

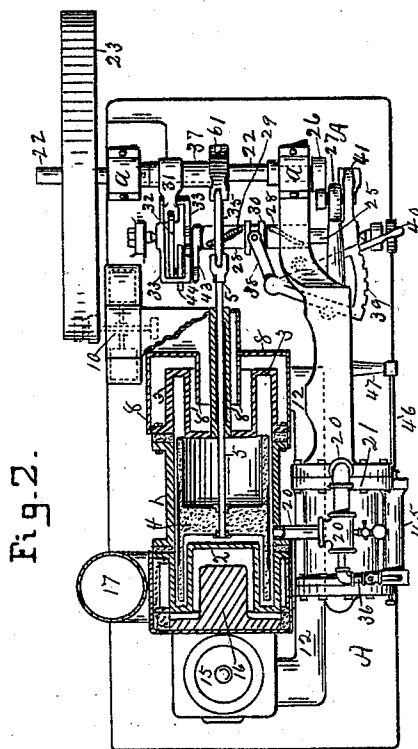
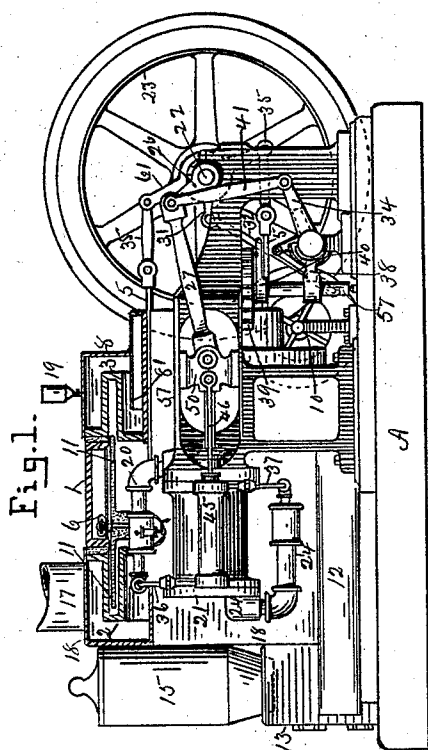
(No Model.)

3 Sheets—Sheet 1.

C. A. ANDERSON.
HOT AIR ENGINE.

No. 537,517.

Patented Apr. 16, 1895.



Witnesses:

Ray Hutchins.

P H Stanton

Inventor:

Charles A. Anderson

By Thor H Hutchins. Attorney.

