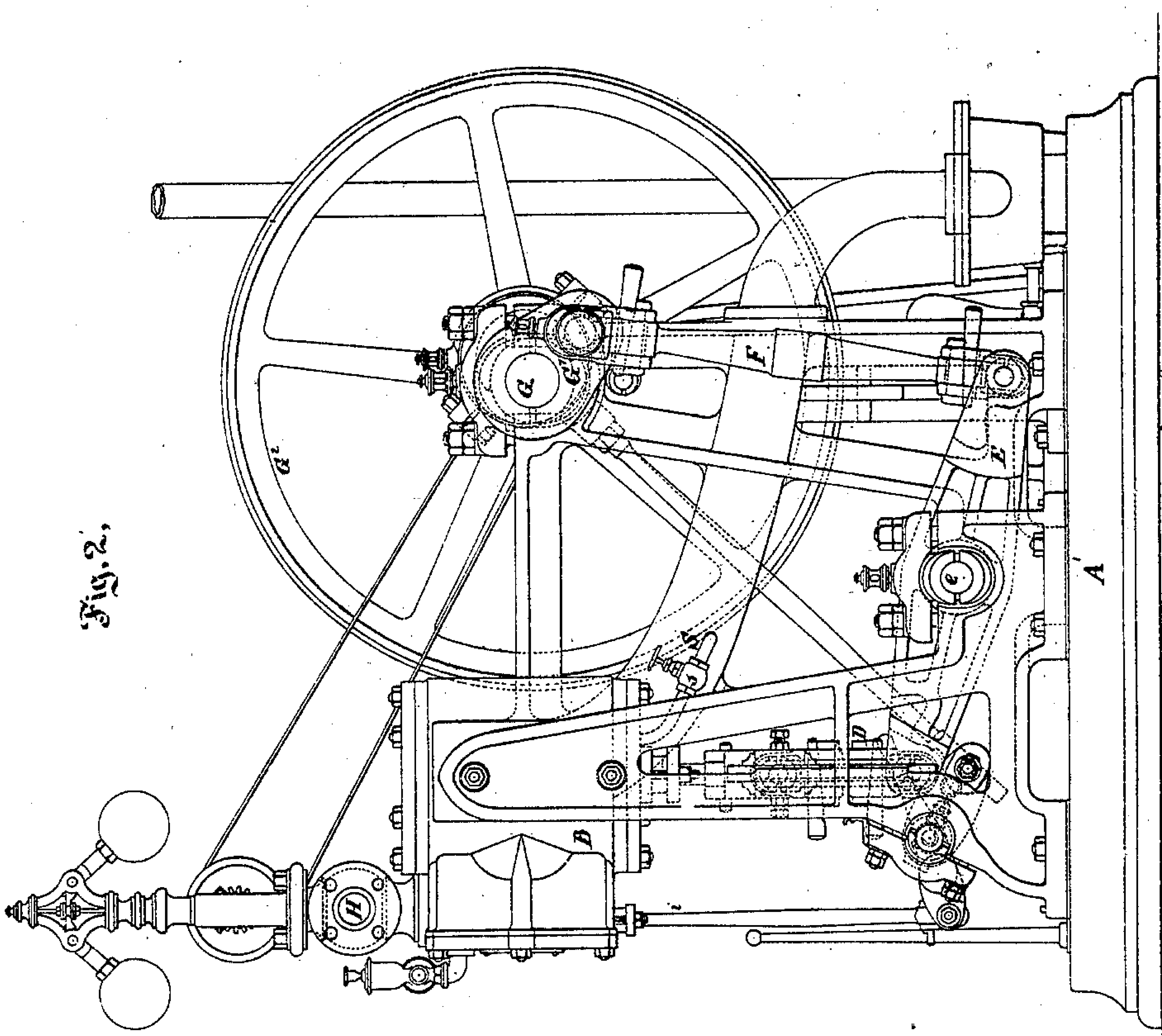
D. A. GREENE.
No. 122,248.

4 Sheets--Sheet 1.

Reciprocating Engines.

