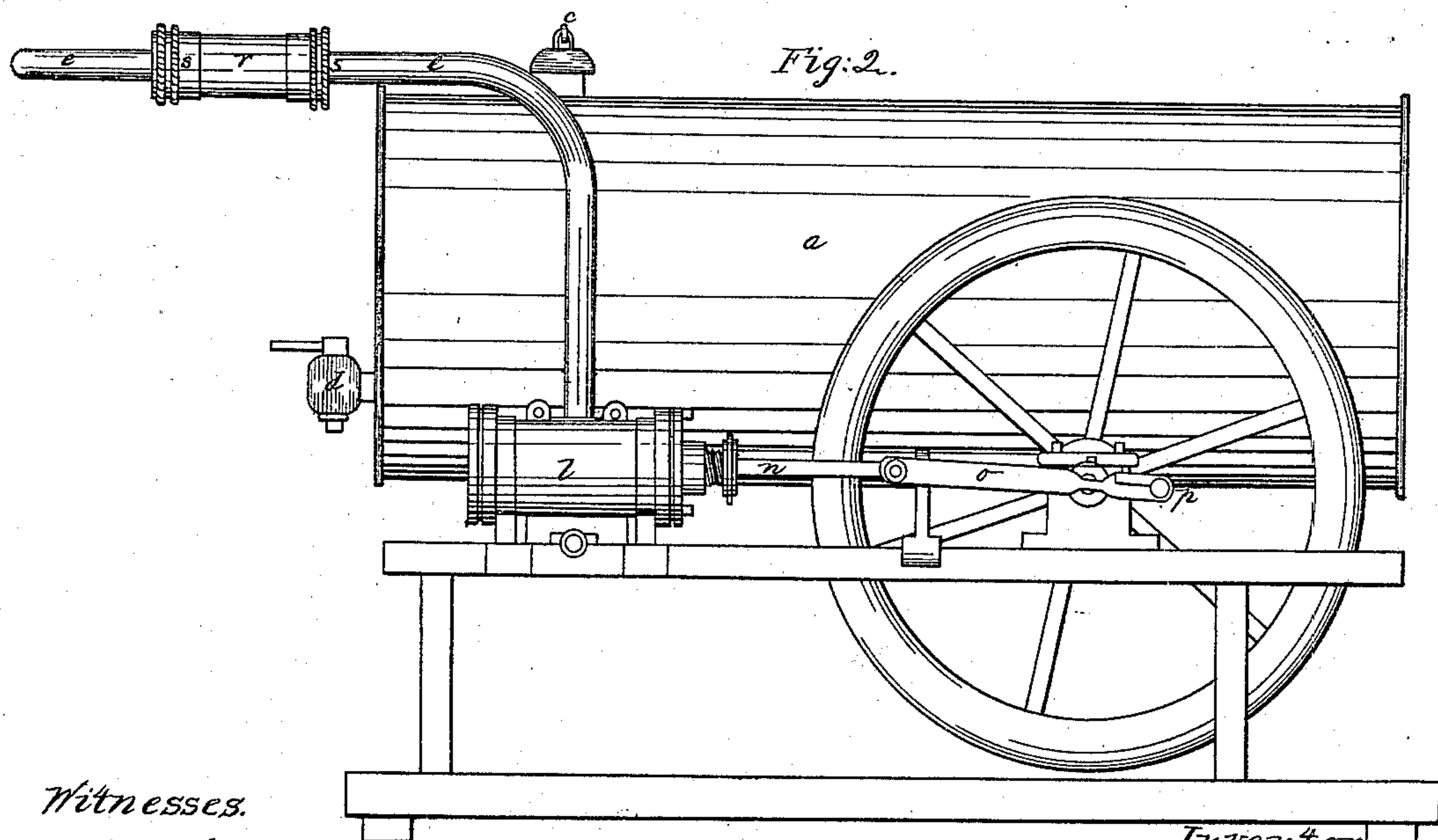
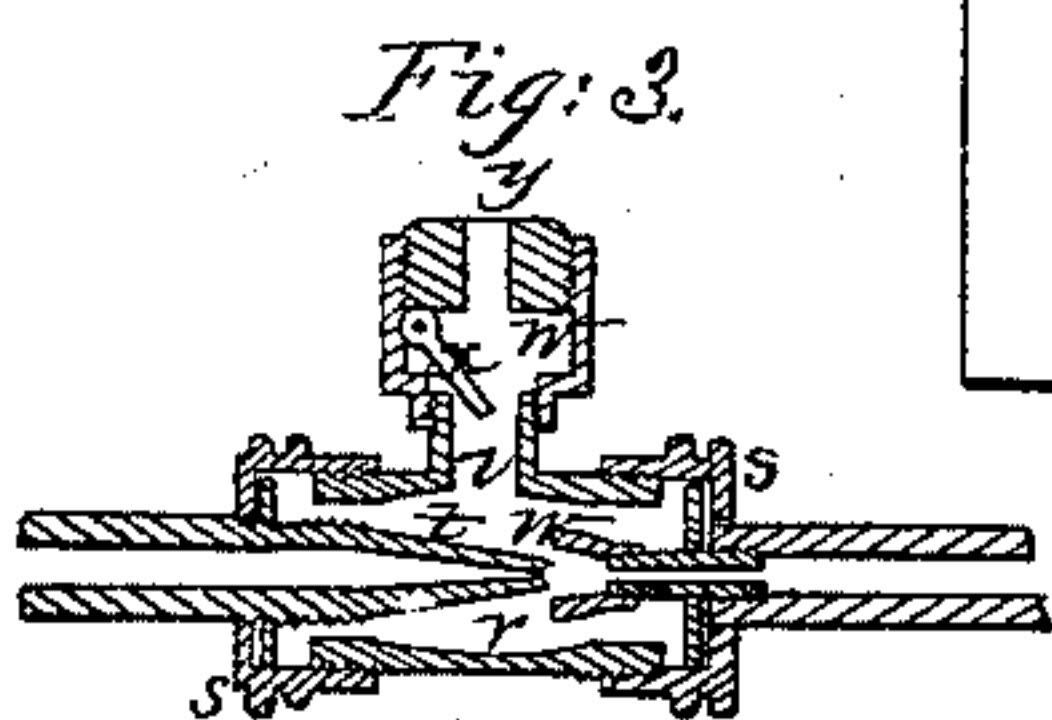
