

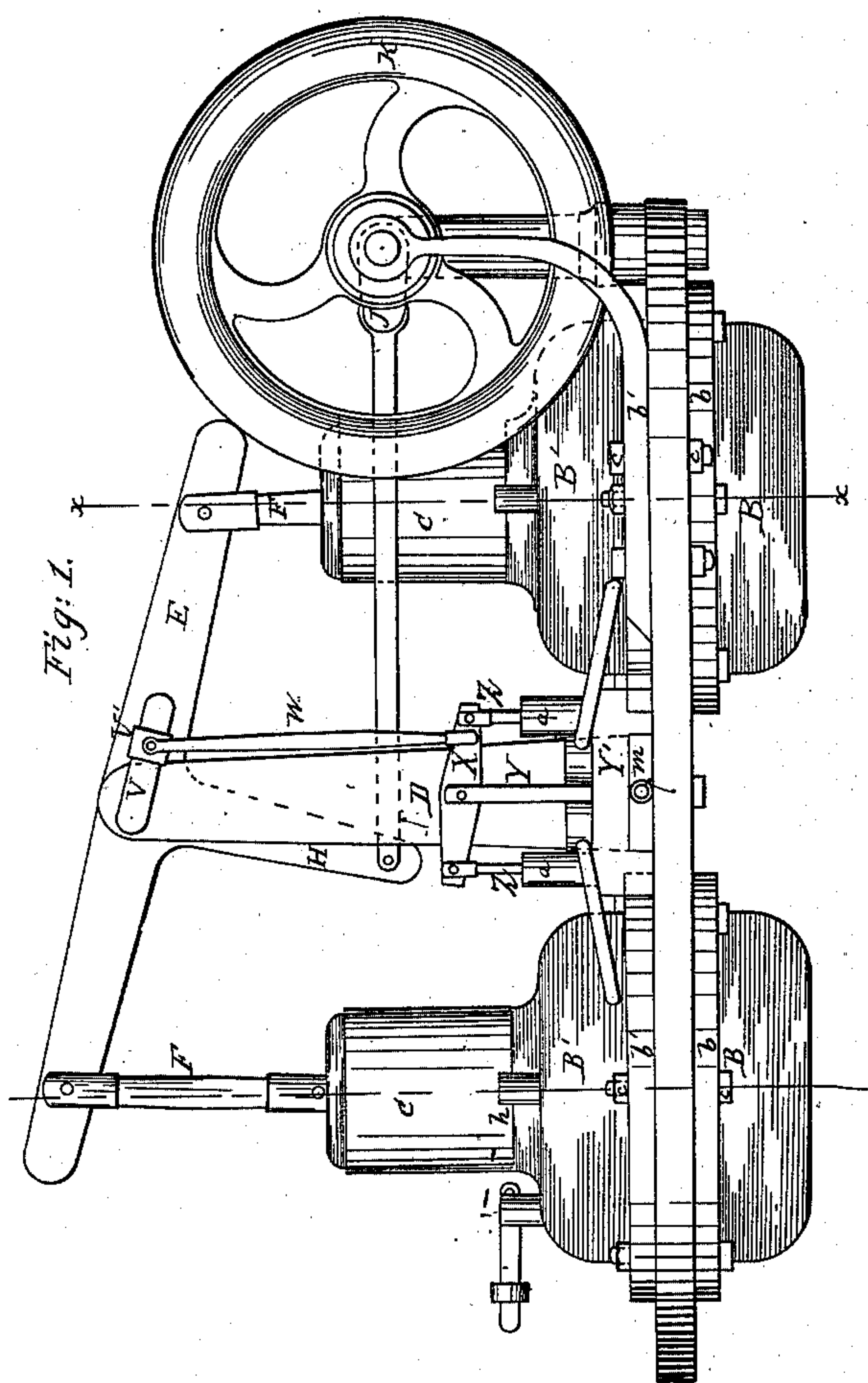
Sheet 1-2 Sheets.

*E. Danford,*

*Reciprocating Steam Engine.*

*Patented May 9, 1865.*

*Nº 47,621,*



Witnesses.