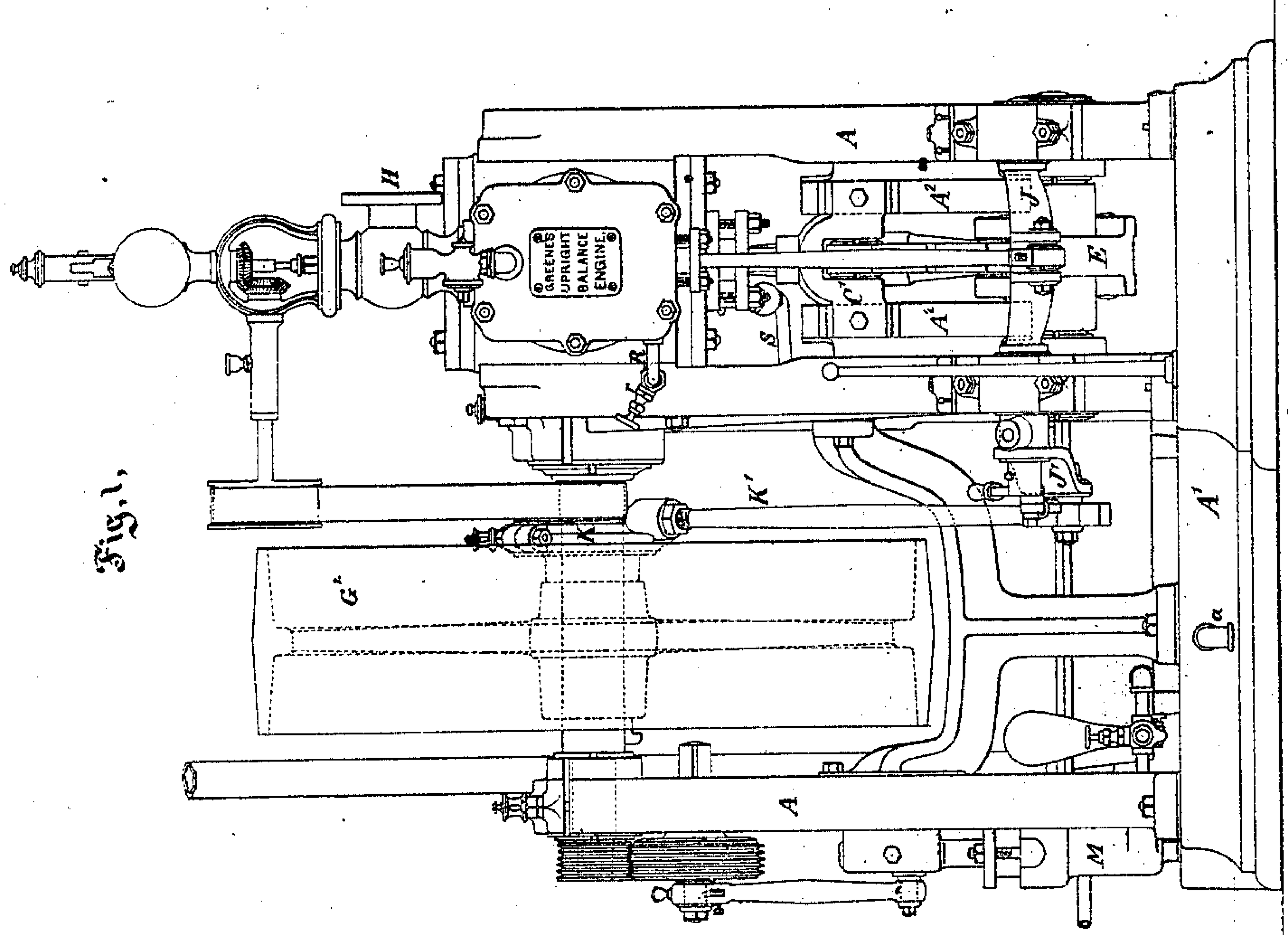
Patented Dec. 26, 1871.

Fig. 2.



Inventor, D. A. Greene
by his attorney T. D. Stetson.

Fig. 1.