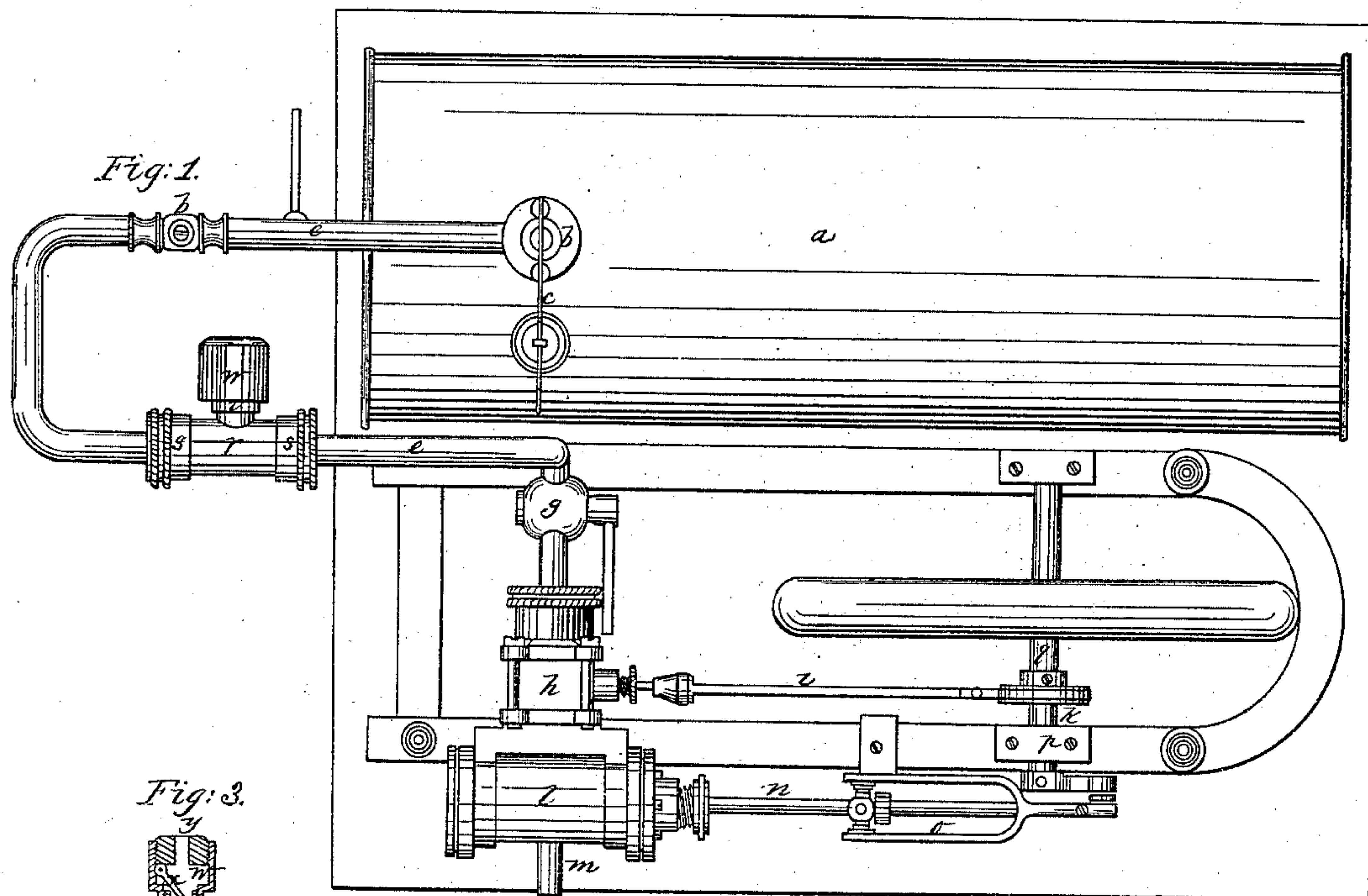


