

No. 729,209.

PATENTED MAY 26, 1903.

J. A. NORTON.
EXPANSIVE FLUID MOTOR.
APPLICATION FILED MAR. 13, 1902.

NO MODEL.

Fig. 1.

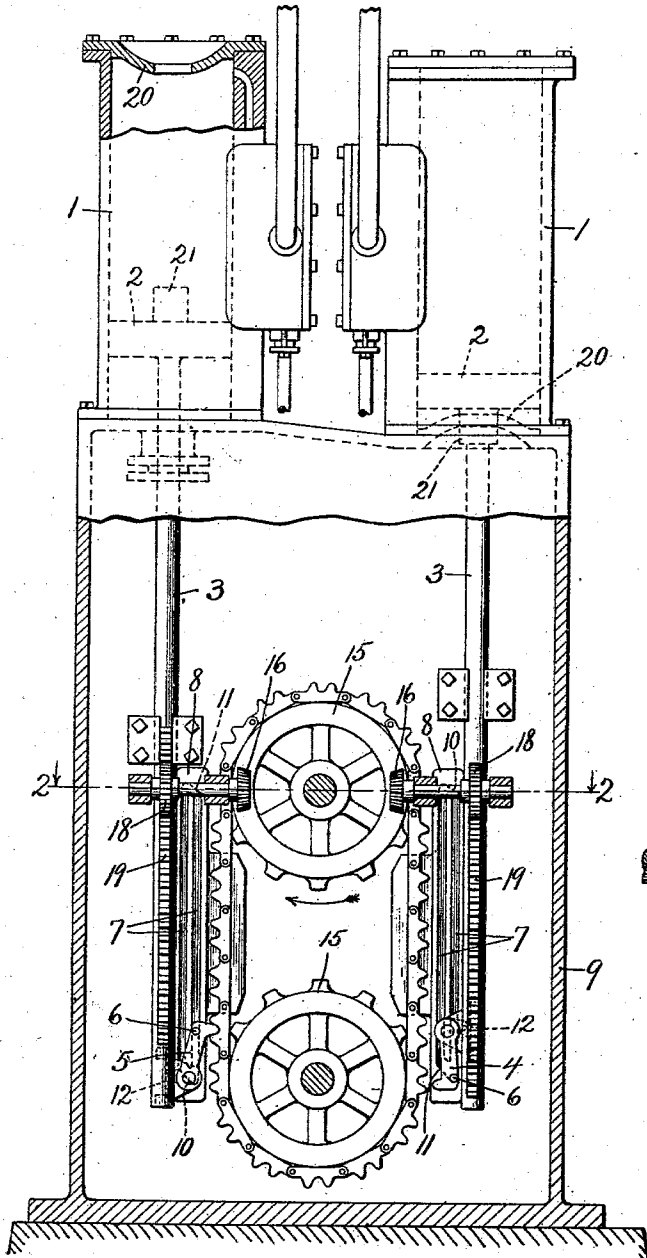


Fig. 3.

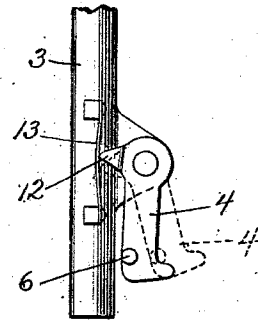
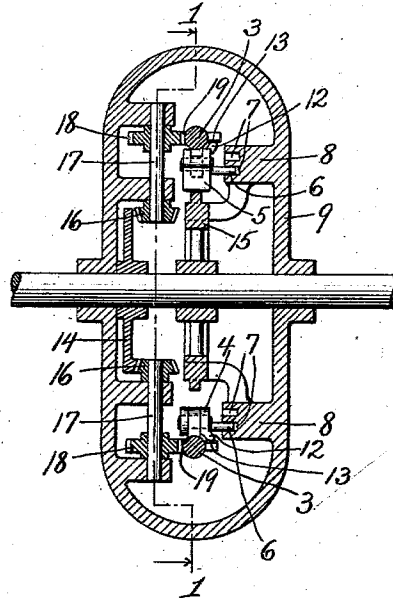


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

JAMES A. NORTON, OF ODEBOLT, IOWA.

