

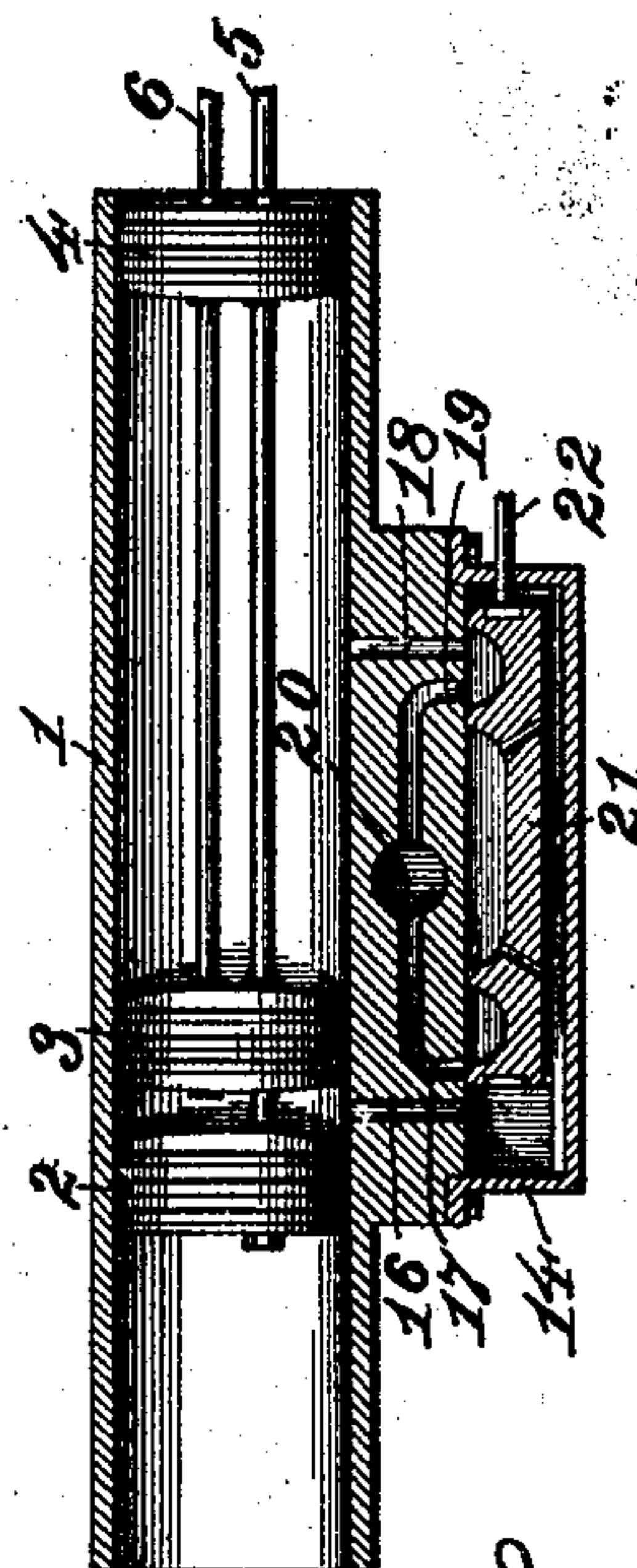
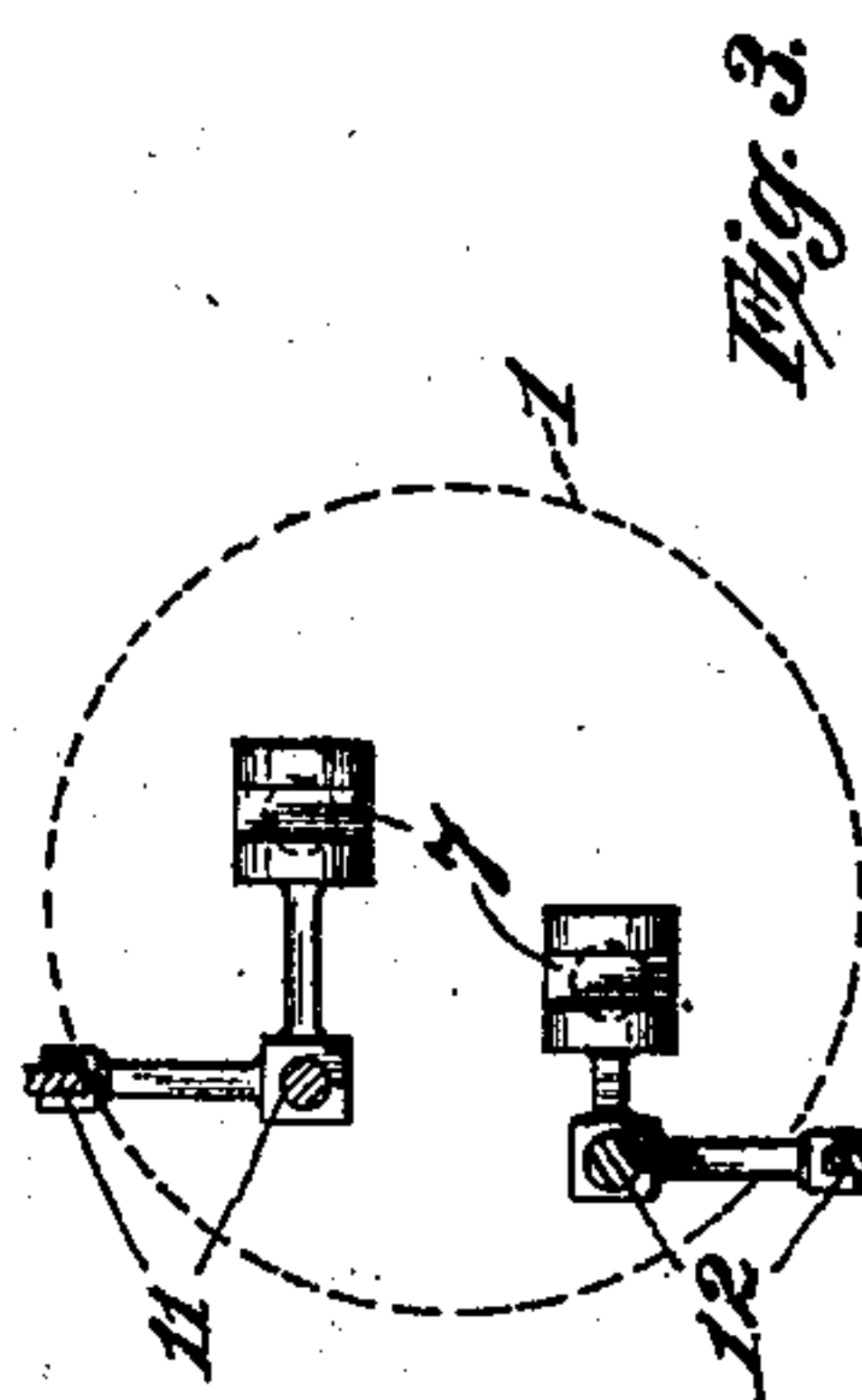
