(No Model.) 2 Sheets—Sheet 1.

H. H. WESTINGHOUSE.

MEANS FOR BALANCING INERTIA OF OSCILLATING CYLINDERS.

No. 557,294. Patented Mar. 31, 1896.

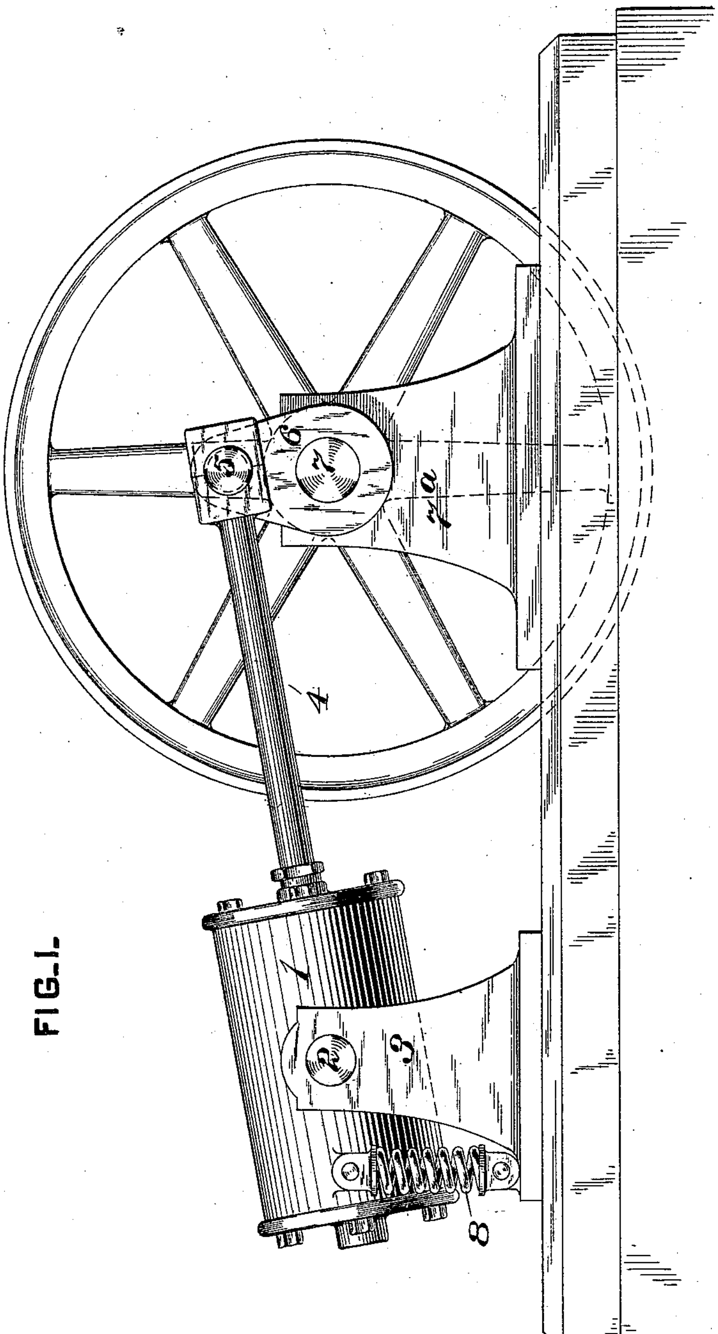

FIG. 1.

WITNESSES:
T. J. Hogan.
F. E. Gaither.

INVENTOR,
H. H. Westinghouse,
By J. Snowden Bell,
Att'y.

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.) 2 Sheets—Sheet 2.

