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W. C. BROWN.

COMPENSATING DIRECT ACTING ENGINE.

APPLICATION FILED SEPT. 7, 1904.

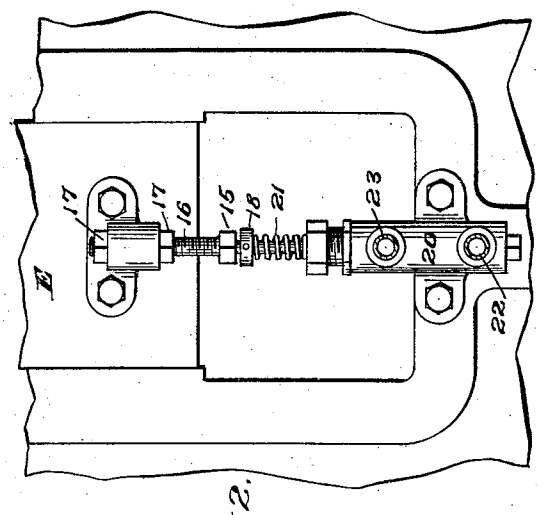

Fig. 2.

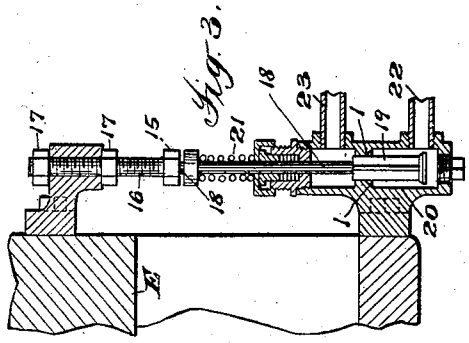

Fig. 3.

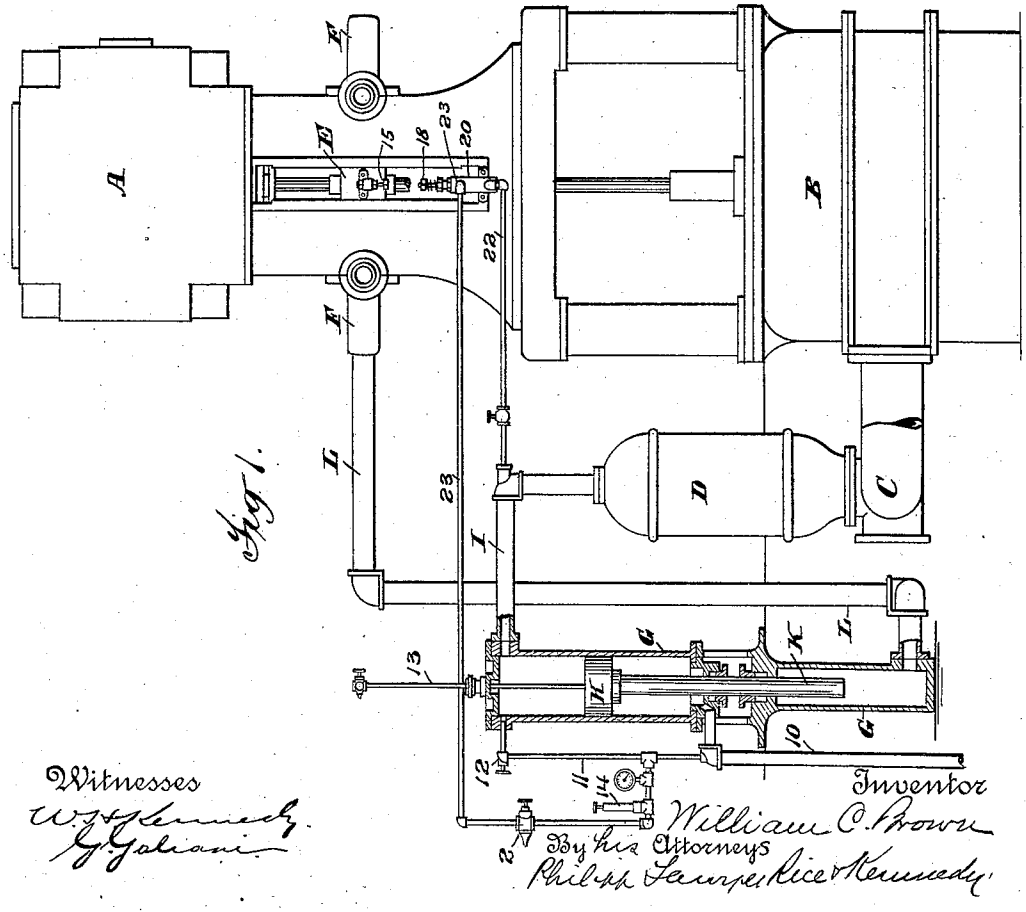

Fig. 1.

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UNITED STATES PATENT OFFICE.

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COMPENSATING DIRECT-ACTING ENGINE.

No. 846,005. Specification of Letters Patent. Patented March 5, 1907.