Witnesses,
A. Hermann
C. C. Livings

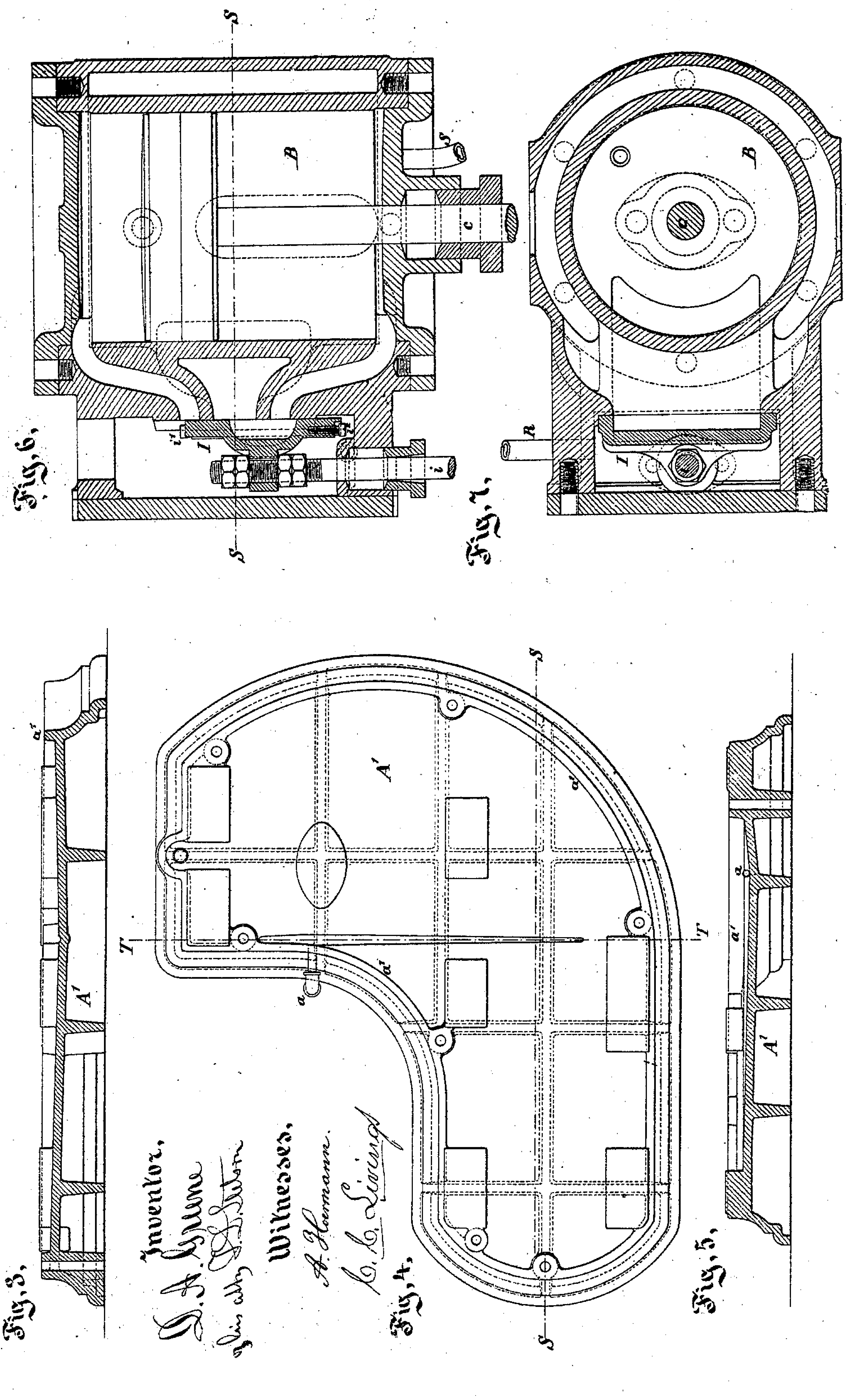
AM. PHOTO-LITHOGRAPHIC CO. N.Y. (OSBORNE'S PROCESS.)

D. A. GREENE.
No. 122,248.

4 Sheets--Sheet 2.

Reciprocating Engines.

Patented Dec. 26, 1871.



D. A GREENE.
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4 Sheets--Sheet 3.
Reciprocating Engines.
Patented Dec. 26, 1871.