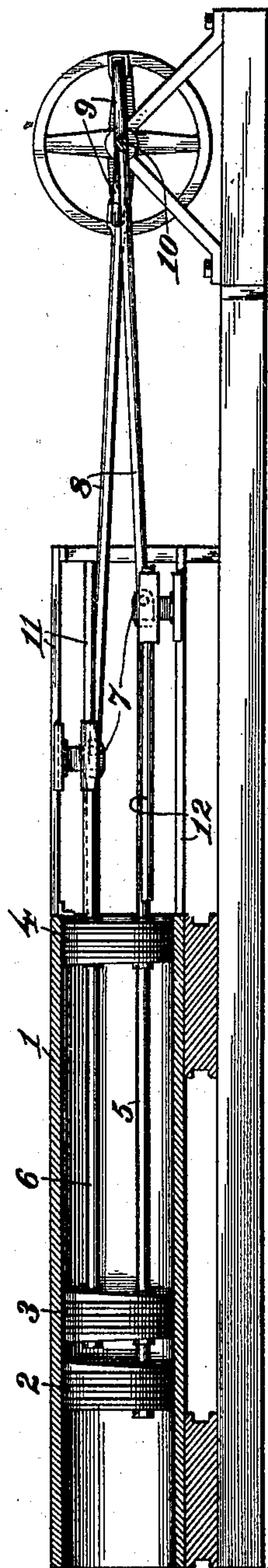
No. 815,185.