EXPANSIVE-FLUID MOTOR.

SPECIFICATION forming part of Letters Patent No. 729,209, dated May 26, 1903.

Original application filed August 28, 1901, Serial No. 73,516. Divided and this application filed March 13, 1902. Serial No. 98,044. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. NORTON, a citizen of the United States, residing at Odebolt, in the county of Sac and State of Iowa, have invented certain new and useful Improvements in Expansive-Fluid Motors, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

This application is a division of my application, Serial No. 73,516, filed August 28, 1901.

The purpose of this invention is to provide an expansive-fluid motor designed to be operated by steam or compressed air, explosive gas, or other fluid operating in a similar way, with operating parts so connected with the pistons that a given travel of the piston in the cylinder or any part of its stroke will produce the same amount of rotary motion of the immediately-actuated or main driving wheel or shaft as a like travel of the piston at any other part of its stroke in the same direction. The construction resulting from the application of this invention is designed to be distinguished in this respect from the action of the ordinary reciprocating engine, with crank-shaft connected with the piston-rod, in which as the crank-arm moves through each ninety degrees through its path of rotation the leverage with which the piston operates upon it varies from zero to a maximum depending on the length of the crank-arm, while the travel of the piston for each degree of angular movement of the crank varies from a minimum at the middle point of the stroke to a maximum at the end.

A further purpose of the invention is to prevent the retardment in the action of the motor which is caused in other constructions by delay in the escape of the exhaust gases or steam, and thereby to make it possible to reverse the stroke as quickly as consistent with the relation of the expansive force of the fluid employed and the inertia of the moving parts.

A third purpose is to make it possible to employ two pistons operating by the same rotative element to produce the rotation thereof, one piston operating during its stroke in

one direction, the other piston during its stroke in the opposite direction, and to cause the operating strokes of the two pistons to overlap, so that there shall not be a point at which the transfer occurs from one to the other by the abrupt cessation of the connection of one and the abrupt commencement of that of the other.

The invention consists in the association, with a proper cylinder and piston connections of an expansive or explosive fluid motor, of an endless chain and two wheels which it connects, the reciprocating pistons having, through proper connecting-rods, engagement with the chain adapted to actuate it in one stroke and to withdraw along it without actuating it in the opposite stroke; and, specifically, it consists also in the construction by which the two connecting-rods, actuated by a cylinder-and-piston construction suitable for the employment of explosive motor fluid, engaged, respectively, on opposite plies of an endless chain passing around two wheels, one of said connections being adapted to actuate the chain by the stroke of the piston in one direction and the other adapted to actuate it by stroke in the opposite direction.

It consists, further, specifically in the employment of two pistons operating in separate chambers, having automatically-disengageable connections, by means of their respective connecting-rods, with the opposite plies of the chain passing around two wheels, each piston being arranged to be driven in only one direction by the motive fluid and to be returned automatically by the mechanism to be operated, whereby it is rendered possible to give the piston different speeds in its actuating and returning strokes, respectively.

It consists, further, in features of construction set out in the claims.

In the drawings, Figure 1 is a partly-sectional plan view of a motor embodying my invention, section being made through the frame and bearings at the plane of the line 11 on Fig. 2. Fig. 2 is a section at the line 22 on Fig. 1. Fig. 3 is a detail view, on a larger scale, of the dog which engages the chain and means controlling it.