Edward H Knight  
Charles D Smith

*Inventor:*

Edw. Sanford

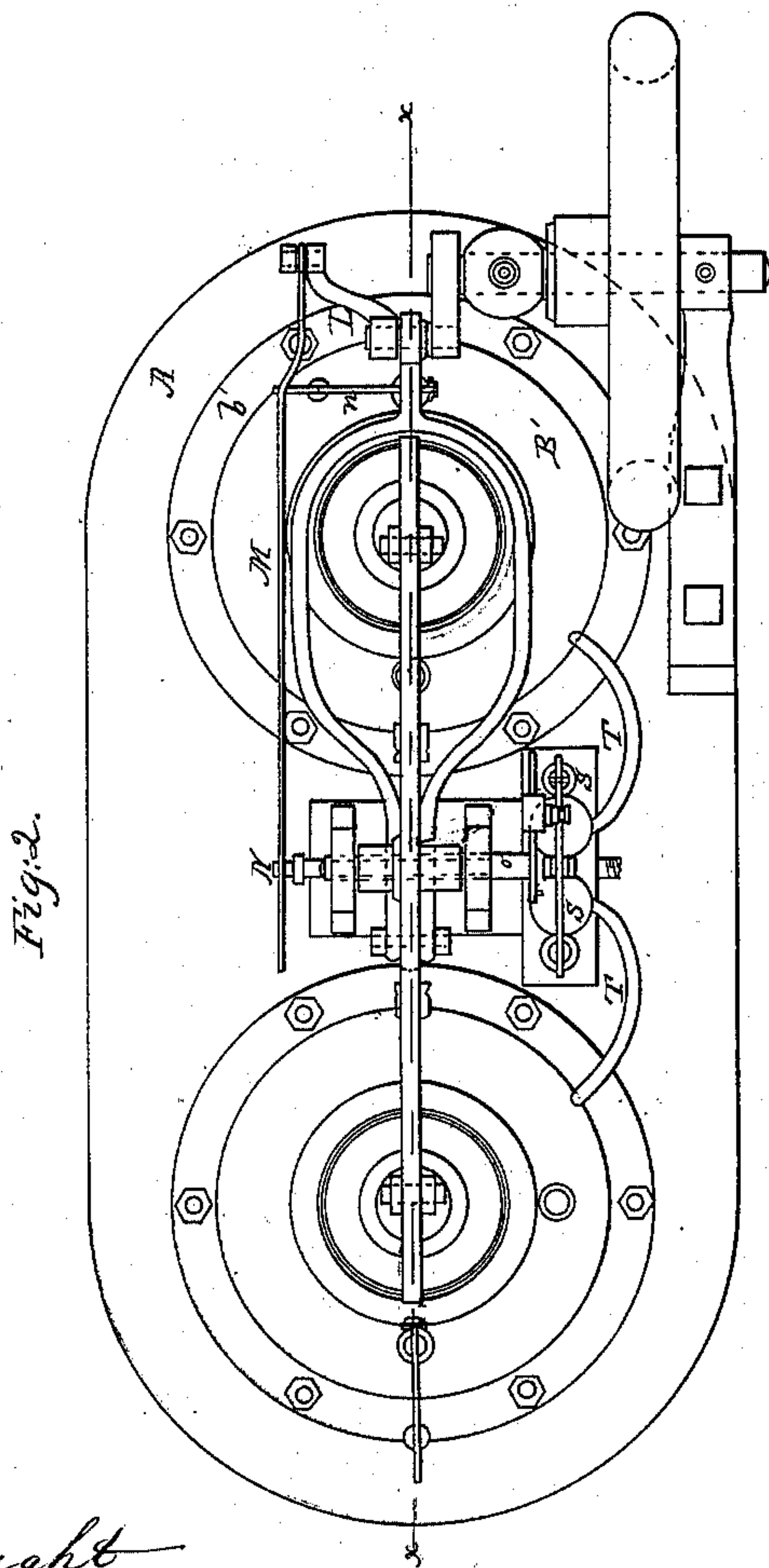