Fig. 8,

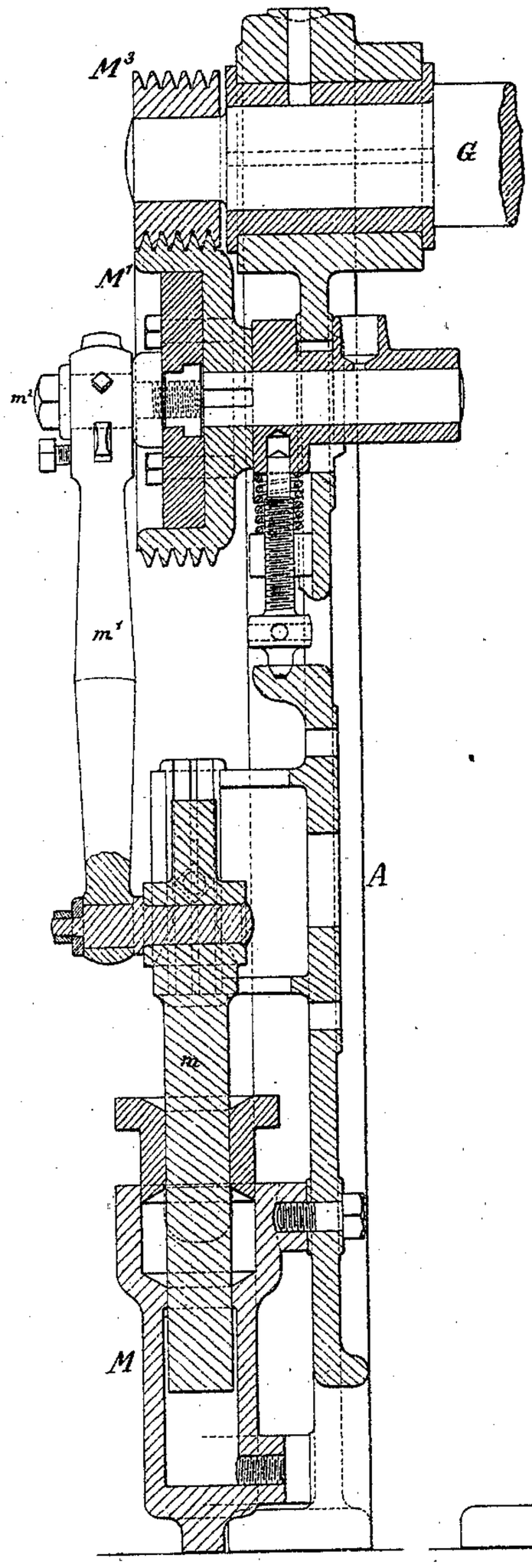
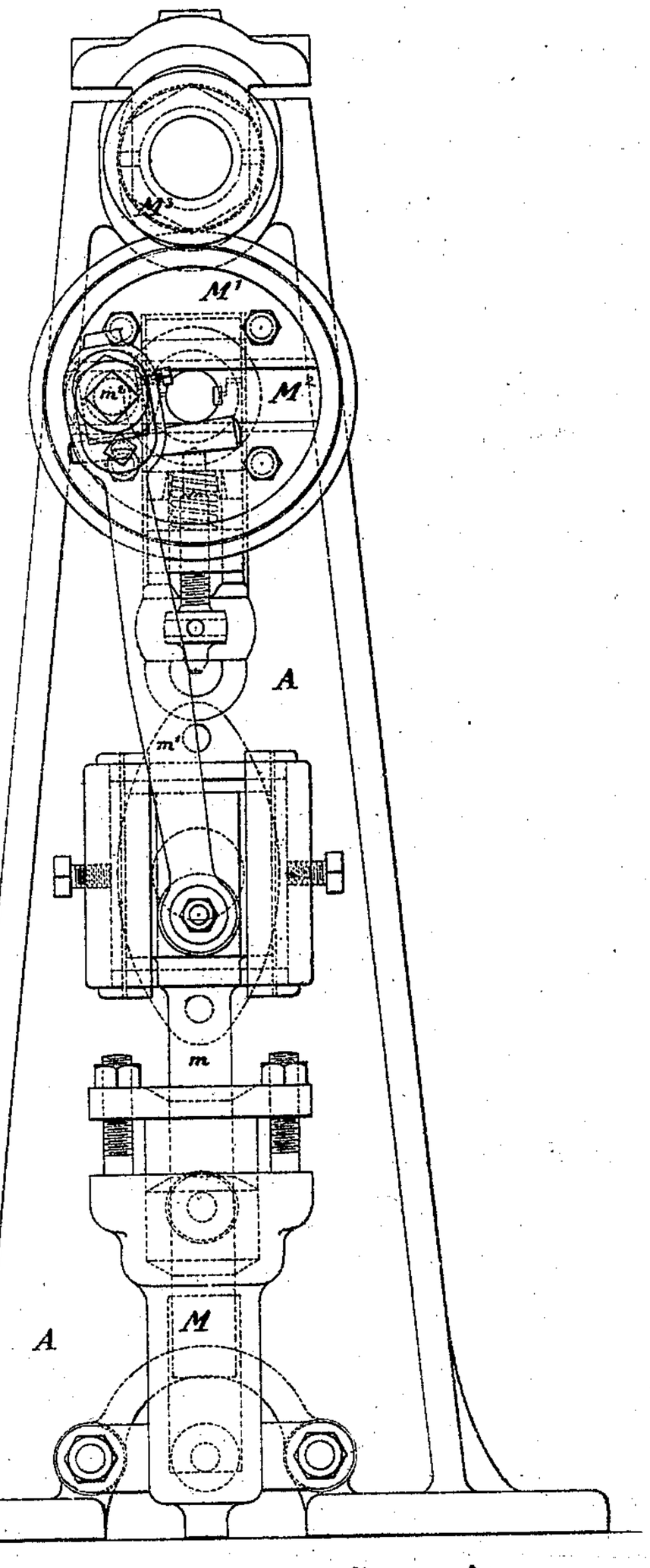


Fig. 9,



Witnesses,
A. Hoermann.
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Inventor,
D. A. Greene
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D. A. GREENE.
No. 122,248.