R. E. ROGERS & J. BLACK.
AIR AND STEAM ENGINE.

No. 32,149.

Patented Apr. 23, 1861.



Witnesses.

Wm. Smith
Jas. Thompson

Inventor.
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UNITED STATES PATENT OFFICE.

R. E. ROGERS AND JAMES BLACK, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF COMBINING AND UTILIZING STEAM AND AIR.

Specification of Letters Patent No. 32,149, dated April 23, 1861.

To all whom it may concern:

Be it known that we, R. E. ROGERS and JAMES BLACK, of the city of Philadelphia, in the State of Pennsylvania, have invented
5 a new and useful Improvement in Combining Air and Steam for Actuating Engines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and to the letters and marks thereon.

Atmospheric air and steam, and air and water heated either by the air or otherwise to the vaporizing point, and air and the
15 gaseous products of combustion and steam, have been mingled or associated, and used as a motive power. Desirable as is the result of turning to profitable account the expansive and elastic power of so cheap and
20 safe a material as air, yet none of the devices for employing it, either alone or in conjunction with steam, have hitherto been productive of any large amount of effective power, when compared to the dimensions of
25 the engine used. In all instances when these elements have been used, the air, or other gaseous material, has been fed into the steam or water by means of a force-pump or air-pump driven by the power of the engine.
30 So much, therefore, of the power of the engine as is consumed in forcing in the air, is necessarily lost; and this is the serious objection and chief drawback to the employment, in the ordinary way, of air in connection with steam. By our invention, which
35 is self-acting in its operation, the air is introduced and commingled with the steam, through the agency and by the power of the current of the steam itself on its way from
40 the generator to the motive cylinder of the engine. Our invention is based upon the principle that a current of steam, air, or other fluid body issuing from an orifice will carry along with it any other fluid body surrounding it.

The drawings forming part of this specification show the means for carrying out our invention attached to the steam pipe between the throttle valve and the regulating valve,
50 or between the boiler and the valve chest.

Figure 1 of these drawings is a top view of a horizontal boiler and horizontal engine with the usual parts and pieces belonging thereto, and with a set of means for exhibiting one way of using our invention.
55 Fig. 2 is a side view of the same boiler and

engine; and Fig. 3 is a view, by horizontal section, of the pipes and valve through which the steam and air pass on their way to the working cylinder.

In each of these figures where like parts are shown like letters and marks are used to indicate them.

(a) marks the boiler, (b) the safety valve, (c) the lever of the safety valve, (d) a try-cock, (e) the steam pipe, (f) the throttle valve, (g) the regulator valve, (h) the valve chest, (i) the valve rod, (k) the eccentric of the valve rod on the shaft, (l) the working cylinder, (m) the exhaust pipe,
65 (n) the connecting rod or pitman, (p) the crank of the main or power shaft, and (q) that shaft.