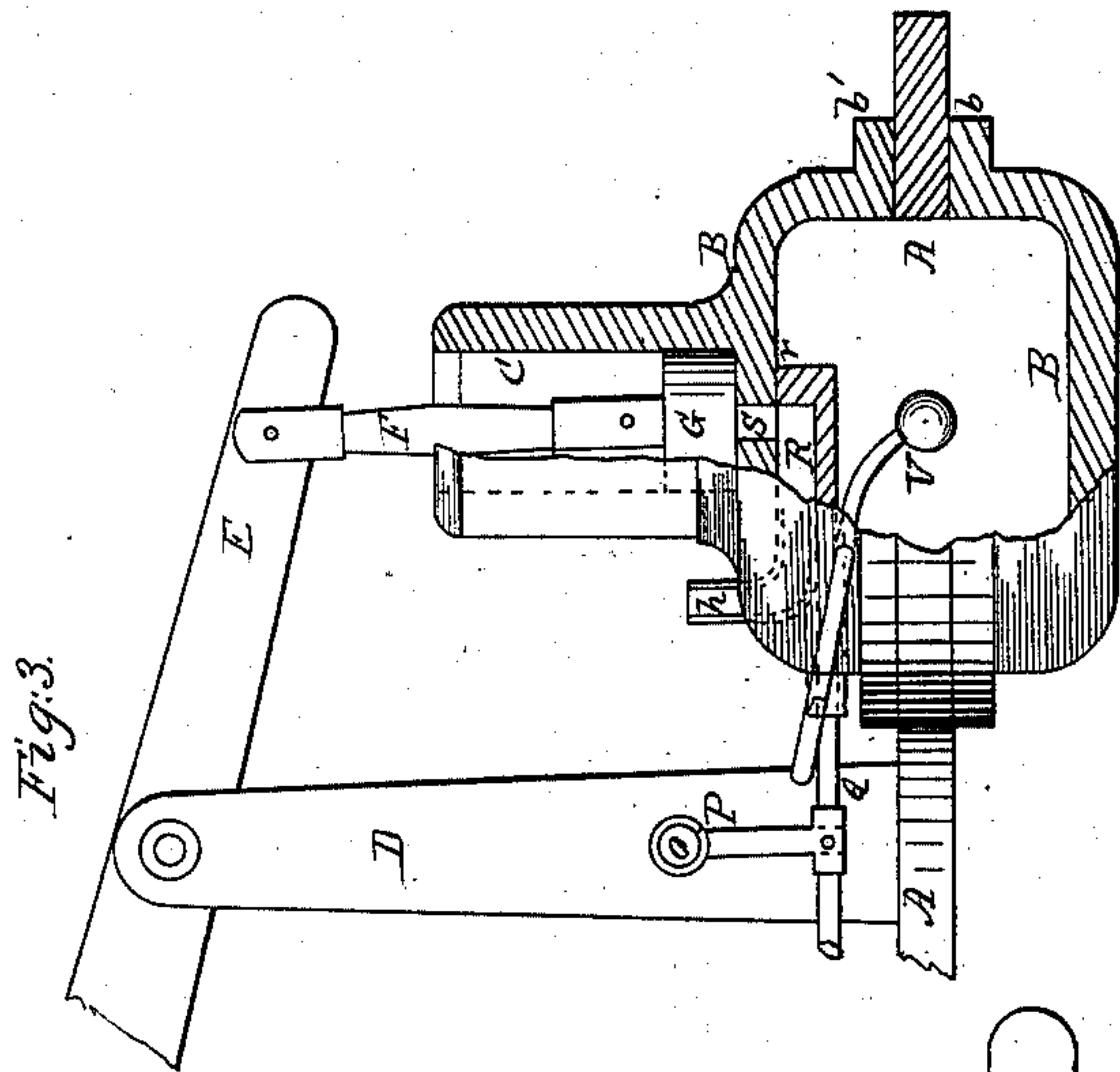
Sheet 2 of 2 Sheets.