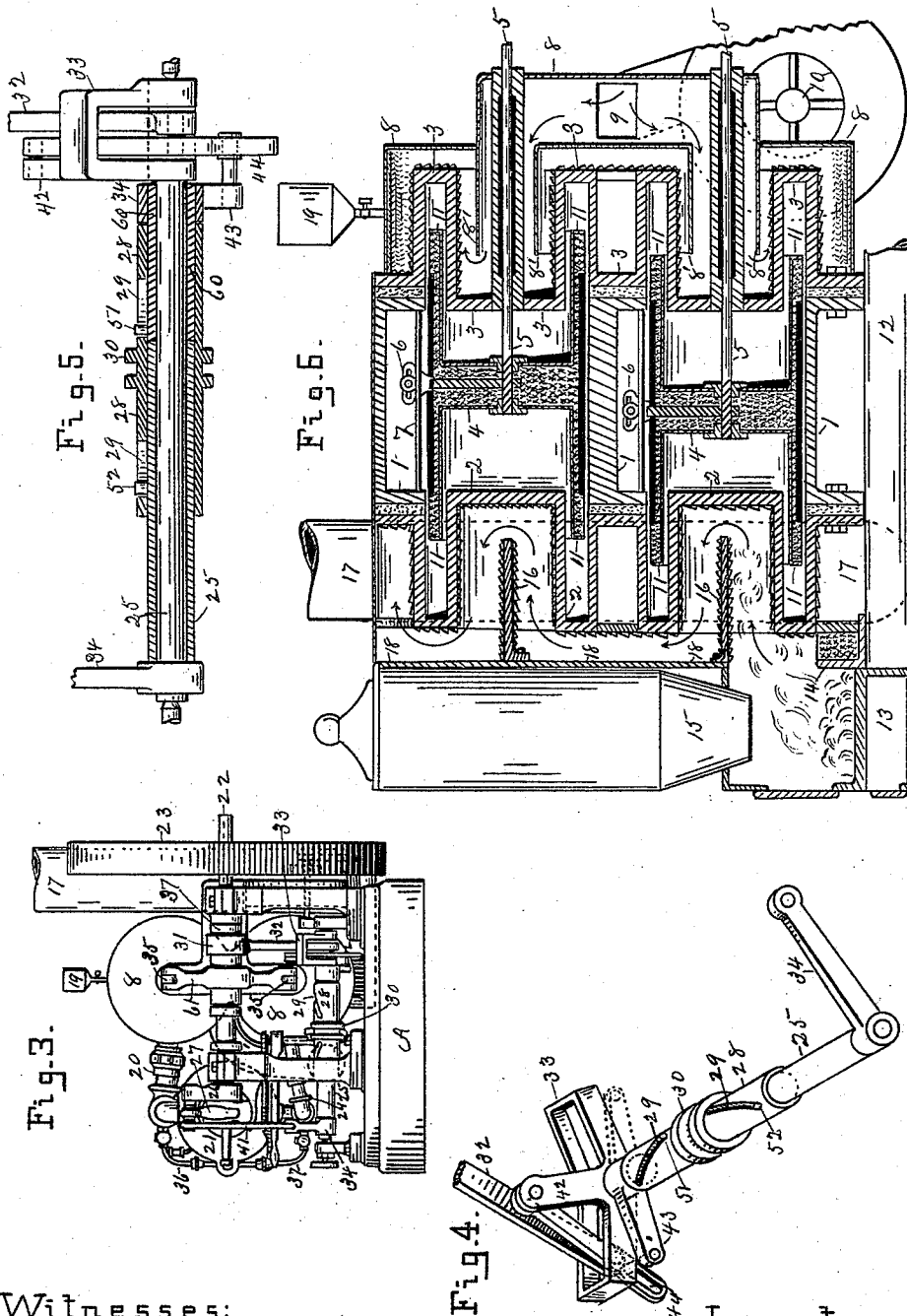
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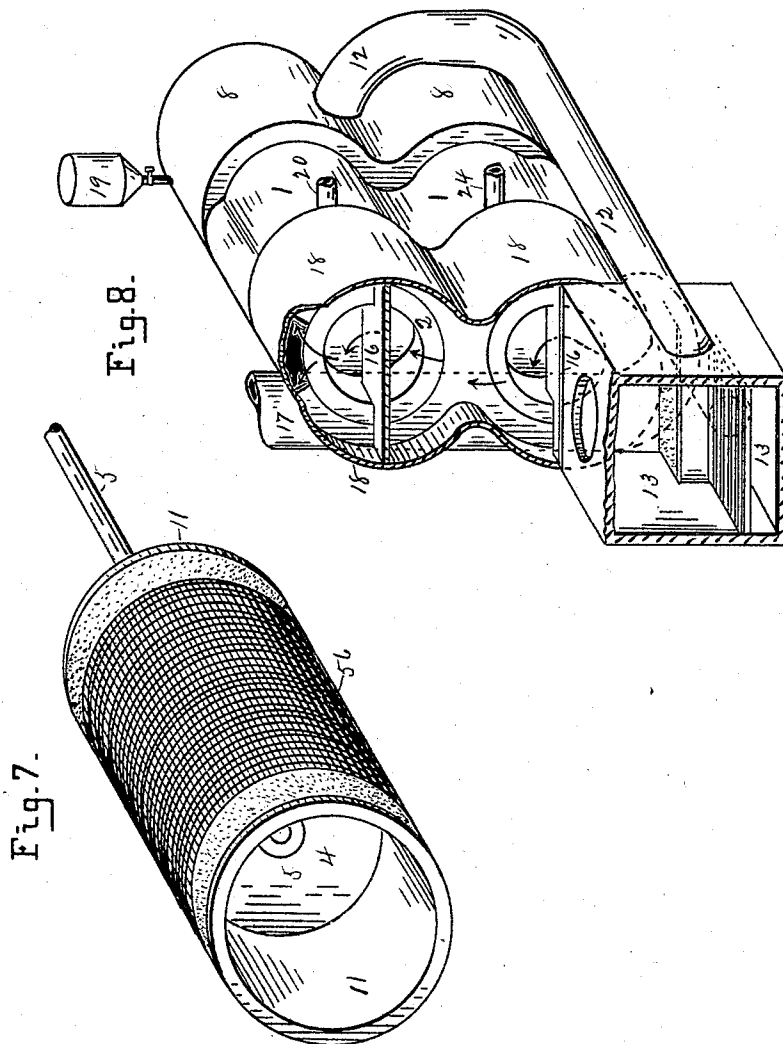
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UNITED STATES PATENT OFFICE.

