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SNAP ACTING MECHANISM ADAPTED FOR
OPERATING VALVES OF STEAM ENGINES

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The present invention is directed to a mechanism for operating the valves of a steam engine.

In many services it is desirable to employ steam engines utilizing only reciprocating parts for the transmission of power. Examples of such devices are the duplex and triplex steam pumps which are utilized for many heavy duty services. It is conventional to provide such steam pumps with valve mechanisms whereby the longitudinal movement of one piston in its cylinder acts to operate the valve mechanism controlling the direction of flow of steam into the cylinder of another piston. The arrangement of the conventional valve mechanism causes one piston to be stationary while another piston is in operation. That is to say, in the conventional duplex type steam pumps each of the two pistons is moving only about 50% of the time, while in the triplex steam pumps each of the three pistons is moving only about 33% of the time. It is obvious that if the valve mechanism of such steam engines were arranged to allow each of the pistons to remain in motion approximately 100% of the time, the capacity of the pumps would be greatly increased; under such circumstances the capacity of a duplex pump would be approximately doubled while that of a triplex pump would be approximately tripled. It is also apparent that the efficiency of such engines would be substantially increased due to the elimination of steam condensation which takes place in the cylinder during the intervals the piston is not in motion.

It is an object of the present invention to devise a valve mechanism adapted for use in a steam engine provided with a piston arranged for reciprocating in a cylinder whereby the reciprocating motion of the piston operates the valve controlling the direction of flow of steam into the cylinder in which said piston reciprocates.

More specifically, it is an object of the present invention to provide a mechanism for operating the valves controlling the flow of steam into a cylinder which alters rapidly the setting of the steam valves as the piston reciprocating on said cylinder nears the end of each stroke.

The device of the present invention allows each piston of the steam engine to which it is applied to operate substantially continuously and so substantially increases the capacity of the pump over the capacity of the conventional duplex type and triplex type steam pumps. The device of the present invention also substantially reduces the steam consumption which takes place in the conventional duplex and triplex type steam pumps during the intervals the pistons are stationary.

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As another advantage, a steam engine having a plurality of cylinders may be arranged so that each piston may operate independently; if the steam engine is arranged to operate a pump, the cylinders of the pump may be manifolded so that the pump may operate in compound or parallel or with either cylinder by itself.

The device of the present invention may be described as a mechanism adapted to be applied to a steam engine provided with a piston operating in a cylinder, a valve rod, and valves carried by the valve rod for controlling the entry of steam into the cylinder, the mechanism involving a means for storing energy during the major portion of each stroke of the piston and suddenly releasing the energy to move the valve rod as the piston approaches the end of each stroke to change the setting of the valve whereby the direction of flow of steam into the cylinder is reversed.

The device may be further described as involving a spring for storing energy, a linkage for supplying energy to the spring by the piston, a holding means for preventing the dissipation of the energy during the major portion of the stroke of the piston, and a release mechanism for suddenly releasing the energy at the end of the stroke of the piston to change the position of the steam valve which controls the direction of flow of steam into the piston cylinder. In other words, the device may be described as a snap-acting valve mechanism which is operated by the reciprocating motion of a piston and operates the valve controlling the direction of flow of steam into the cylinder in which the piston reciprocates.

Other objects and advantages of the present invention may be seen from the following description taken with the drawing in which—

Fig. 1 is an elevation, partly in section, of an embodiment of the present invention, and

Fig. 2 is a view taken along the line II—II of Fig. 1.

The principal elements of the mechanism of the present invention are designated by letters and the remaining portions are designated by figures.

In the figure it will be seen that springs A and A' serve as the means for storing up energy to operate the mechanism. These springs are mounted on longitudinally movable rod B which has one end attached to valve C and serves to operate said valve. Lever arms D and D' serve to transmit energy from piston rod E to the springs A and A', respectively. During the major portion of the stroke of piston rod E a holding

means F prevents motion of rod B and allows either spring A or spring A' to store up energy. As the piston rod approaches the end of its stroke, the holding means is released by contact with releasing means G.