4 Sheets--Sheet 4.
Reciprocating Engines.
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Fig. 10,

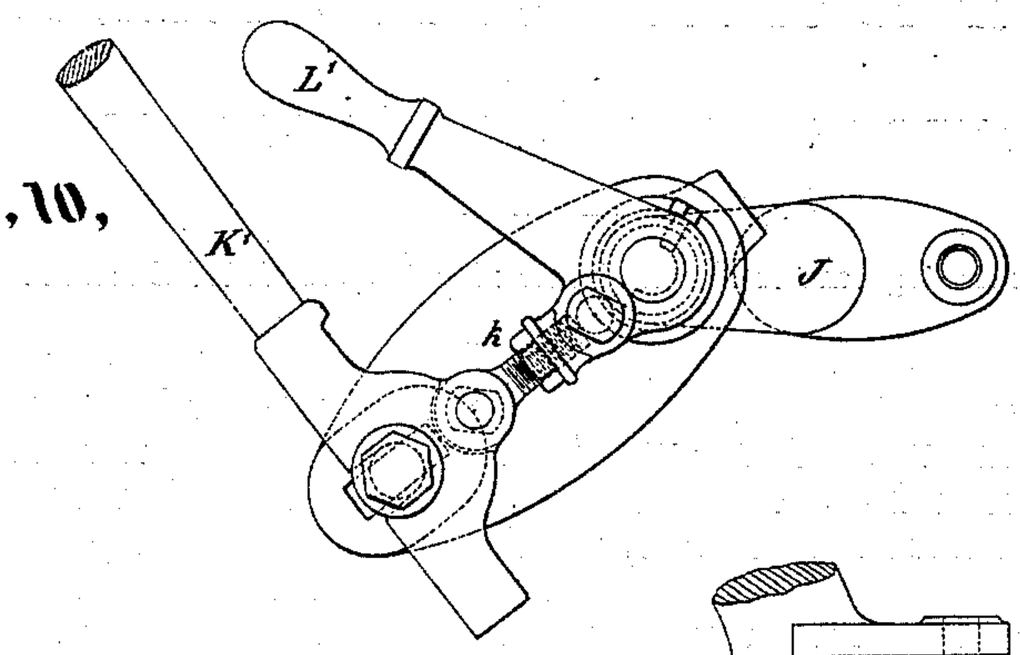


Fig. 11,

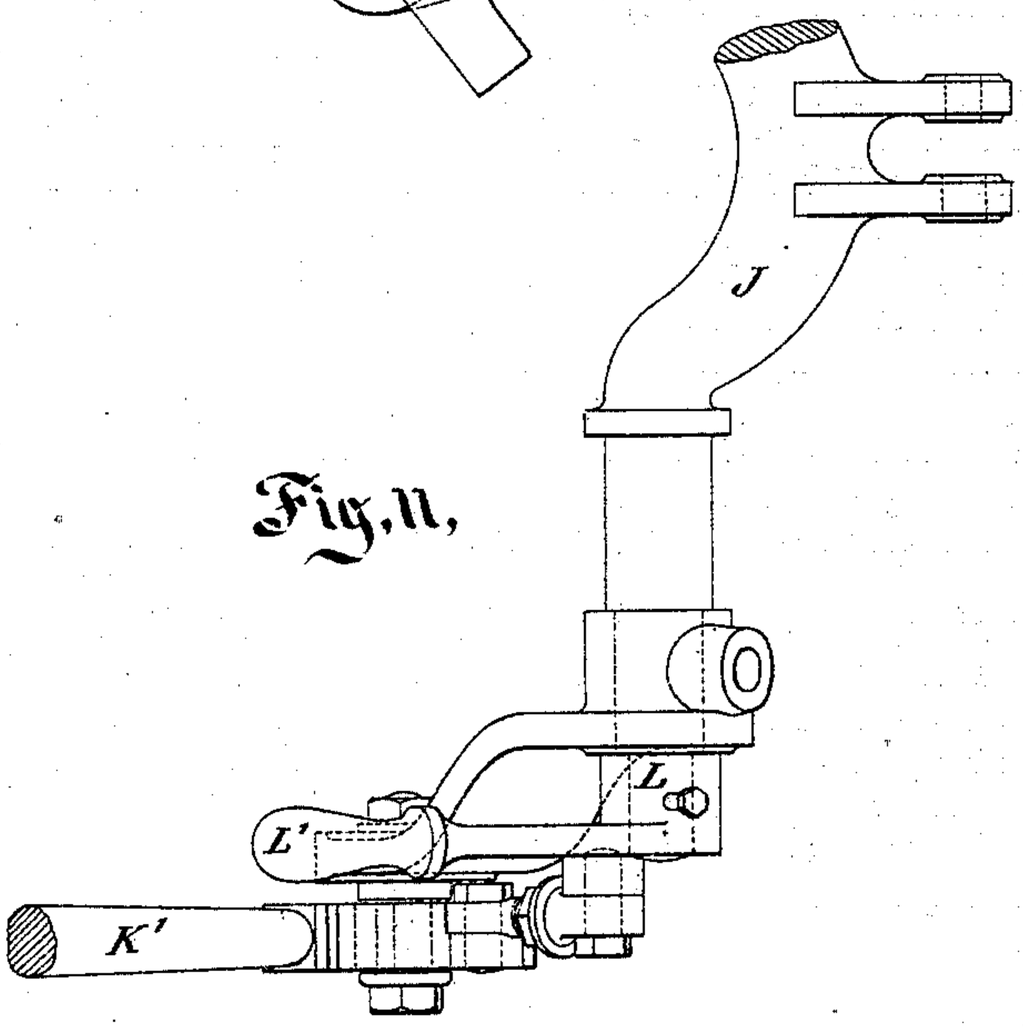


Fig. 12,

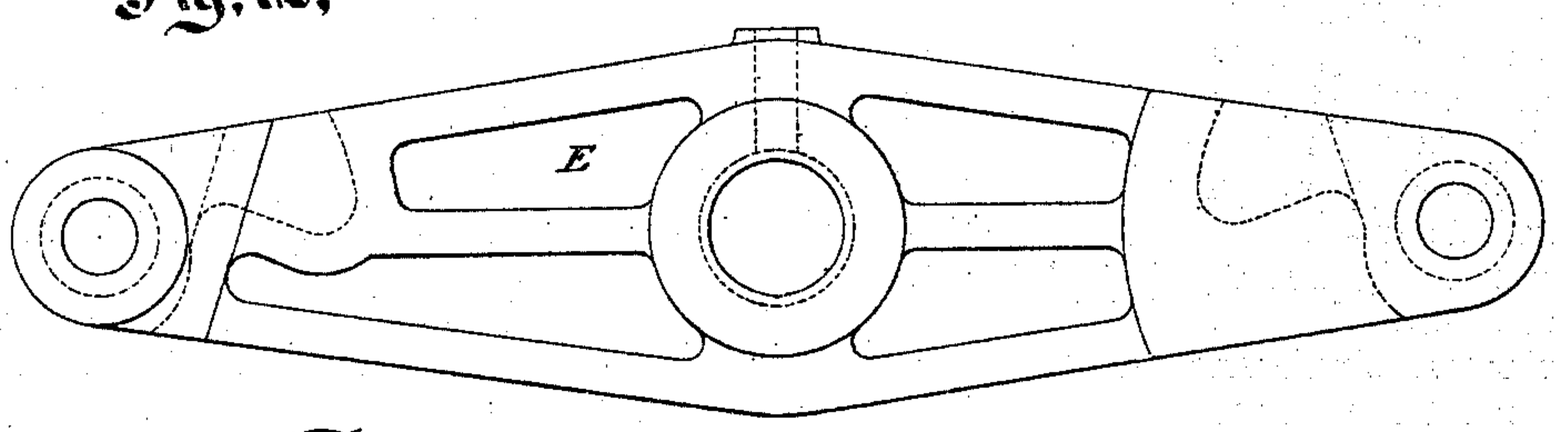
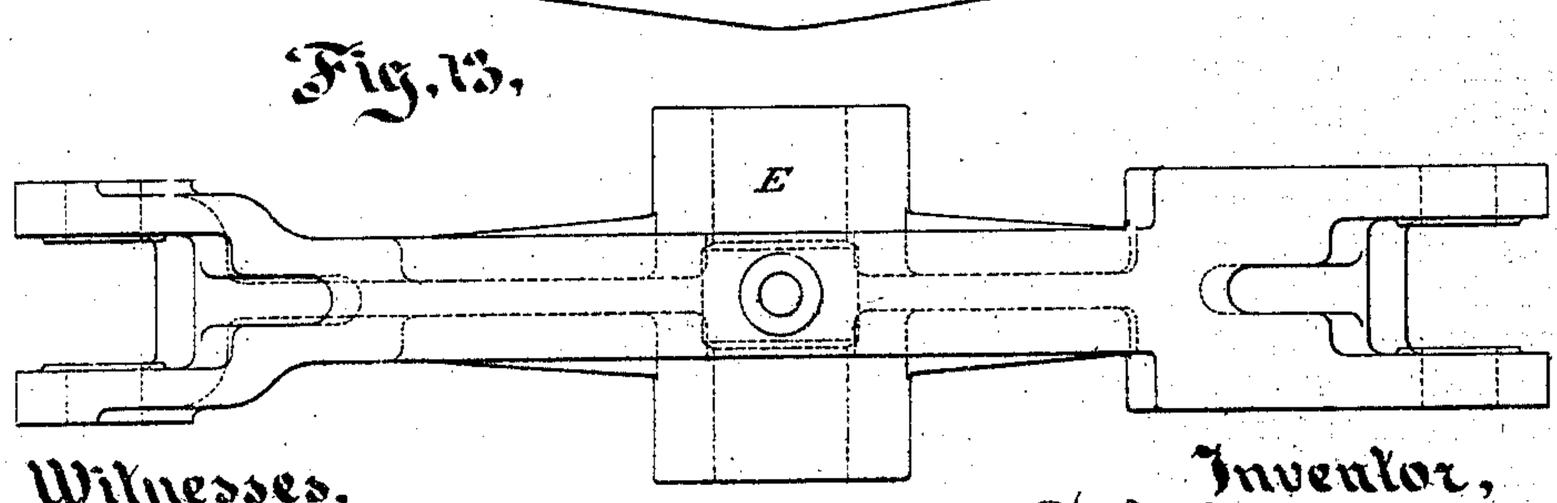


Fig. 13,



Witnesses,
A. Hoermann
C. Livings

Inventor,
D. A. Greene
by his attys Dewey & Sutton

UNITED STATES PATENT OFFICE.

DARWIN A. GREENE, OF NEW YORK, N. Y.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 122,248, dated December 26, 1871.

To all whom it may concern:

Be it known that I, DARWIN A. GREENE, of New York city, in the State of New York, have invented certain new and useful Improvements in Steam-Engines.

The invention relates to the general construction and arrangement of the parts by which the engine is made compact, easily accessible, more portable, and very nicely balanced; to peculiar means for operating the feed-pump, which afford marked advantages; and to peculiarities in the means for connecting and disconnecting the valve motion in starting and stopping.

The following is a description of what I consider the best means of carrying out the invention. The accompanying drawing forms a part of this specification.