CHARLES A. ANDERSON, OF JOLIET, ILLINOIS.

HOT-AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 537,517, dated April 16, 1895.

Application filed December 15, 1894. Serial No. 531,868. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. ANDERSON, a citizen of the United States of America, residing at Joliet, in the county of Will and State of Illinois, have invented certain new and useful Improvements in Hot-Air Engines, of which the following is a specification, reference being had therein to the accompanying drawings and the figures of reference thereon, forming a part of this specification, in which—

Figure 1 is a side elevation of the engine except the upper generator, which is shown in longitudinal section. Fig. 2 is a plan view of the engine except the upper generator which is shown in horizontal section. Fig. 3 is an end elevation of the engine. Fig. 4 is a perspective view of the mechanism for starting and stopping the engine and also for reversing the engine and regulating its speed. Fig. 5 is a side elevation of Fig. 4 except the sleeves on the shaft which are shown in section. Fig. 6 is a central vertical longitudinal section of the two matching generators, and their end cases. Fig. 7 is a perspective view of one of the generator plungers; and Fig. 8 is a perspective view of the two matching generators detached from the cylinder and other parts of the engine, and having the head of the case at the fire box end removed to show the parts within said case.

This invention relates to certain improvements in air engines of the class designed to operate upon the recuperative system, and thus use the same air over and over, which improvements are fully set forth and explained in the following specification and claims, reference being had to the drawings, and the figures of reference thereon, accompanying and forming a part of this specification.

Referring to the drawings two matching generators are shown, both connected to the same ordinary cylinder, so that the description of one generator will answer for both.

1 represents the generator cylinder having a recess in its upper wall for containing a track 7, and for furnishing room for a wheel hanger 6 for rolling on said track, said hanger being for the purpose of supporting the generator plunger. Said generator cylinder 1 is closed at each end by means of heads 2 and 3 securely bolted thereto by means of bolts

passing through annular flanges on either end of the generator cylinder and also on said heads in the ordinary manner, and having a non-combustible packing, preferably asbestos placed between said flanges to prevent leakage from said cylinder. The head 2 has formed in its outer side a recess for the reception of heat from a furnace 13, 14. A jacket 18 is used to inclose said head, and extends out forward a short distance beyond the head so as to leave a passage or flue between the head and jacket and in order to cause the heat to pass into the interior of said recess a horizontal plate 16 is secured in said jacket in such manner as to close the flue except at the inner edge of said plate and between it and the bottom of said recess as shown particularly in Figs. 6 and 8, but leaving a passageway or flue around the projecting portion of said head for the purpose of conducting the smoke and gases to a chimney 17. Said plate and also the outer surface of said head are ribbed or corrugated so as to augment their heating surface. The head 3 attached in a similar manner to the opposite end of the generating cylinder 1 is formed in a similar manner to head 2, and is inclosed in a jacket 8, having the inwardly extending flanges 8' for extending into the recess in the outer side of said head for causing cold air blown into said jacket by means of a fan blower 10 to pass in close contact with the whole outer surface of said head for keeping it cool to condense the air within the generator and in contact with the inner surface of said head 3. The air as it is blown through the jacket 8 becomes partially heated by means of its contact with said head, and is conducted from said jacket 8 by means of a pipe 12 to the ash pit 13 under the grate of the fire box 14 for the purpose of creating a draft, and to assist combustion on account of the air being partially heated.