Considering now the drawing in detail, the body 11 of a steam pump defines a steam cylinder having an inner wall 12 in which piston 13 is arranged to reciprocate. Secured to the piston is piston rod E which passes through a suitable packing means comprising a packing gland 15 and a follower 16 mounted on the cylinder head 17 of the pump. The body 11 of the steam pump defines a conventional steam inlet and outlet passages arranged to be controlled by suitable valves; these passages and valves are not shown in detail. A portion of the passages is shown which defines the inner wall 18 of a cylindrical passage in which valve C is arranged to reciprocate, while a single valve C is shown by way of representing the plurality of valves with which the engine is provided. Rod B is secured to valve C and passes through the head of the steam pump through a packing means comprising packing gland 20 and follower 21.

The rod B is shaped to define cylindrical shoulders 22 and 22' which serve to limit the movement outwardly along rod B of springs A and A', respectively. Rod B also defines a rectangular section or shoulder 23 which is arranged to cooperate with holding means F. In addition, rod B defines a pair of spaced rectangular sections 24 and 24'. Slidably mounted on rod B is an outside pair of downwardly extending means 25 and 25' and an inner pair of downwardly extending members 26 and 26'. Pairs of members 25, 25' and 26, 26' serve as support means for releasing member G.

Releasing member G consists of a rod 27 which is supported by downwardly extending members 25, 25' and 26, 26' and is slidable therein. Mounted on rod 27 are upwardly projecting lugs 28 and 28' defining cam surfaces 29 and 29', respectively. At the right-hand end of rod 27 is a shoulder 30 which is of such dimension that it may engage with downwardly extending member 25 and similarly the left-hand end of rod 27 terminates in shoulder 30' which is of such dimension that it may be engaged with downwardly extending member 25.

The frame of the steam pump is designated by numeral 31. The upper ends of elongated arms D and D' are pivoted to the engine frame by means of rod members 32 and 32', respectively. These arm members are arranged so that the lower end of D may be engaged with upwardly projecting lug 33 which is secured to piston rod E and similarly arm D' may be engaged with lug 30' secured to piston rod E.

A link 34 has one end pivoted to arm D and the other end pivoted to member 25 and similarly link 34' has one end pivoted to arm D' and the other end pivoted to member 25'.

The holding means F of the device consists of a cam roller 35 mounted for rotation on member 36. Member 36 in turn is mounted on frame 31 of the steam pump by suitable means which allows the cam roller to be moved through an arc on a horizontally extending axis. The mounting means shown in the drawing includes lugs 37 and 37' which are provided with suitable holes for receiving a horizontally extending pin 38 which engages a corresponding passage in member 36.

The device shown is arranged so that rod B is

held against longitudinal movement during the major portion of the stroke of the piston while one of the arms D or D' engages with a corresponding lug 33 or 33' of the piston rod and causes either spring A or A' to be compressed. As the piston rod approaches the end of its stroke, rod 27 is moved to cause either cam surface 29 or 29' to engage with cam roller 35 of releasing means; this causes the cam roller to be moved upwardly and disengages it from contact with shoulder 23 or rod B. As soon as the cam roller is disengaged from shoulder 23 the energy stored up either in spring A or A' is released and drives valve C; this, in turn, alters the direction of flow of steam into the cylinder of the engine and starts the piston of the engine on its return stroke.

The device is shown in the drawing as in the position assumed as the piston approaches the end of its stroke to the right. It will be evident that as the piston was moved to the right, lug 33 engages the lower end of lever arm D and this motion was transmitted through link 34 to member 25 thereby compressing spring A; as the spring A was compressed, movement of rod B to the right was prevented by the engagement of shoulder 23 with cam roller 32. As the piston completes its movement to the right, it will be apparent that member 25 will engage shoulder 30 of rod 27 and this, in turn, will cause cam surface 29' of lug 28' to move cam roller 35 upwardly away from rod B, thereby disengaging roller 32 from shoulder 23. This, in turn, releases rod B whereby the stored up energy in spring A will be released to push rod B and valve C to the right to reverse the direction of flow of steam into the cylinder 12 of the engine. As soon as valve C is moved to the right to change the direction of flow of steam into the cylinder 12 the cam roller 32 drops downwardly and since shoulder 23 has now moved to the right thereof the cam roller engages with shoulder 23 to hold rod B against longitudinal movement to the left. When the direction of motion of the piston is reversed, the lug 33' of piston rod E will engage with the lower end of pivoted arm D' and on the return stroke energy will be stored in spring A'. As the piston rod E approaches the end of its return stroke, the cam surface 29' of releasing means G will be forced into contact with cam roller 35 and force the cam roller upwardly to release rod B so that the stored up energy in spring A' may be released to force valve C to the left; this movement brings the valve C into the position as shown in the drawing and the pump is in position to begin a new stroke to the right.