PATENTED MAR. 13, 1906.

J. LINDBERG.
STEAM ENGINE.

APPLICATION FILED JULY 5, 1904.

2 SHEETS--SHEET 1.



WITNESSES:

Agood H. Dowell
G. A. Brereton

Johan Kinding
INVENTOR

BY  **ATTORNEY**

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Fig. 4.

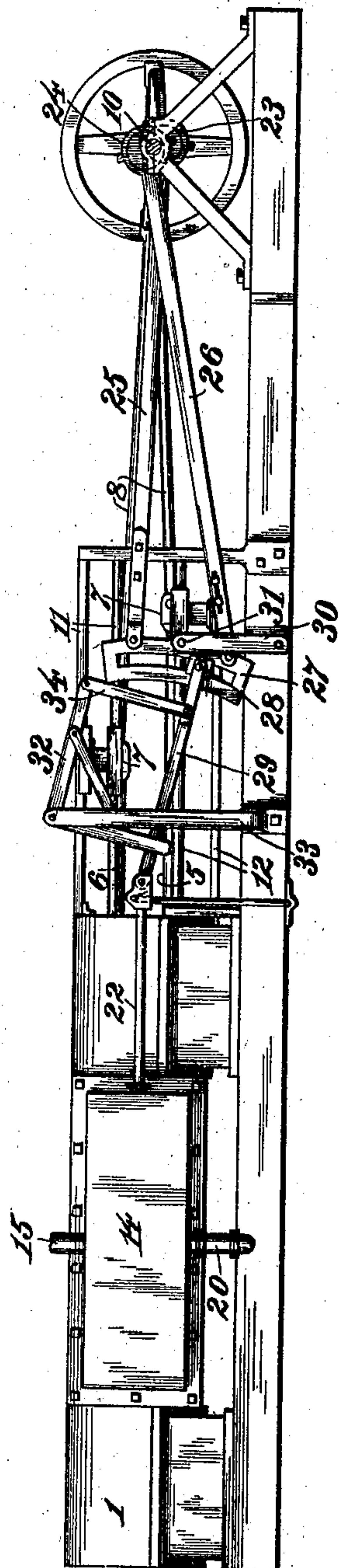
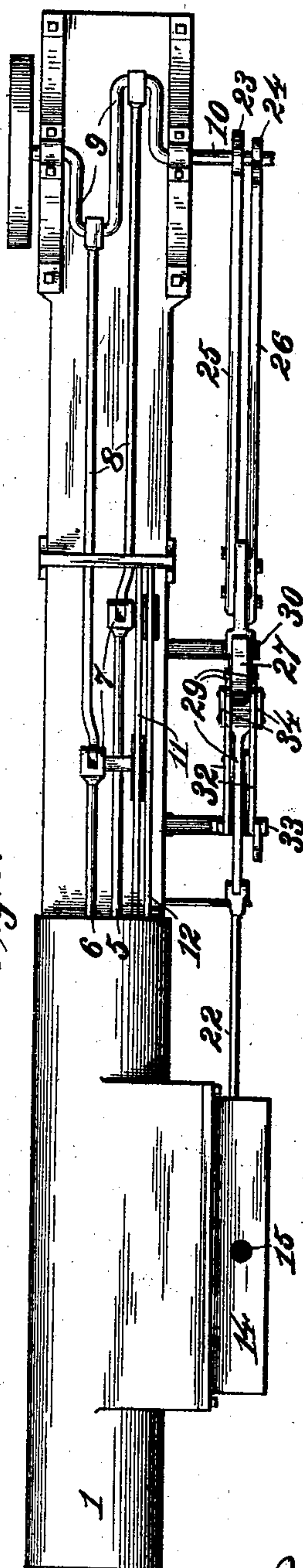


