide these double passages at both ends, as shown, the exhaust-passage having its port in the cylinder at a position inward from the inlet-passage and at a sufficient distance back from the cylinder-head, so that although the valve may not have closed the port at the valve-seat by the 35 time the returning idle piston requires the cushion the piston will itself close the port of the exhaust-passage in the cylinder and imprison beyond it of the spent motive fluid enough to afford it proper cushion. In the 40 drawing, 17 17 are the exhaust-passages, and 18 18 the inlet-passages, the exhaust-ports in the cylinder being shown at 19 19 and at the valve-seat at 20 20, the inlet-ports in the cylinder being shown at 21 21 and at the valve-seats at 22 22.

45 Manifestly each foot or seating-face of the valve must have an extent sufficient to enable it to cover the inlet and exhaust ports at the valve-seat at the same time when it is 50 at the position occupied when the motive fluid is cut off and while the piston is finishing its stroke by the expansion of the fluid, and it must be sufficiently greater in extent than this to allow for its movement from the 55 point of cut-off to the point at which the release should occur. In respect to the end of the valve which controls the inlet-port at the end from which the working stroke of the piston is made the seating-face requires lap 60 inside the exhaust-port at the position at which the inlet-port is closed corresponding only to the relatively short travel after the cut-off occurs; but the face at the other end of the valve requires a length adapted to give 65 it a lap corresponding relatively to the longer travel of the piston after the steam is cut off, because an almost instantaneous cut-off for

admission will give enough impulse to the piston to send it through its idle stroke. We therefore make the valve-face at the end 70 which controls the admission of steam for the idle stroke longer than the face at the other end of the valve. The effect of this will manifestly be that the steam is admitted later and cut off sooner for the idle stroke than for 75 the working stroke. It is manifest that the length of the valve-face to have the effect described has to be considered as a length relative to the extent of valve-seat which comprises the two ports to be covered by the 80 faces, respectively, and in the statement that the valve-face which controls the inlet if the idle stroke is longer than the other it is to be understood that the extent of valve-seat within which the inlet and exhaust ports are com- 85 prised at one end is the same as at the other end. The valve-faces may be equal if the inlet and exhaust ports of the same are nearer together at the end for admission of steam to give the idle stroke. 90

The equivalents of the modifications which may be made in the valve and its seat to produce the results above described will be obvious to any mechanic familiar with the art.

We do not limit ourselves to the particular 95 mechanism shown for actuating the valves, except in so far as the claims specify this mechanism.

We claim—

1. In an expansive-fluid motor, a cylinder 100 having an inlet and an exhaust port at both ends, the exhaust-ports being inward from the inlet-ports respectively, in combination with the valve and valve-gear constructed and timed to hold the inlet-ports closed and 105 the exhaust-ports open at the valve-seat until the piston closes the cylinder exhaust-port at the same end.

2. In an expansive-fluid motor, a cylinder 110 having an inlet and an exhaust port at both ends, the exhaust-ports being inward from the inlet-ports, respectively, in combination with the mechanism by which the piston transmits motion, constructed to transmit the same at one stroke only, whereby it has a working 115 and an idle stroke, the inlet and exhaust ports at the end from which the piston moves in its idle stroke being nearer together than those at the opposite end and valve and valve-gear constructed and timed to hold the inlet- 120 ports closed and the exhaust-ports open at the valve-seat until the piston closes the cylinder exhaust-port at the same end.

3. In an expansive-fluid motor, a cylinder and piston working therein, connections by 125 which the piston transmits motion in one of its strokes only and is idle in the return stroke, the cylinder having both an inlet and an exhaust port at the end toward which the piston moves in its idle stroke, the exhaust-port 130 being inward from the inlet-port, in combination with the valve and valve-gear constructed and timed to hold the inlet-port closed and the exhaust-port open at the valve-

seat until the piston closes the cylinder exhaust-port at said end having the two ports.

4. In an expansive-fluid motor comprising two cylinders and pistons operating therein, 5 said pistons having a working and an idle stroke, the working stroke of one piston being in one direction and of the other being in the opposite direction, each piston being connected so as to be free to make the idle stroke 10 at any speed, the cylinders having at the end toward which the idle stroke is made; a separate inlet and exhaust port, the exhaust-port being inward from the inlet-port a sufficient distance to cause the piston to imprison and 15 compress between itself and the cylinder-head after passing the exhaust-port a sufficient quantity of motive fluid for cushioning said stroke; valves and mechanism for operating them, having their movement controlled by 20 the working speed of the motor, timed to hold the inlet-port closed and exhaust-ports open at the valve-seat when the piston starts on its idle stroke, whereby the cushioning of such idle stroke is secured independently of the 25 time of closing the exhaust-port at the valve-seat.

5. An expansive-fluid motor comprising two cylinders and pistons therein; an endless chain or belt and two wheels which it encompasses, the pistons being arranged to engage respectively the opposite plies of the belt, one in its stroke in one direction and the other in its stroke in the opposite direction, and to be retracted without engagement 35 along the belt in the return strokes respectively; a wheel deriving rotation from such chain and making a half-revolution for each working stroke of each piston; valves controlling the inlet and exhaust ports of the cylinders respectively; and elements reciprocating by the rotation of said last-mentioned 40

wheel operatively connected to the valves to give them their movements once for each working stroke of the pistons which they respectively control.

6. In an expansive-fluid motor, two cylinders and pistons operating therein connected 45 to the working parts of the motor so as to have one working and one idle stroke each, and being free to make their idle strokes at 50 a speed independent of the working speed of the motor; separate passages for inlet and exhaust leading from the cylinders to the valve-seats respectively, the exhaust-passages having their ports both in the cylinder and 55 at the valve-seat located inward from the inlet-ports; a slide-valve for each cylinder having the face or foot which controls the port for one end of the cylinder longer than the foot or face controlling the ports at the other end 60 relatively to the extent of seat comprised between the extreme limits of said ports; mechanism for operating the valves, deriving its movement from the motor as distinguished from deriving it directly from the pistons, 65 whereby the movements of the valves correspond to the working speed of the motor and are the same in both directions, the longer foot or face of the valve being at the end from which the piston is driven in its idle stroke, 70 whereby the steam is admitted later and cut off earlier at that end than at the opposite end.

In testimony whereof we have hereunto set our hands as joint inventors, in the presence 75 of two witnesses, at Sioux City, Iowa, this 5th day of February, 1902.

JAMES A. NORTON.

ALBERT F. ROCKWELL.

In presence of—

MELVIN SMITH,

MARY HANLON.