Inasmuch as the pressure operating upon

the piston in an ordinary steam-engine construction, for example, is a diminishing one from the point at which the steam is cut off to the end of the stroke and may be reduced in some instances to zero at the end of the stroke by the opening of the exhaust-passage and inasmuch as in view of this fact a motor of the construction above described running slowly might come to a halt at the end of each stroke, it is desirable that the pressure for each stroke in each direction should become effective as a source of motive power a little before the end of the preceding stroke, so that there shall be no point at which the power is at zero or limited to the momentum derived from the preceding motion. In order to accomplish this result, I employ the construction shown in the drawings, in which I employ two parallel cylinders 11, having independent pistons 2 2, the two cylinders being arranged to receive the steam at opposite ends, but each at one end only, and the valve-controlling mechanism being constructed so that the steam is admitted alternately to the two cylinders, so that one piston is adapted to make its actuating stroke in the opposite direction, said actuating strokes alternating in point of time. Each piston has its connecting-rod 3 provided with a dog, one of the dogs, 4, being designed to engage one ply of the chain on the outstroke of the piston, while the other dog, 5, is designed to engage the opposite ply of the chain on the instroke of the piston. The cylinder whose piston-rod has the dog 4 receives steam at the end remote from the dog, so that the outstroke of its piston may be its power-stroke or actuating stroke, while the other cylinder receives steam at the opposite end, so that the instroke of its piston is the power-stroke. Thus the chain derives its movement in each instance from the power-stroke of the piston whose dog engages it. To throw the dogs into and out of engagement with the chain, each dog has a stud 6, traveling, preferably, in a groove or slot 7 in a web 8, projecting from the frame 9, such groove being formed with cam-slopes 10 and 11 at opposite ends, adapted, respectively, to throw the dog into and out of engagement with the chain. The dogs have each a projection 12 from the hub near the pivot, such projections bearing against a spring 13, lodged at its ends and yielding at the middle. The movement of the dogs about the pivot from engaged to disengaged position carries the projection 12 past the line of direct pressure of the spring toward the pivot, and the spring thus tends to hold the dog at either position after it is moved by the cam-slopes, respectively. In the absence of special provision for the purpose it will be seen that neither piston would have any return stroke. The provision for this purpose which I have shown consists of a segment-rack 14 upon one of the wheels 15 15, such rack occupying from ninety degrees to one hundred and twenty degrees of the circumference and

being adapted to mesh during a corresponding portion of the rotation of the wheel with the pinion 16 on one end of the shaft 17, journaled in the frame, the other end of the shaft having a spur-gear 18, which meshes with the rack 19, rigid with the piston 2. Each piston being similarly provided and the pinions 16 and 18 and shaft 17 being duplicated at opposite sides to actuate the similar racks 19 19, it will be seen that the continued rotation of the wheel 15 having the rack 14 will in one half of its movement rotate the shaft 17 and cause the spur-gear 18 thereon to actuate the rack 19, and thereby retract the piston to which it is connected, while in the other half of the rotation of the wheel 15 the gear-segment 14 will in like manner retract the other piston, the retracting movement being in opposite directions, as the power-actuating movements of the two pistons are in opposite directions. The relation of the gear-segment 14, the pinion 16, the spur-gear 18, and the rack 19 are calculated so that retraction of each piston is more rapid than its operating stroke—that is to say, is performed in less than half the rotation of the wheel 15—and the parts are assembled and put in engagement so timed that the retracting movement of each piston commences later than the actuating or power-communicating movement of the other piston, but ends substantially simultaneously therewith, or, to state the matter in inverse order, the power-actuating movement of each piston commences a little before the corresponding movement of the other piston closes, the apparent loss of the later piston being made up by the more rapid retraction which it receives from the mechanism described, so that it reaches the opposite end of its path ready to receive its actuating impulse and commence its power-stroke before the other piston finishes the power-stroke which it in like manner began while the first piston was still making its power-stroke.

I have not shown the mechanism for operating the inlet and exhaust valves of these cylinders, the construction of such valves and their operating mechanism being a matter which will readily be understood by those familiar with the art in view of the timing of their action indicated in the above description.

For the purpose of cushioning the strokes of the piston in the form shown, having two cylinders and pistons, in view of the fact that steam is admitted only at one end it may be desirable to provide at the end opposite that at which the steam is admitted a space which shall become a closed pocket just before the end of the stroke, which may be done by the construction shown in the drawings, wherein that end of the cylinder is provided with a diaphragm 20, apertured at the center, the piston having a central cylindrical boss 21, which enters this aperture and closes it a little before the end of the piston-stroke in that direction, and thereby causes an air-

cushion to be inclosed in the space between the piston and the cylinder-head.