Figure 1 is a front elevation, and Fig. 2 is a side elevation of the engine entire. Fig. 3 is a vertical section through my bed-plate on the line S S in Fig. 4. Fig. 4 is a plan view of the bed-plate. Fig. 5 is a section of the bed-plate on the line T T in Fig. 4. Figs. 6 and 7 are sections through the cylinder and adjacent parts on a larger scale. Fig. 6 is a central vertical section. Fig. 7 is a horizontal section on the line S S in Fig. 6. Figs. 8 and 9 represent the pump mechanism in section and elevation. Fig. 8 is a vertical section on the plane of the axis of the pump. Fig. 9 is an elevation of the same parts. The remaining figures show details detached. Fig. 10 shows the hooking and unhooking gear in elevation. Fig. 11 shows the same in plan. Fig. 12 shows the beam in elevation, and Fig. 13 shows the same in plan.

Similar letters of reference indicate corresponding parts in all the figures.

A is the fixed frame-work, considered collectively, the several parts being indicated by A^1 A^2, &c., when necessary. B is the cylinder, mounted in an elevated position, as represented. The piston-rod *c* extends downward therefrom, and connects with the cross-head C′, running on slides A^2, and communicating motion, through a short link, D, to a stout lever, E, turning on a center, *e*, near the base of the frame-work, but sufficiently elevated to allow the beam to rock above the base of the bed-plate. The entire bed is formed in one casting, A^1, with a rim or raised ridge around its edge, as indicated by *a*′. This construction of the bed causes it to hold all the drippings of water, oil, or anything else, and retain them in a stratum over the bed, and allow them to be drained either constantly or at intervals through the drain-pipe *a*. This may be provided with a cock or other means of control, not represented. A connecting-rod, F, communicates motion from the beam E to the crank G^1 on the main shaft G, which latter carries a fly-wheel, G^2, adapted to serve also as a pulley to communicate motion to the mill-work or other work to be driven through the medium of a belt, not represented. The valve-chest is on the front of the cylinder, and receives steam through a connection, H, from a pipe and boiler, not represented. The steam is admitted to the cylinder by a slide-valve, I, which is reciprocated through the medium of a valve-rod, *i*, which communicates motion from a bent rock-shaft, J, in front of the beam at the bottom, and which is bent, as represented, to allow the keys and other work on the front of the cross-head and link D to project a considerable distance, if necessary. The rock-shaft J is operated through the medium of its arms J′ and an eccentric rod, K′, leading from an eccentric, K, all in the usual manner, except in the provision for engaging and disengaging the parts. A hook is formed on the eccentric-rod adapted to engage with the pin on the rock-shaft arm. The hooked end of the eccentric rod is raised and lowered by means of a light link, *k*, which connects a pin on the eccentric rod K′ to a pin on a revolving part, L, which is free to be revolved at will by turning loosely on the end of the rock-shaft J, being controlled by the short hand-lever L′. To unhook or disengage the eccentric rod from the pin on the rock-shaft the engineer pulls the hand-lever L′, and turns it into the position opposite of that shown in Fig. 10, and the engine is stopped. To hook on or make the connection the engineer turns the handle L′ by pushing it around so as to cause it to perform a half revolution. This lowers the link *k* and allows the hook on the eccentric rod K′ to engage with the pin on the rock-shaft. Thus conditioned the eccentric maintains the proper rocking motion of the rock-shaft, and consequently imparts the proper motion to the slide-valve I. The arrangement of the parts requires a slight play on the link *k* at each rocking motion. This is allowed for making a short slot in the link *k*. This slot may be either on the pin which connects this link to the revolving part L or on the other

pin which connects it to the eccentric-rod K′. It is sufficient in practice to allow a quarter of an inch or less for a large engine. Without such provision a slight lift would be given to the eccentric hook at each revolution, and this, although slight, would induce a rapid destructive wear and abrasion of the surfaces in contact. The device thus provided is very convenient and durable.

The slide-valve is liable to descend by gravity into too low a position when unhooked. This, if permitted, would induce various evils, not the least of which might be the moving of the rocker-arm J′ into such a position that the hook on the eccentric-rod K could not engage with it. To prevent this an adjustable stop is provided in the valve-chest by the screw i^2, which is capable of being adjusted with very great delicacy. After setting the valve properly this screw is turned into such a position that at each descent of the valve the screw comes very nearly or quite in contact with the interior of the valve-chest at the bottom. It may be guarded against any possible derangement of position afterward by a jam-nut, if such should be necessary. To avoid a liability to lift the valve too high when starting the engine by hand a similar screw is also provided on the upper side, as indicated by i^1. One of these stops prevents the valve from being ever moved beyond its extreme lowest position, and the other prevents it from being ever moved above its extreme highest position. It follows that it cannot be placed by any unskillfulness or thoughtlessness in any position where the hook on the eccentric-rod is not ready to engage with it when lowered for the purpose.

