Feb. 24, 1953 G. F. McCLAY 2,629,363

RECIPROCATORY ENGINE

Filed Dec. 22, 1949

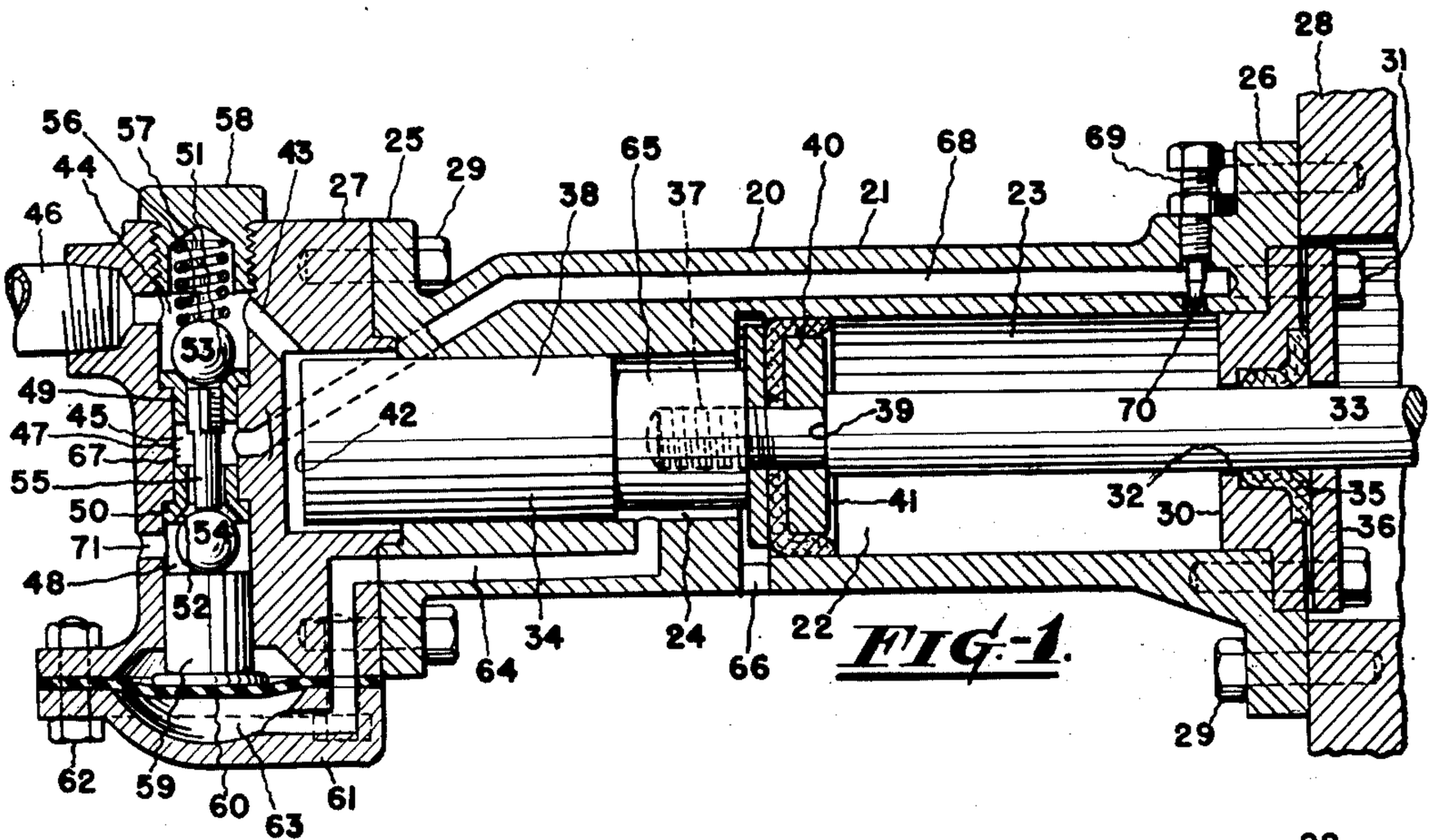

FIG.-1.

FIG.-2.

INVENTOR
GORDON F. McCLAY
BY
HIS ATTORNEY.

Patented Feb. 24, 1953

2,629,363

UNITED STATES PATENT OFFICE

2,629,363

RECIPROCATORY ENGINE

Gordon F. McClay, Lennoxville, Quebec, Canada, assignor to Ingersoll-Rand Company, New York, N. Y., a corporation of New Jersey

Application December 22, 1949, Serial No. 134,440

2 Claims. (Cl. 121—27)

1

This invention relates to engines, and more particularly to a pressure fluid actuated engine of the reciprocatory piston type.

The engine, constructed in accordance with the practice of the invention, is intended more particularly for use with an apparatus, or device, that is required to operate normally at a definitely rated speed and which speed may occasionally require variation. An example of such a device is that of a spray pipe serving to dislodge matter clinging to the screens used in the production of paper pulp.