E. Danford,

Reciprocating Steam Engine,

No. 47,621

Patented May 9, 1865.



Witnesses.

Edward H. Knight  
Charles L. Smith

Inventor.

E. Danford



# UNITED STATES PATENT OFFICE.

EBENEZER DANFORD, OF GENEVA, ILLINOIS.

## IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 47,621, dated May 9, 1865.

*To all whom it may concern:*

Be it known that I, EBENEZER DANFORD, of Geneva, in the county of Kane and State of Illinois, 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 same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a side elevation of the engine. Fig. 2 is a plan or top view. Fig. 3 is a partial section on the line *x x*, Fig. 2, of one of the generators with attached cylinder and other parts.

Similar letters refer to like parts in the different figures.

My machine is intended to apply a motive power upon the piston of an engine by means of the instantaneous generation of steam from water injected into a generator which communicates immediately by means of a valved opening with the cylinder in which the piston works, and I proceed to give a detailed description of the invention which will enable any one skilled in the art to which it appertains to construct and use the same.

A is a bed-plate which forms the upper part or roof of a furnace. To the upper and lower sides of said plate hemispheres B B' are attached by means of bolts *c* and flanges *b b'*. That part of the bed-plate included between the hollows of the hemispheres is removed, as seen in Fig. 3, leaving a space which forms a chamber for the generation of steam.

D is a pillar or standard erected upon the bed-plate, which supports the walking-beam E, on the respective ends of which are the pitmen F F, attached to the pistons G of the cylinders C, which are imposed upon the generators and communicate therewith in a manner to be described. An arm, H, projects downwardly from the walking-beam E, and attached to its lower end is a connecting-rod, I, which, passing by a yoke on each side of one of the cylinders, connects with the crank J on the shaft of the fly-wheel K. A prolongation of the said shaft gives attachment for an outer crank, L, which connects by pitman M with the vibrating lever N, on whose shaft O is an arm, P, connecting by a rod, Q, with the slide-valves R, one of which governs each of the apertures which connect the generator with

their respective cylinders. On the shaft of the walking-beam is a plate, V, on which is a sliding box, V', which connects by a pitman, W, with the walking beam X, which vibrates on a pillar, Y, attached to the chest Y' on the bed-plate A. To each end of the last-named walking-beam is a plunger-rod, Z, with a piston attached, which works in a pump, *a*, and as it descends forces a portion of water through the pipe T, which connects with the rose-sprinkler in the interior of the generator.

*m* is the water-supply pipe by which the pumps are fed, and *n* is the safety-valve.

The engine being suitably located over a furnace and the requisite heat having been attained, which must be sufficient to flash a portion of water into steam instantaneously, a motion of the pump is made by hand, which injects a portion of water through the pipe T and rose-sprinkler U into the interior of the heated generator B, which expands under the piston G, raising it and that end of the walking-beam, while the other end of the latter descending, empties the other cylinder through the exhaust *h*, the slide-valve R of this last-mentioned cylinder being in the position shown in the sectional view, Fig. 3, the port in the same communicating with the exhaust-opening. As the fly-wheel traverses the motion of the crank L, communicated through the rod M and arm N to the shaft O, operates the slide-valve under the cylinder just exhausted, and the edge *r* of the valve is brought to cover the opening to the cylinder, immediately after which the appropriate pump injects a portion of water into the generator, which has a fraction of a second in which to expand before the further withdrawal of the valve opens the communication between the generator and cylinder and repeats the action. The action of each generator and cylinder, as well as of the valves and pumps, are similar and alternate, and it is believed that the description of one series of motions will be sufficient to stand for the whole.

It is believed that there are many advantages in this method of generating steam, and that in the engine, the subject of the present application for Letters Patent, the construction and adaptation is different from all other devices for the same purpose and more economically effective.



While not limiting myself strictly to the spheroidal or ellipsoidal form of generator, I believe that both, especially the former, are possessed of advantages in respect of the ability to resist concussion, as well as in respect of capacity relatively to the amount of material and the method of construction shown, by which the upper and lower domes are made detached and removable, permits their renewal in case of accident or wear.

One principal advantage which I aim to secure is the freedom from the weight and danger incident to boilers of every description, from the ordinary risks of their explosive contents or from the effects of projectiles, and by making no more steam at a time than I use for one stroke I reduce the danger of casualty from this source to its minimum.

Having thus described my invention, the

following is what I claim as new and desire to secure by Letters Patent:

1. Attaching the hemispheres (or the upper and lower chambers of other form) to the upper and lower sides of the bed-plate.

2. Placing the generator immediately over the fire with the cylinder in immediate connection therewith when the said generator is used as a chamber in which a portion of water is flashed into steam, for the purpose described.

3. The combination of the generator, the cylinder, and the interposed slide-valve, which is actuated so as to open and close the passage S at the specified times, for the purpose described.

EBENR. DANFORD.

Witnesses:

WILLIS DANFORD,

EDWARD H. KNIGHT.