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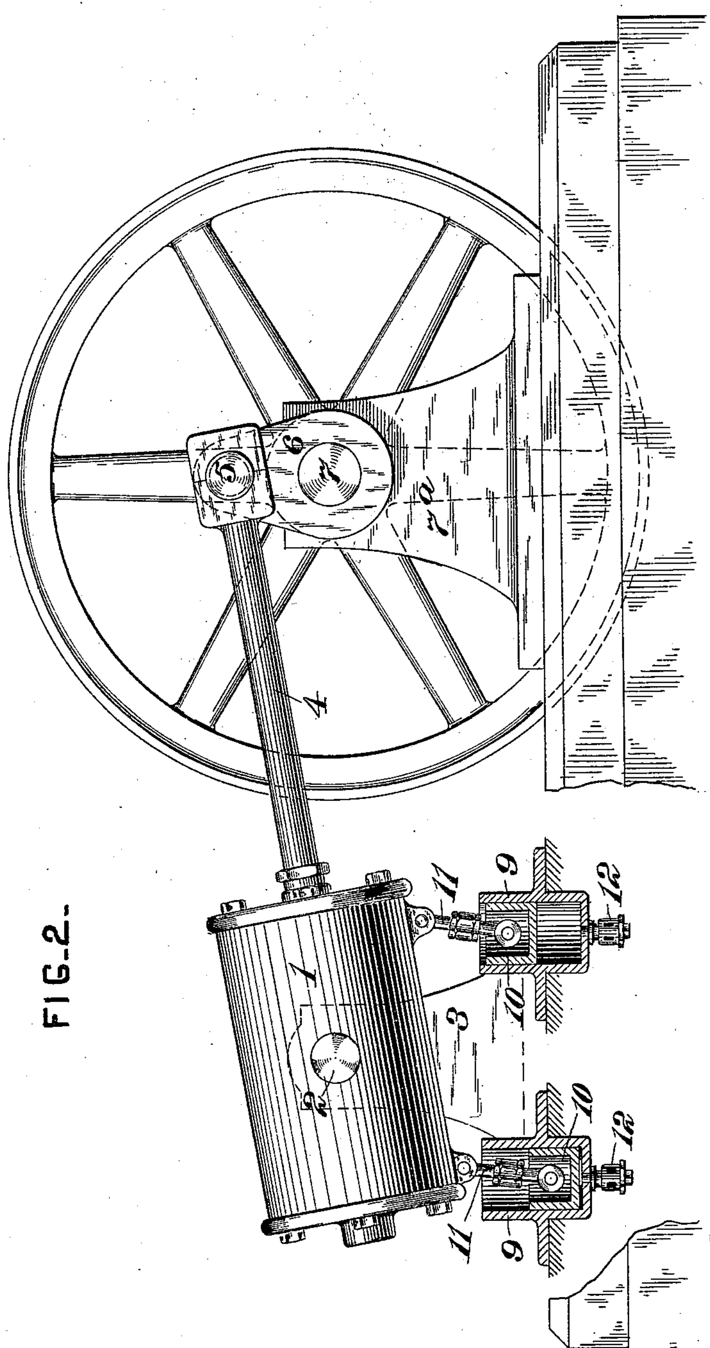

FIG. 2.

WITNESSES:

T. J. Hogan,
F. E. Gaither.

INVENTOR,

H. H. Westinghouse,
By Snowden Bell, Att'y.

UNITED STATES PATENT OFFICE.

HENRY HERMAN WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

MEANS FOR BALANCING INERTIA OF OSCILLATING CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 557,294, dated March 31, 1896.

Application filed November 20, 1894. Serial No. 529,357. (No model.)

To all whom it may concern:

Be it known that I, HENRY HERMAN WESTINGHOUSE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Means for Balancing the Inertia of Oscillating Cylinders, of which improvement the following is a specification.

The object of my invention is to provide an inertia-balance for oscillating cylinders; and to this end it consists of means whereby inertia, which tends to keep the cylinder in motion at and near the extremity of its oscillation and which resists its motion from the extremity of its oscillation toward a central position, is balanced by a force which resists the oscillating movement of the cylinder as it approaches the extremity of its oscillation and assists its movement from the extremity of its oscillation toward a central position.

In the accompanying drawings, Figure 1 is a side elevation of an oscillating cylinder and its connections, illustrating an application of my invention; and Fig. 2 a similar view showing the cylinder provided with another form of my improvement.

When an oscillating cylinder is moving toward the extremity of its oscillation in either direction inertia tends to keep it moving in that direction, and when the direction of movement changes opposes the motion in the opposite direction. The effect of inertia is, therefore, on the reversal of the movement to produce strains on the crank-pin and piston-rod and on the packing-gland of the piston-rod, and thereby to cause wear and danger of breakage, especially when the weights of the moving parts are great. It is to overcome these objectionable effects that my improvement is intended.

While I have shown the trunnions on which the cylinder oscillates located midway between the ends of the cylinder, my improvement is equally applicable to other constructions in which the trunnion or pivot is located at or near the end or to one side of the cylinder.

In the constructions shown in the drawings the cylinder 1 is provided with trunnions 2 mounted in bearings 3, whereby the cylinder is adapted to oscillate. A piston (not shown) is fitted inside of the cylinder and is provided with a piston-rod 4, which is connected at its outer end to a crank-pin 5 on a crank 6, which is fixed upon a shaft 7 journaled to rotate in bearings 7[a].

The oscillating cylinder may be employed as part of a pump or compressor or fluid-motor, so that motion may be transmitted from the shaft 7, through the crank 6, pin 5, and rod 4, to the piston within the cylinder, and thereby cause the cylinder to oscillate; or the piston may be caused by fluid-pressure to reciprocate within the cylinder and to transmit motion to the shaft 7, through the piston-rod, crank-pin, and crank, and thereby oscillate the cylinder. In either case, when the crank is at its dead-points the cylinder will occupy a central position with its axis in line with the extension of the axis of the shaft, and as the crank moves away from either dead-point the cylinder will be oscillated in one direction or the other until the crank reaches a position about midway between its dead-points, when the motion of the cylinder will be reversed and the cylinder will oscillate in the opposite direction until the crank is near its middle position on the opposite side of the shaft, when the motion of the cylinder will again be reversed.