Application filed September 7, 1904. Serial No. 223,576.

To all whom it may concern:

Be it known that I, WILLIAM C. BROWN, a citizen of the United States, residing at Prescott, Province of Ontario, Dominion of Canada, have invented certain new and useful Improvements in Compensating Direct-Acting Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates generally to that class of direct-acting engines which are provided with one or more compensating or auxiliary cylinders and pistons which are supplied with a suitable motor fluid and are arranged to act in opposition to the main piston or pistons during the first part of the stroke of the engine and in conjunction therewith during the last part of the stroke, thereby permitting the admission of the steam to the main cylinder or cylinders to be cut off before the stroke is completed while maintaining the proper power of the engine. Such compensating direct-acting engines are well known and different forms are shown and described in various United States Letters Patent. In such compensating direct-acting engines the pump is liable to make too long or too short a stroke under the varying conditions of use; and the object of the present invention is to provide suitable means for automatically regulating or adjusting the compensating pressure so as to maintain a practically constant stroke of the engine.

The invention may be applied to compensating engines employing an accumulator between the compensating cylinders and source of compensating pressure or to engines in which no such accumulator is employed; but certain specific features of the invention relate to constructions employing such accumulators, and the invention will be illustrated and described in connection with such a construction.

For a full understanding of the invention a detailed description of a construction embodying the same in its preferred form will now be given, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a diagrammatic side elevation of a vertical pumping-engine embodying all the features of the invention in their preferred form. Fig. 2 is a detail outside view of the tappet and regulating-valve, with the latter opened by the tappet. Fig. 3 is a vertical section of the parts shown in Fig. 2.

Referring to said drawings, A is the steam-cylinder; B, the pump-cylinder; C, the force-main; D, the air-chamber on the force-main; E, the engine cross-head; F, the compensating cylinders having their pistons connected to the cross-head, and G the accumulator connected on one side of its piston H to the air-chamber D by pipe I and transmitting pressure to the compensating cylinders F from its smaller piston K through pipe L.

The accumulator is shown as of a well-known construction substantially the same as shown in United States Letters Patent Nos. 455,935 and 628,511 except for the persent invention, the effective pressure of the piston H being adjusted by admitting compressed air from an air-tank through pipe 10 to the under side of the piston H and this pipe 10 being connected by pipe 11, controlled by cock 12 with the air-chamber at the upper end of the cylinder G for the supply of air to the air-tank as desired. The usual gage and blow-off pipe 13 and safety-valve 14 are shown. All the construction thus far described is old and may be of any other common or suitable form.

Referring now to the features added for the embodiment of the present invention, the cross-head E carries a tappet 15, which is preferably made adjustable, as shown, by screw 16 and set-nuts 17, and this tappet engages the upper end or the head of valve-rod 18, carrying valve 19, which is seated upon seat 1 in valve-chamber 20 by spring 21 when not engaged by the tappet 15. The valve-chamber 20 has below the valve-seat 1 an inlet-pipe 22, connecting with pipe I, so as to admit air from the air-chamber D to the valve-chamber 20, and above the valve-seat 1 a pipe 23, connecting with pipe 11, and thus through pipe 10 with the space below the accumulator-piston H. When the valve 19 is forced off the seat 1 against the pressure of spring 21 by tappet 15 engaging the head of valve-rod 18, therefore air from the air-chamber D passes through pipe 22, the valve-chamber, and pipe 23 to the lower side of piston H, and thus increases the pressure on the lower side of the piston H and decreases the effective pressure tending to force the piston H dowward, so as to lessen the pres-

sure in the lower chamber of the accumulator in which piston K moves, and consequently the accumulator-pressure. The amount of air that thus passes from the air-chamber D to the accumulator-cylinder below piston H when the valve is opened by the tappet depends upon the length of time the valve 19 is open, which obviously depends upon the distance the valve is moved by the tappet or upon the length of the engine-stroke.

Leakage from the back-pressure system—that is, the system supplying pressure on the back or lower side of piston H and tending to lower the compensating pressure—is provided so as to gradually reduce the back pressure in case the tappet does not open the valve 19, this result being secured in the construction shown by an adjustable needle-valve 2 on pipe 23, which permits a small constant leakage of air and by which the amount of such leakage may be adjusted. The safety-valve 14 is set so as to blow off at the desired point and prevent the back pressure rising too high in case of an excess admission of air through pipe 23.

The operation of the construction will be understood from a brief description in connection with the drawings. The tappet 15 engages the valve-rod 18 and opens the valve 19 at the end of each stroke of full length in one direction, so as to admit air from air-chamber D to the back-pressure system. The tappet 15 and the valve 2 are so adjusted that on the normal stroke of the engine the valve 19 is opened by the tappet only for such a time as to compensate for the leakage from the back-pressure system through valve 2, and thus maintain a uniform load on the accumulator-cylinders F, or if the stroke be too long the valve 19 will be open for a longer time and more air admitted to the back-pressure system, with the result that the pressure in the back-pressure system is increased and the compensating-cylinder load slightly reduced, which will tend to shorten the stroke of the engine and gradually bring the engine back to normal stroke. When by reason of shortened stroke the tappet fails to open the valve 19, the pressure of air in the back-pressure system drops gradually on account of the leak through the valve 2, and as the back pressure decreases the compensating-cylinder load increases and the stroke is gradually lengthened. By adjusting the taptpe 15 and the valve 2 a practically-constant stroke of the engine may readily be secured.