Fig. 5.



WITNESSES:

Alfred H. Howell
G. A. Breerton

Johan Linberg
INVENTOR

BY *Walter T. Rogers*
ATTORNEY

UNITED STATES PATENT OFFICE.

JOHAN LINDBERG, OF CROOKSTON, MINNESOTA.

STEAM-ENGINE.

No. 815,185.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed July 5, 1904. Serial No. 215,320.

To all whom it may concern:

Be it known that I, JOHAN LINDBERG, a citizen of the United States, residing at Crookston, in the county of Polk and State of Minnesota, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to that class of reciprocatory engines in which three pistons are arranged in one cylinder; the middle piston working independently and oppositely to the two outer ones, which are connected and work together, and the steam acting alternately at opposite sides of the middle piston between it and the two outer ones.

The object of the invention is to provide an improved engine of this character of simple compact construction and efficient operation, with improved valve-gear, link-motion therefor, and adjusting-lever connections, together with other improved features of construction and arrangement hereinafter pointed out.

In the accompanying drawings, which are to be taken as a part of this specification, I have illustrated a stationary horizontal engine embodying my invention, which, however, is capable of embodiment in other forms and susceptible of modifications in details of construction and arrangement of parts. Without limiting myself, therefore, to the particular construction shown the invention will be first fully described with reference to said drawings and then defined in the following claim.

In said drawings, Figure 1 is a central longitudinal vertical section through the cylinder, showing the pistons and connections with the crank-shaft in elevation. Fig. 2 is a central horizontal section through the cylinder. Fig. 3 is a vertical cross-section through the guides for the cross-heads, showing the latter in elevation. Fig. 4 is a side elevation of the whole engine. Fig. 5 is a top plan of the same.

The engine-cylinder 1 is shown open-ended, which is suitable for stationary or indoor engines, though in locomotives it is desirable to close the ends by appropriate covers to keep out the dust.

In the cylinder are arranged three pistons 2 3 4. The front and rear pistons 2 and 4 are attached to a piston-rod 5, which works

through a stuffing-box in the intermediate or middle piston 3. The intermediate piston is attached to a piston-rod 6, which works through a stuffing-box in the rear piston 4. These piston-rods are shown arranged one above another, and they are connected at sliding cross-heads 7 to pitmen or connecting-rods 8, which are connected to oppositely-disposed cranks 9 on the crank-shaft or main engine-shaft 10.

The piston-rods are preferably arranged as close together as possible, while the pitmen or connecting-rods are necessarily arranged somewhat farther apart to permit free passing of one another, and the rear ends of the connecting-rods are therefore curved inward to join the cross-heads 7. The upper cross-head reciprocates in top and side guides 11, and the lower cross-head in bottom and side guides 12, as shown in Fig. 3.

Steam acts alternately at opposite sides of the middle piston 3, first pushing apart pistons 2 and 3, and thereby causing pistons 3 and 4 to approach, and then pushing apart pistons 3 and 4 and causing pistons 2 and 3 to approach. The travel of each piston is of course less than one-third the working length of the cylinder. The intermediate piston may travel one or two inches more than the outer pistons by properly lengthening its crank.