In Fig. 3 is shown an arrangement which exhibits the principle of our method—the
75 subject of this specification—which arrangement we have found a good one, though it is only one of many which may be devised for carrying out our invention.

For the sake of convenient reference, and
80 because of the peculiar sound which is produced in it by the swift ingress of air during each half stroke of the engine, not unlike that of loud breathing or inhaling, we designate the device an aspirator.

(r) represents a small cylinder having couplings (s) for keeping in proper juxtaposition the jet (t) and the receiving mouth (u) of the pipes. To the side of this cylinder is attached a short tube (v) having an
90 inlet chamber (w) in which is a flap valve (x) or its equivalent. This inlet chamber has an air opening (y).

The operation of the invention is as follows: When the steam is let on from the
95 boiler (a) it passes from the jet (t) into the mouth (u) of the receiving tube and onward to the engine with such a velocity as, notwithstanding the resistance offered by the piston, to invite or draw in through (y, w,
100 v,) a large amount of air. To this air with which it intimately mingles while conveying it to the working cylinder, it imparts a portion of its heat and thereby develops an available elastic force, greater than that lost
105 by the steam itself in the act of producing the expansion of the air. The quantity of air which the steam is capable of thus drawing in and carrying forward to the working cylinder of the engine varies with cir-
110 cumstances, such as the tension of the steam and the size, form, and relative position of

the orifices and other parts of the aspirator. In some instances it has been found by measurement to be nearly equal at each half stroke of the engine to a volume corresponding to one-half the capacity of the working cylinder. The effective power obtained from the engine by this automatic introduction of the air—estimating it by the increased velocity of the piston, all other conditions remaining the same—has been found greatly augmented beyond that resulting from steam when used alone. The valve (x) in the inlet chamber (w), it will be noticed, opens inwardly. Its design is not to control the quantity of air admitted through this chamber. It comes into play and performs its functions only when, from any cause, the motion of the engine is checked, as will be the case when it turns the center sluggishly, or when more work is suddenly thrown upon it, or greater or unusual obstacles have to be overcome. Under these circumstances the steam will have greater resistance to meet, and were not this valve in the inlet chamber, for a moment the steam would pass out through the chamber, but as the pressure will come upon the valve, it will be forced outward closing the opening (y), thus chambering the steam and allowing the initial pressure—the pressure of the steam in the generator—to overcome the additional or unusual resistance, and then the valve will drop in and the flow of air be resumed.

The invention is applicable to low pressure or humid steam as well as to high pressure and to super-heated steam; to every character of boiler or generator, and to every class of engine.

The means for carrying out the invention can be placed at any point between the boiler and the working cylinder, or may even be connected directly with or upon the cylinder itself whenever its arrangements of valves, ports and passages will allow the device to be there placed. The invention may likewise be used, wherever any kind of steam generator is useful for any purpose whatever.

We do not confine ourselves to the particular form or mode of constructing the arrangement for carrying out our invention

here described. Modifications embracing the same principle or method may be used. The pipe conveying the steam may be arranged in relation to the air surrounding it or admitted to it in various ways; and the steam pipe itself may have modifications and be different from what is shown in the drawings. The steam pipe may surround the air pipe, the annular space between the two being the track of the steam, or the steam pipe may be within a pipe which has perforations for admitting the air, and the dimensions and relative position of the tubes and orifices of the "aspirator" may be varied or regulated by adjusting screws or other appropriate contrivances. Neither do we limit ourselves to the use of a single aspirating system for the purposes herein specified. Two or more of the combinations may be associated with each other, and be made, under certain circumstances to cooperate advantageously, as we have ascertained by experience.

Of the advantages of combining air and steam for actuating engines it is not necessary here to speak in detail, as our invention does not extend to the broad ground of their joint use, but is limited to the special track here pointed out.

What we consider as new and original is the method of using air and steam as a motive power; and we may state that we have clearly ascertained that by this method of intimately combining or blending the air and steam, the "latent caloric" of the steam, to say nothing of its "sensible caloric" is rendered remarkable available in expanding the air, whose "specific heat" or "capacity for caloric" is known to be low.

What we claim as our invention, and desire to secure by Letters Patent is—

1. The method of combining and utilizing steam and air herein set forth.

2. The valve (x), or its equivalent, in combination with the other parts of the aspirator, as described.

R. E. ROGERS.
JAMES BLACK:

Witnesses:

WM. I. SMITH,
WM. THOMPSON.