4 is a plunger located in the generator 1 on the inner end of the piston rod 5, and is supported on a track 7 overhead by means of a wheel hanger 6, so said head will not weigh down and bend said piston rod, as said plunger is of less diameter than the generator so as to form a very narrow annular passageway between said plunger and the said generator so that air may pass back and forth between

said plunger and generator to either end of the plunger. Said plunger extends in each direction to form the hollow ends 11, which, as the plunger reciprocates enter the annular recesses alternately of the heads 2 and 3, but not in contact therewith, so that the air in its passage from one end of the plunger to the must pass around the ends 11 of the plunger. Said plunger has a covering on its outer side consisting of wire screening as shown in Fig. 7, at 56, said screening forming an exorbant of heat, absorbing the heat from the heated air as it passes from the heated forward end of the generator, and giving out its heat to the cold air as it returns from the inner cooling end of the generator.

The innersurface of the jacket 8 is intended to be lined or covered with some sort of material like cloth for absorbing and holding moisture such as water which may be admitted thereto from a funnel 19, the said dampened surface of said jacket being for the purpose of more thoroughly cooling the air that is blown through said jacket by means of the fan blower 10 as aforesaid.

An ordinary cylinder 21 is located at the side of the generators, and is connected to the upper generator by means of pipe 20 at one end, and to the lower generator by means of pipe 24, at its opposite end so that heated air is admitted at either end of the cylinder from the generators alternately. Said cylinder is provided with an ordinary piston and rod, and is connected by means of connecting rod 27 and crank 26 with drive shaft 22 having a balance wheel 23 on its opposite end. Said drive shaft has sleeved on it a hub 37 to which is attached a double arm 61, to the respective ends of which are connected the piston rods 5 of the plungers 4 by means of the pitmen 35 in such manner that said arm in its oscillation will move the plungers in opposite directions alternately. Said hub 37 has also connected to it permanently the arm 31 which is connected with arm 42 on rock shaft 25 through the medium of the pitmen 32 and 44. See Figs. 4 and 5. The pitman 32 is pivotally connected to pitman 44 by means of a wrist pin, a short distance from its outer end, and the outer end of pitman 44 is provided with a slot as shown in Fig. 4 for receiving the wrist pin of a crank arm 43 which crank arm is secured on a sleeve 60 as shown in Fig. 5, on shaft 25.

28 is a sleeve on shaft 25 and arranged to inclose or sleeve over the sleeve 60. Said sleeve 28 is provided with spiral slots 29 as shown in said Figs. 4 and 5 for receiving respectively pins 51 and 52—the pin 51 being set in sleeve 60, and pin 52 being set in the shaft 25, so that when sleeve 28 is moved endwise in either direction on shaft 25 by means of a forked arm 38 forked over said sleeve 28 between a pair of integral flanges 30 of said sleeve, the sleeve 60 together with the crank arm 43 attached to it may be partially rotated on shaft 25 from the full lines shown in Fig. 4, to position shown in broken lines in

said figure, for the purpose hereinafter set forth. Said forked arm 38 is connected to the post 57 shown in Fig. 1, and said post has attached to its upper end a hand lever 40 by means of which said arm 38 is caused to reciprocate sleeve 28 as stated, and said lever may have a spring latch for detachably connecting it to the notched segment 39 shown in Figs. 1 and 2 for placing crank arm 43 in any position it may be desired. The frame 33 on the end of shaft 25 is for the purpose of permitting the pitmen 32 and 44 to pass the shaft, and also forms a bearing for that end of the shaft as shown in Fig. 5. The said rock shaft 25 has also secured to it at one end a crank arm 34 which is pivotally connected at its outer end by means of pitman 41 to the wrist pin of crank 26 on the drive shaft 22 as shown particularly in Fig. 1.