The number 14 denotes the steam-chest, to which steam from a source of generation is admitted by the steam-pipe 15. Steam-ports 16 and 18 lead from the steam-chest to opposite sides of the middle piston, each port being located about one-third the length of the cylinder from the end thereof. In this case the length of the cylinder is of course the distance between the extreme positions of the outer pistons. Adjacent to and located between the ports 16 18 are corresponding exhaust-ports 17 19, connecting with the exhaust-pipe 20. These ports are controlled by a slide-valve 21 of a length sufficient to include the ports. It has two chambers or cups therein, one adapted to connect ports 16 17 when the port 18 is uncovered and the other adapted to connect ports 18 19 when the port 16 is uncovered, also an intermediate chamber into which steam is admitted through small ports or orifices to "balance" the valve or counteract the pressure upon it and permit the valve-stem 22 to move easily. In Fig. 2 the valve is shown in such position that the port 16 is opened or

uncovered, the port 17 closed, and the ports 18 19 connected by the chamber or cup in the opposite end of the valve. Live steam enters through port 16 between pistons 2 3 and forces them apart, while the spent steam between the approaching pistons 3 4 is exhausted through the connected ports 18 19. After the valve is moved to cut off the inlet of steam at port 16 and when pistons 3 4 are together the port 18 is opened, port 19 closed, and ports 16 17 connected by the chamber in the other end of the valve, so as to admit steam for expansion force between pistons 3 4 and to permit exhaust of steam from between pistons 2 3.

The pistons are preferably formed wider at the top than at the bottoms, the middle piston slanting downward at opposite sides and the outer pistons slanting on their inner faces, which is for the purpose of establishing floating pistons or utilizing the force of the steam in holding up the pistons and preventing an excess of friction on their under sides.

The slide-valve is operated and controlled to regulate the admission of steam and cut-off to the two sets of ports 16 17 and 18 19 by valve-gear including a link-motion adapted to obtain the accurate adjustments needed in this type of engine. This consists of two eccentrics 23 24 on the main shaft, having their rods 25 26 pivotally connected to the upper and lower ends of a link 27, in which works a block 28, pivotally connected by rod 29 to the valve-stem 22. The slot in the link is of course formed on an arc with the front end or pivot of rod 29 as a center. The link has a fixed location except in so far as it is permitted to oscillate and is sustained by an upright rocker-arm 30, to which it is pivoted, preferably at its middle. Said rocker-arm is shown in the form of two uprights inclosing the eccentric-rod 26 and embracing an eye in the middle of the link, through which and the upper ends of said uprights a pivot-pin 31 is inserted. The block

28 is vertically adjustable in the slotted link to change the motions of the valve by means of a lever arrangement, which, as shown, comprises a bell-crank lever 32, fulcrumed in the upper end of an upright 33 between the link and the valve-stem, having its front arm depending for manipulation or connection to a handle (not shown) and its rear arm longitudinal of the rod 29 and pivotally connected therewith near the block by link or links 34. Besides obtaining accurate adjustments the construction described is simple, compact, and keeps the mechanism low. The operation of the link-motion is of course apparent. The block 28 in the oscillating link receives its motion from the two eccentrics and comes under the dominance of that eccentric-rod whose end of the link it occupies.

I claim as my invention and desire to secure by Letters Patent of the United States—

A steam-engine having, in combination with the crank-shaft, three pistons in one cylinder, the two outer ones of which are attached to a piston-rod which slips through a stuffing-box in the middle one, while the middle piston is attached to a piston-rod which slips through a stuffing-box in the rear piston, said rods arranged one above another and connected to sliding cross-heads, the upper one of which reciprocates in top and lateral guides while the lower one reciprocates in bottom and lateral guides, and pitmen connected to oppositely-disposed cranks on the shaft and having inturned ends connected to said cross-heads, and means for admitting steam alternately between the middle and front pistons and middle and rear pistons, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHAN LINDBERG.

Witnesses:

EMIL HANSEN,
ALBERT CHILGREN.