In the constructions shown in the drawings I employ means whereby a gradually-increasing resistance is opposed to the movement of the cylinder from its central position to the limit of its oscillation, and when the direction of the movement is reversed a gradually-decreasing force assists the return movement of the cylinder toward its central position. The force by which the return movement is assisted may act during the whole of the movement from the end of the oscillation to the central position, or it may act during a portion only of that movement; but it does not act after the cylinder has reached the central position. When the cylinder has reached the central position and is continuing its movement toward the other end of its oscillation, its movement is again resisted until it reaches the end of its oscillation, and its return movement is assisted during the whole or a part of its movement toward the central position.

In the construction shown in Fig. 1 of the drawings a spring 8 is pivoted at one end to the bearing 3 or other stationary part and at its other end to the cylinder 1 and is so adjusted that when the cylinder is in its central position the spring exerts no force tending to move it in either direction; but when the cylinder is being moved into the position shown in the drawings the spring is compressed and resists the movement of the cylinder into that position with a gradually-increasing force, which reaches a maximum when the cylinder is at the end of its oscillation, and as the cylinder returns toward its central position the movement is assisted by the spring with a gradually-decreasing force. When the cylinder in its return movement passes the central position and moves toward the other extremity of its oscillation, the spring 8 is extended or stretched and resists the movement with increasing force until the end of the oscillation is reached, when it assists the return movement with a gradually-decreasing force. The effect of the spring is to balance the inertia which tends to keep the cylinder moving as it approaches the end of its oscillation and also the inertia which tends to resist the return movement at the beginning of the oscillation, both of which are greatest at the extremity of the oscillation and at that point in the movement cause the objectionable strains already referred to.

In the construction shown in Fig. 2 the cylinder 1 is provided at each end with a dash-pot 9 and a plunger 10, the plungers being connected to the cylinder 1 by means of adjustable links 11. The dash-pot is provided at its lower end with a valve 12 for the admission of air, which may be kept closed or partially open during the operation of the machine, of which the cylinder 1 forms a part. The plungers 10 are fitted so as to work air-tight in the cylinders 9, and the cylinders 9 are fixed to the frame or other stationary part of the engine.

When the cylinder 1 is in the central position, each of the plungers 10 will be at the middle of its stroke and the air confined in the cylinders 9 will have the same pressure as the atmosphere, so that it will have no tendency to move the cylinder 1 in either direction. When the cylinder 1 is oscillated to one side of the central position, as shown in Fig. 2, the air in one of the dash-pots will be compressed and the air in the other dash-pot will be expanded, so that the motion of the cylinder 1 will be resisted by the movement of both plungers. The principal resistance will be that due to the compression of the air in one of the cylinders 10. In the cylinder in which the air is expanded the motion of the plunger will be resisted by the excess of atmospheric pressure acting on the outside of the plunger above the pressure of the expanded air.

The resistance to the motion of the cylinder 1 will, as in the instance first described, increase as the cylinder 1 approaches the end of its oscillation; and the return movement will be assisted principally by the expansion of the compressed air in one of the dash-pots and to a less degree by the excess of atmospheric pressure over the expanded air in the other dash-pot.

If preferred, instead of employing a single spring, as shown in Fig. 1, two or more springs may be employed at one end only of the cylinder, or one or more springs may be employed at each end, and instead of employing a single dash-pot at each end of the main cylinder, as shown in Fig. 2, a number may be employed at each end or the dash-pots may be connected to one end only and arranged to compress air by the opposite movements of the main cylinder.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, with an oscillating cylinder, of means connecting the cylinder with a fixed bearing for balancing the inertia of the cylinder at and near the end of its oscillation, substantially as set forth.

2. The combination, with an oscillating cylinder, of means connected, substantially as shown, with the cylinder whereby the movement of the cylinder as it approaches the end of an oscillation is resisted, and its movement at the beginning of an oscillation is assisted, substantially as set forth.

3. The combination, with an oscillating cylinder, of means, substantially as shown, whereby the movement of the cylinder from its central position to the end of an oscillation is resisted with a gradually-increasing force, and its movement from the end of an oscillation to its central position is assisted by a gradually-decreasing force, substantially as set forth.

4. The combination, with an oscillating cylinder, of a spring or cushion coupled to the cylinder and interposing a yielding resistance between said cylinder and a fixed bearing, substantially as set forth.

In testimony whereof I have hereunto set my hand.

HENRY HERMAN WESTINGHOUSE.

Witnesses:
T. J. HOGAN,
F. E. GAITHER.