It will be seen that I have disclosed a method for operating a steam engine having a piston and piston rod with valves controlling the direction of the flow of steam driving the piston and carried by valve rod, the method including the step of building up a pressure extraneous of the engine by movement of the piston rod and suddenly applying the pressure longitudinally of the valve rod at the end of the stroke of the piston to change the valve setting thereby reversing the direction of flow of steam into the engine.

It will also be seen that I have disclosed a valve operating mechanism for application to a steam engine having a power piston and valves carried by a longitudinally movable valve rod for controlling the inlet and exhaust valves of the engine, the valve operating mechanism providing a means for storing up energy during the major portion of the stroke of the power piston and for suddenly releasing the energy at a prede-

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terminated point near the end of the piston stroke whereby the released energy is utilized to operate the inlet and exhaust valves of the engine.

Having fully described and illustrated the practice of the present invention, what is desired to be claimed as new and useful and to be secured by Letters Patent is:

1. In a steam engine having a piston and a piston rod and valves covering the inlet and exhaust ports carried by a valve rod, a pair of spaced springs mounted on the valve rod, a cam roller adapted to assume a first position to engage with said valve rod and lock it against longitudinal movement and to assume a second position to release the valve rod for longitudinal movement, a first linkage arranged to compress one of the springs when the piston rod is moving in a first direction, a second linkage arranged to compress the second spring when the piston rod is moving in the opposite direction, a pair of cam surfaces longitudinally movable with respect to the valve rod mechanically connected to said first and second linkages whereby one of the cam surfaces moves the cam roller from its first to its second position as the piston rod is at a predetermined point near the end of its stroke in the first direction and the second cam surface engages the cam roller to move it from its first to its second position as the piston rod is at a predetermined point near the end of its stroke in the opposite direction.

2. In a steam engine having a piston and a piston rod and valves for covering the inlet and exhaust ports carried by a valve rod, a first and second spring mounted on the valve rod, a first shoulder mounted on the valve rod and arranged to engage with an end of the first spring to prevent movement thereof toward the outer end of said rod, a second shoulder mounted on the valve rod and adapted to engage with an end of the second spring to prevent movement thereof toward the opposite end of the valve rod, a cam

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roller mounted on the frame of the engine and adapted to assume a first position and a second position, a third shoulder carried by the valve rod and arranged to engage with the cam roller when the cam roller is in its first position and would be disengaged from the cam roller when the cam roller is in its second position, a rod having its axis parallel with said valve rod, mounting means arranged to hold said rod with its axis parallel to the valve rod and longitudinally movable, a lug carried by the rod defining a first cam surface adapted to engage with the cam roller and move the cam roller from its first to its second position as the rod is moved in a first direction, a second lug mounted on the rod defining the second cam surface adapted to engage with the cam roller and move it from its first to its second position as the rod is moved in a second direction, a lever arm pivoted to the engine frame and arranged to cooperate with the piston rod to move therewith as the piston rod moves in a first direction, a linkage connected to said lever arm arranged to compress the first spring and to move the first cam surface as the piston rod moves in its first direction, a second lever arm pivoted to the engine frame, a linkage connected with said second lever arm and arranged to compress the second spring and move the second cam surface from its first to its second position as the piston rod moves in the second direction.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
953,993	Forbes	Apr. 5, 1910
1,506,929	Harrison	Sept. 2, 1924