There is no joint in valve-rod. The motion of this member of the mechanism is nearly but not quite vertical. The upper end slides vertically, while the lower end describes a small arc. It has been common in small engines, and even in locomotives having long connections between the valve and rocker-arm, to make the valve-stem without a joint, and to cause it to spring sufficiently to allow for its slight deviation from a constant line. This would involve difficulties on an engine as compact or with as short connections as this. I avoid them by a very simple device. The valve-stem is made rigid or with a moderate degree of elasticity, and the obliquity of its position is allowed for in the gland of the stuffing-box at the base of the steam-chest. The surface on the interior at the base of the steam-chest is elevated around the valve-rod, and at the extreme upper end of this elevation it fits quite closely. Below this it is filled with packing, which is intentionally and necessarily a yielding material and will allow very completely for its slight deviations of positions to one side and the other.

The feed-pump M is of the ordinary solid-plunger variety, and is mounted directly below the overhanging end of the main shaft. The engine is intended to run very rapidly, and it is important to the smooth and successful working of the pump that it shall reciprocate at only a moderate speed. I employ a friction-gearing to reduce the motion, and have adapted it to perform in its ordinary manner with a variable pressure to hold the surfaces in contact. The large wheel M^1, which receives a slow motion from the quick revolution of the small friction-wheel M^3 on the end of the main shaft G, is mounted on a movable center, and is held up to its work by the force of a gentle spring. (See Fig. 8.) The force of this spring should be little more than sufficient to overcome the gravity of the wheel M^1 and the connected parts, but not sufficient to induce any powerful frictional contact. The pump-plunger *m* is worked by means of a connection, m^1, which receives motion from a pin, m^2, fixed in a radial slot, M^2, in the wheel M^1. This pin m^2 may be set out and in, so as to give the pump-plunger the required amount of throw.

I construct the parts capable of adjustment to pump a much greater amount than is needed to supply the boiler, so that the surplus water may be used to supply an elevated tank, or for other purposes; and it can be adjusted exactly at the center in any case, when necessary, so that the pump will remain absolutely motionless. The main resistance to the motion of the pump is during the descent of the plunger *m*. It is a peculiarity of my arrangement that it provides for an increase of friction between the friction-wheels at this period without inducing any excess of friction at other times, whatever may be the resistance to the descent of the plunger *m;* and this will vary according to the pressure of the steam. A corresponding increase of friction is induced between the large friction-wheel M^1 and the small friction-wheel. It follows that the contact of these friction-wheels is always just sufficient.

The pipe which drains the base of the cylinder is marked S, and its cock *s*. The pipe which drains the bottom of the steam-chest is marked R, and its cock *r*.

I propose, in large engines, to apply some compact form of water-trap in place of the controlling means *r* and *s* here represented; but for small engines the screw-valves shown are amply sufficient.

The parts being all properly proportioned to afford proper strength and stiffness, it is usually or invariably found that the weight of the piston and its connections exceeds the weight of the connecting-rod and crank. I compensate for this difference by giving an excess of weight to the beam at the end which connects to the crank, as shown in detail in Figs. 12 and 13.

Some of the advantages due to certain features of the invention may be separately enumerated, as follows: First, by reason of the arrangement of the elevated cylinder and shaft with the single-loaded beam below, connected as represented, to make an inverted beam-engine, I am able to mount the shaft at a just sufficient elevation, and to employ a large fly-wheel without cutting through the floor or ceiling. It also allows the employment of a continuous bed-plate under the entire engine, and the pillow-blocks being mounted on a rigid frame-work, and con-

nected together by the bed-plate, holds the work more strongly and reliably in line. The entire framing is a unit, and the engine is remarkably compact and stiff, while every part is easily accessible. Second, by reason of the employment of the friction-gears M^1 and pin m^2, adjustable in the slot M^2 for variably operating the pump-plunger, as specified, I am able to vary the quantity pumped within wide limits with very simple and noiseless mechanism. Third, by reason of the mounting of the friction-gear wheel M^1, slotted and carrying an adjustable pin, m^2, and pump-connections, as represented, with the wheel M^1 on a spring bearing directly in line between the friction gear-wheel M^1 and the pump, I am able to render available the variable resistance of the pump to increase the contact of the friction-gears at the right moment without any considerable excess at any time, as herein specified. Fourth, by reason of the construction and arrangement of the revolving part L with its handle L′ and link k, connecting it to the eccentric rod K′, I am able to hook and unhook the engine by very simple and efficient mechanism, and to hold the hook efficiently in or out of connection without inducing any appreciable friction or wear.

I claim as my invention—

1. The within-described inverted-beam engine having the elevated cylinder and shaft, and single loaded beam below, connected and adapted to operate within a rigid cast-iron framing, substantially as herein specified.

2. The friction-gears M^1, slot M^2, and adjustable pin m^2, arranged, as represented, relatively to the main shaft and to the pump M m, and connection m^1, for the purposes specified.

3. The arrangement of the friction-gears M^1 in line with the pump, and the mounting of the wheel M^1 on the spring-bearing, so as to induce a self-acting adjustment of the frictional contact varying with the change in the resistance of the pump, as specified.

4. The turning piece L L′ and link k, arranged and operating relatively to the eccentric hook K′ and the rock-shaft arm, as and for the purposes set forth.

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

DARWIN A. GREENE.

Witnesses:

C. C. LIVINGS,

A. HOERMANN.

(150)