In arrangements of this type, a pipe equipped with spray nozzles is caused to oscillate across the surface of the screen and the jets of water issuing from the nozzles are directed toward the screen to loosen and wash away the clogging matter. Owing to the importance of preventing the undue dilution of the paper pulp at some of the stages of its manufacture, it is essential that the movements of the spray pipe be so regulated as to effect a miximum flushing action with a minimum amount of spray, and it is, therefore, desirable that the stroke of the engine be variable in order that concentrations of blocking material may be quickly removed and that when the screen has been cleansed the speed of the engine may again be quickly and conveniently adjusted for normal operation.

It is accordingly an object of the invention to enable the speed of the engine to be conveniently and quickly varied in accordance with immediate requirements.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figures 1 and 2 are longitudinal views, partly broken away, showing the movable parts of the engine in opposite hand limiting positions.

Referring more particularly to the drawings, the engine designated **20**, in its entirety, comprises a cylinder **21** which is recessed to form a piston chamber **22** consisting of a large bore **23** and a reduced bore **24** that opens at one end into the large bore **23**. At the opposite ends of the cylinder **21** are external flanges **25** and **26** that respectively abut a head **27** and a support **28** and are secured to these parts by bolts **29**.

A closure is provided for the outer end of the large bore **23** adjacent the support **28** by a head **30** which is secured to the cylinder **21** by bolts **31** and has a bore **32** to receive the rod **33** of a piston **34** reciprocable in the piston chamber **22**. Only a fragmentary portion of the rod **33** is shown projecting exteriorly of the head **30** but it is to be understood that it may be of any suitable length and terminal construction for attachment to a device or apparatus (not shown) intended

2

to be actuated. The head **30** is recessed to receive a packing member **35** that encircles the rod **33** to prevent leakage of fluid from the piston chamber and said packing member is retained in position by a plate **36** overlying the outer end of the head **30** and held in assembled position by the bolts **31**.

The rod **33** is separable from the piston **34** and has, to this end, a stem **37** threaded into the small portion or stem **38** of the piston lying within the bore **24**. At the juncture of the stem **37** and the body of the rod **33** is a shoulder **39** that bears against the portion, or head, **40** of the piston lying within the large bore **23** for pressing said head against the end of the portion **38**.

The outer end of the head **40** constitutes a pressure surface **41** that is intermittently subjected to pressure fluid for actuating the piston in the direction of the head **27** and the free end of the stem **38** of the piston serves as a pressure surface **42** that is constantly subjected to pressure fluid conveyed thereto by a passage **43** leading from an end portion **44** of a valve chamber **45** which is in constant communication, at said end portion, with a source of pressure fluid supply (not shown) through a conduit **46**.

The valve chamber **45** extends transversely of the head **27**. Its intermediate portion **47** is of reduced diameter and opens at one end into the end portion **44** and at its opposite end into a similar end portion **48**. The ends of the portion **47** of the valve chamber contain bushings **49** and **50** having beveled seats **51** and **52**, respectively, for ball valves **53** and **54**, and between the valves **53** and **54** is a spacer in the form of a rod **55** which is movable endwise in the bushings **49** and **50** and of a length to prevent the valves from engaging their seats simultaneously.

The ball valve **53** is normally held on the seating surface **51** by the pressure fluid in the end portion **44** acting against an actuating surface **56** of said valve. Such pressure is augmented by a spring **57** that seats at one end against the valve **53** and at its other end against a closure **58** for the adjacent end of the valve chamber.

The force serving to lift the valve **53** off of its seat and press the valve **54** against the seating surface **52** is imparted thereto by a plunger **59** slidable in the portion **48** of the valve chamber and seating at one end against the valve **54**. The opposite end of the plunger **59** rests upon a diaphragm **60** which is clamped, at its marginal portion, to the head **27** by a cover **61** and bolts **62**, and in the cover is a chamber **63** into which pressure fluid is intermittently conveyed by a passage **64** in the head **27** and the cylinder **21**.

The passage **64** opens into the small bore **24** at a point near its juncture with the large bore **23** so that the piston will uncover it immediately prior to the end of its stroke. The passage **64** also conveys exhaust fluid from the chamber **63**

and the small portion 38 of the piston is accordingly provided with an annular groove 65 adjacent the head 40 to register with the passage 64 in the opposite hand limiting position of the piston for conveying such fluid to a vent 66 at the inner end of the large bore 23.