I claim—

1. An expansive-fluid motor, comprising
5 two cylinders and pistons therein, and means for admitting the expansive fluid to said cylinders at opposite ends thereof respectively, whereby the power-strokes of the pistons are in opposite directions; two wheels, and a
10 chain which connects them; connecting-rods from the two pistons having means for engaging the opposite plies of the chain respectively, adapted to engage the chain in the power-strokes of the pistons respectively, and
15 to be disengaged from the chain in the opposite strokes.

2. An expansive-fluid motor, comprising two parallel cylinders, and pistons therein; means for controlling the admission of the expansive fluid at the opposite ends of said cylinders respectively, to give to the pistons power-strokes in opposite directions; two
20 wheels, and a chain which connects them; rods reciprocated by the pistons respectively, having means for engagement with the opposite plies respectively of said chain, adapted to engage the chain in the power-strokes of the respective pistons, and to be disengaged from the chain in the opposite strokes; and
25 mechanical connections by which each piston in its power-stroke gives a retracting stroke to the other piston.

3. An expansive-fluid motor, comprising two parallel cylinders and pistons therein,
35 suitably arranged for the admission of the expansive fluid at opposite ends of said cylinders respectively, to cause the pistons to have their power-strokes in opposite directions; two wheels, and a chain which connects them;
40 rods reciprocated by the pistons respectively, and means for engagement with the opposite plies respectively of the chain, constructed to engage and actuate the chain in the power-strokes of the pistons respectively, and to be
45 without engagement with the chain in the opposite strokes; and mechanical connections between the two pistons by which each piston in its power-stroke retracts the opposite piston with a movement more rapid than its own.

4. An expansive-fluid motor, comprising a
50 cylinder and a piston adapted to reciprocate therein under the action of the expansive fluid; an endless chain, and two wheels which the chain connects; a rod reciprocated by the
55 piston, and a dog connected with said rod adapted to engage the chain to actuate the latter by its stroke in one direction, and a cam

adjacent to the path of movement of the dog to throw it into engagement with the chain at the commencement of one stroke, and to
60 throw it out of such engagement at the end of such stroke.

5. An expansive-fluid motor, comprising two wheels and a chain which encompasses and connects them, in combination with piston-actuating reciprocating rods having dogs
65 connected to them respectively, adapted to engage the opposite plies of the chain; cams adjacent to the path of the dogs adapted to be encountered by the latter and throw them
70 into engagement with the chain at the commencement of their operating strokes respectively, and to throw them out of engagement at the end of such strokes.

6. An expansive-fluid motor, comprising
75 two parallel cylinders and pistons therein suitably arranged for the admission of the expansive fluid at opposite ends of the said cylinders respectively, to cause the pistons to have their power-strokes in opposite direc-
80 tions; two wheels and a chain which connects them; rods reciprocated by the pistons respectively, and dogs connected with said rods, adapted to engage respectively the opposite plies of the chain on the power-strokes
85 respectively of the pistons; and cams adjacent to the paths of said dogs, for throwing them out of such engagement at the end of such stroke.

7. An expansive-fluid motor, comprising a
90 cylinder and a piston adapted to reciprocate therein under the action of the expansive fluid; an endless chain, and two wheels which the chain connects; a rod reciprocated by the piston, having pivoted to it a dog adapted to
95 engage the chain in the movement of the rod in one direction; a cam at one end of the path of the dog to throw it into engagement with the chain, and a cam at the opposite end to throw it out of such engagement; a spring
100 whose tension is exerted toward the pivot of the dog, the dog being constructed to receive the pressure of such spring at a point which is carried past the pivot in the movement of the dog into and out of engaged position,
105 whereby said spring tends to hold it in either position to which it is forced by the cams.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Odebolt, Iowa.

JAMES A. NORTON.

In presence of—

MELVIN SMITH,
MEL. J. SMITH.