It will be understood that the invention is not limited to the particular arrangement or construction of engine and compensating system shown nor to the particular devices shown for adjusting the compensating pressure, but that the invention as defined by the claims may be embodied in constructions of widely-different forms.

What I claim is—

1. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, means for applying motor fluid in opposition to the working pressure for adjusting the compensating-cylinder pressure, and means controlled by the length of the engine-stroke for varying the relative working and opposing pressures to vary the compensating-cylinder pressure.

2. The combination with a direct-acting engine, of one or more compensating-cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, and means controlled by the length of the engine-stroke for admitting fluid to the compensating system in opposition to the working pressure to vary the compensating-cylinder pressure.

3. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, means controlled by the length of the engine-stroke for admitting fluid to the compensating system at each stroke of the engine of normal or greater length, and an outlet from the system for the constant escape of fluid from the compensating system.

4. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, means controlled by the length of the engine-stroke for admitting fluid to the compensating system in opposition to the working pressure at each stroke of the engine of normal or greater length, and an outlet from the system for the escape of fluid to lessen the opposition to the working pressure.

5. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, an accumulator through which said compensating cylinder derives its pressure, and means controlled by the length of the engine-stroke for admitting fluid to said accumulator in opposition to the working pressure to vary the compensating-cylinder pressure.

6. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the

stroke and in conjunction therewith during the last part of its stroke, an accumulator through which said compensating cylinder derives its pressure, a pipe for admitting fluid to said accumulator in opposition to the working pressure, an outlet permitting a constant escape of fluid from the back-pressure system, and a valve opened by the main piston on each stroke of normal or full length for admitting air to the back-pressure system.

7. The combination with a direct-acting engine, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, an accumulator through which said compensating cylinder derives its pressure, a pipe for admitting fluid to said accumulator in opposition to the working pressure, an outlet permitting a constant escape of fluid from the back-pressure system, a tappet moving with the engine-piston, and a valve engaged by said tappet on each stroke of normal or full length to open the valve for the admission of air to the back-pressure system.

8. The combination with a direct-acting pumping-engine and its air-chamber on the force-main, of one or more compensating cylinders and pistons acting in opposition to the engine-piston during the first part of the stroke and in conjunction therewith during the last part of its stroke, an accumulator through which said compensating cylinder derives its pressure from the air-chamber, a pipe for admitting fluid to said accumulator in opposition to the working pressure, an outlet permitting a constant escape of fluid from the back-pressure system, a tappet moving with the engine-piston, and a valve engaged by said tappet on each stroke of norma or full length to open the valve for the admission of air to the back-pressure system.

9. The combination with a direct-acting engine and its compensating cylinder or cylinders and accumulator, of pipe 23 connecting the back-pressure side of the accumulator-piston with a source of pressure fluid, and a valve controlling said pipe and controlled by the length of stroke of the engine-piston.

10. The combination with a direct-acting engine and its compensating cylinder or cylinders and accumulator, of pipe 23 connecting the back-pressure side of the accumulator-piston with a source of pressure fluid, an adjustable outlet permitting a constant escape of fluid from said pipe, a valve controlling said pipe, and adjustable means moving with the engine-piston for admitting fluid through said pipe at each normal or longer stroke of the piston.

11. The combination with a direct-acting engine and its compensating system, of a valve for admitting fluid to the compensating system to vary the compensating pressure, and means moving with the engine-piston for actuating said valve.

12. The combination with a direct-acting engine and its compensating system, of an outlet permitting the constant escape of fluid from the compensating system, a valve for admitting fluid to the compensating system to vary the compensating pressure, and means moving with the engine-piston for opening said valve for the admission of fluid.

13. The combination with a direct-acting engine, of a compensating piston acting in opposition to the movement of the engine-piston during one part of the stroke and in conjunction therewith during another part of the stroke, means for applying motor fluid in opposition to the working pressure for adjusting the compensating-cylinder pressure, and means controlled by the length of the engine-stroke for transferring fluid from the working-pressure fluid to the fluid opposing the working pressure to vary the compensating-cylinder pressure.

14. The combination with a direct-acting engine, of a compensating cylinder having a piston acting in opposition to the movement of the engine-piston during one part of the stroke and in conjunction therewith during another part of the stroke, means controlled by the length of the engine-stroke for transferring fluid from the working-pressure fluid to a supply of fluid working in opposition to the working pressure at each stroke of the engine of uniform or greater length, and an outlet from the system for the escape of fluid to lessen the opposition to the working pressure.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM C. BROWN.

Witnesses:
J. A. GRAVES,
W. H. KENNEDY.