In the form of the invention shown, the combined lengths of the bushings 49 and 50 is less than the length of the intermediate portion 47 of the valve chamber so that a space 67 exists therebetween and leading from said space is a passage 68 that extends through the head 27 and the cylinder 21 and opens into the outermost end of the large bore 23. The passage 68 serves both as a supply passage and an exhaust passage and is provided with means for varying the rate of admission to and the discharge of fluid from the bore 23. To this end a needle valve 69 is threaded into the cylinder to extend with its valve portion 70 into the passage 68 at the juncture of the latter with the bore 23. The fluid exhausted from the bore 23 returns to the space 67 and passes through the bushing 50 into the end 48 of the valve chamber whence it passes to the atmosphere through an exhaust port 71.

In the operation of the device, and assuming the movable parts of the engine to be in the positions shown in Figure 1, the pressure fluid entering the small bore 24 of the piston chamber will act against the pressure surface 42 to drive the piston in a right hand direction, as Figure 1 is viewed in the drawings. The chamber 63 will then be open to the atmosphere through the passage 64, the annular groove 65 and the vent 66 so that the spring 57 and the pressure of the fluid against the actuating surface 56 will hold the valve 53 against the seating surface 51 to prevent the flow of pressure fluid into the space 67. In the closed position of the valve 53 the rod 55 will hold the valve 54 unseated to afford communication between the space 67 and the port 71. Thus, as the piston moves rightwardly the air in advance of the head 40 will be expelled from the bore 23 through the passage 68 into the space 67, thence through the bushing 50, the end portion 48 and the port 71 to the atmosphere.

As the piston approaches the end of its stroke, in the direction described, the free end of the small portion 38 uncovers the passage 64. Pressure fluid will then flow from the small bore 24 through said passage into the chamber 63 and, acting against the plunger 59 through the diaphragm 60, will move the valve 54 against the seating surface 52 to cut-off communication between the passage 68 and the port 71. This movement of the valve 54, transmitted through the rod 55, will lift the valve 53 off of its seat. Pressure fluid will then flow from the end 44 of the valve chamber through the bushing 49, the space 67 and the passage 68 into the outer end of the large bore 23 and drive the piston leftwardly, thereby completing the cycle of operation. During this movemnt of the piston pressure fluid will be expelled from the bore 24 through the constant supply passage 43 and the pressure fluid in the chamber 63 will be retained therein until the annular groove 65 registers with the passage 64. The fluid in the chamber 63 will then escape through the passage 64, the annular groove 65 and the vent 66 to the atmosphere to permit the return of the valve 53 to its seat and the unseating of the valve 54 preparatory to a new cycle of operation.

Whenever, during the operation of the engine, it is desired to accelerate or decelerate the movement of the piston 34, the needle valve 69 may be adjusted to either increase or decrease the flow area around the valve portion 70 of the needle valve 69.

I claim:

1. A reciprocatory engine, comprising a casing having a differential bore, a reciprocatory piston in the bore having portions corresponding to the diameters of the bore, a passage in the casing to constantly admit pressure fluid into the small end of the bore, a second passage in the casing for conveying pressure fluid to and exhaust fluid from the opposite end of the bore, a valve chamber in the casing having an atmospheric vent, valve means in the valve chamber for controlling the flow of fluid to and from said second passage, a kicker passage in the casing controlled by the piston for valving pressure fluid to the valve means for throwing the valve means to a position for admitting pressure fluid into said second passage, an actuating surface on the valve means subjected constantly to pressure fluid tending to move the valve to a position for cutting-off the admission of pressure fluid to said second passage and to establish communication between said second passage and the atmospheric vent, a spring acting against the valve means to augment the pressure of the fluid acting against the actuating surface, and means for selectively controlling the rate of flow of fluid through said second passage.

2. A reciprocatory engine, comprising a casing having a differential bore and an exhaust port for the bore, a reciprocatory piston in the bore having portions corresponding to the diameters of the bore, a passage in the casing to constantly admit pressure fluid into the small portion of the bore, a valve chamber in the casing having a vent, a second passage in the casing for conveying pressure fluid from the valve chamber to the large portion of the bore and to convey exhaust fluid from said large portion to the valve chamber, reciprocatory valve means in the valve chamber, fluid actuated means for throwing the valve to a position for admitting pressure fluid into said second passage, a kicker passage in the casing for conveying pressure fluid from the small portion of the bore to the fluid actuated means and being controlled by the piston, a groove in the piston for communicating the kicker passage with the exhaust port to permit the exhaust of the fluid acting against the pressure surface, an actuating surface on the valve means subjected constantly to pressure fluid tending to move the valve means to a position for cutting-off the admission of pressure fluid to said second passage and to establish communication between said second passage and the vent, a spring to augment the pressure of the fluid against the actuating surface, and means for selectively controlling the rate of flow of fluid through said second passage.

GORDON F. McCLAY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,306,301	Chadwick	June 10, 1919
1,595,939	Hukill et al.	Aug. 10, 1926
1,737,456	Gartin	Nov. 26, 1929
1,829,246	Smith, Sr., et al.	Oct. 27, 1931
2,100,092	Tear	Nov. 23, 1937
2,302,232	MacNeil	Nov. 17, 1942