The cylinder 21, has located at its side an air pump of the ordinary pattern having its opposite ends connected respectively with the two generators by means of the small pipes 36, and 37. This air pump has its piston rod 46 connected by means of arm 47, with the cross head 50 of the cylinder piston rod as shown in Figs. 1 and 2, and said air pump is for the purpose of supplying air to the two generators that may be lost by leakage or from other causes.

The plunger 4 is formed hollow so it may be filled with some non conducting material such as asbestos to prevent its being heated through. The said plunger has its outer surface covered with wire netting for the purpose of taking up heat from the heated air as it passes to the cooling end of the generators, and for giving out heat to the air as it returns to the heating end of the generators, as the air is caused to pass back and forth in a thin sheet from one end of the generators to the other around the said plunger, between it and the walls of the generator.

The operation is as follows: Before heat is applied air is admitted to each generator through a valve or cock under pressure of the atmosphere. Fire is then made in the furnace until the air is dilated, a portion of which is then permitted to escape through one of the valves or cocks, which is then closed. The heat is then continued until the air has acquired sufficient elasticity to force the piston up the cylinder 21. This communicates motion to the crank shaft and to the upper end of the piston. This will cause the plunger in one generator to move forward so its hollow end will cover the heater, and this motion of the plunger will cause the air contained in it to pass between its outer surface over and among the meshes of the wire netting, and the inner surface of the generator cylinder 1, and accumulate at the back of the plunger where it is cooled by means of its contact with the cold surface of the jacket and of the head 3 and the cool outer surface of the plunger. The air thus contracted produces a partial vacuum which permits the pis-

ton to be forced down by the pressure of the atmosphere above, and as the two plungers are connected with each other by means of the mechanism hereinbefore described in such manner that they move in opposite directions alternately, they alternately cause dilated air to enter one end of the cylinder, and cause a partial vacuum at the other end of the cylinder, so that the piston is moved in either direction by both a pressure of dilated air and a partial vacuum. The mechanism for connecting the piston rods 5 of the two plungers may be operated by means of the lever 40 so as to vary the stroke of each plunger and thus regulate the amount of air to be heated, or to hold them central in their respective generators balanced, so as to stop the engine altogether, or to reverse the engine by means of turning crank 43 from the position shown in the full lines in Fig. 4, to that shown in broken lines in said figure. If the crank 43 were turned to a position central between said points, the plungers 4 would be located exactly opposite each other in the center of the generators and not move in either direction and the engine would be stopped.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a hot air engine the combination of the generators comprising the cylinders 1 having the heads 2 and 3 each having a track 7 for a hanger, the hollow plungers 4 each having a wheel hanger 6, and each having a non conductor filling such as asbestos, the wire cloth

or netting 56 for covering the sides of said plungers, the jacket 18 connected with a fire box and having the deflecting plates 16 and flue 17, jacket 8 having the inwardly projecting flanges 8', the fan blower 10 for blowing cold air into said jacket, pipe 12 for conducting air from said jacket 8 to the fire box, the plunger rods 5 and the means for connecting said rods and for regulating the stroke of and reversing said plungers, the cylinder 21 and its crank and shaft and the means for connecting it with the generators, and the air pump for replacing escaped air from the generators, all arranged to operate substantially as and for the purpose set forth.

2. In a hot air engine the combination of the hollow plungers 4, rods 5, double crank 61, arm 31, drive shaft 22, pitmen 35, pitman 32, slotted pitman 44, shaft 25, arm 42 and frame 33 secured to one end of said shaft, arm 43 secured to sleeve 60 on said shaft, and connected with pitman 44, sleeve 28 having the spiral slots 29 and annular flanges 30 and sleeved on said shaft and also on sleeve 60, pins 51 and 52 located in said slots, forked arm 38, post 57 having arm 38 and hand lever 40 notched segment 39, and crank 34 and pitman 41, for connecting rock shaft 25 with crank 26 of drive shaft 22 all arranged to operate substantially as and for the purpose set forth.

CHARLES A. ANDERSON.

Witnesses:

THOS. H. HUTCHINS,
RAY HUTCHINS.