(No Model.) 3 Sheets—Sheet 1.

H. DENNEY.

HOT AIR PUMPING ENGINE.

No. 538,068. Patented Apr. 23, 1895.

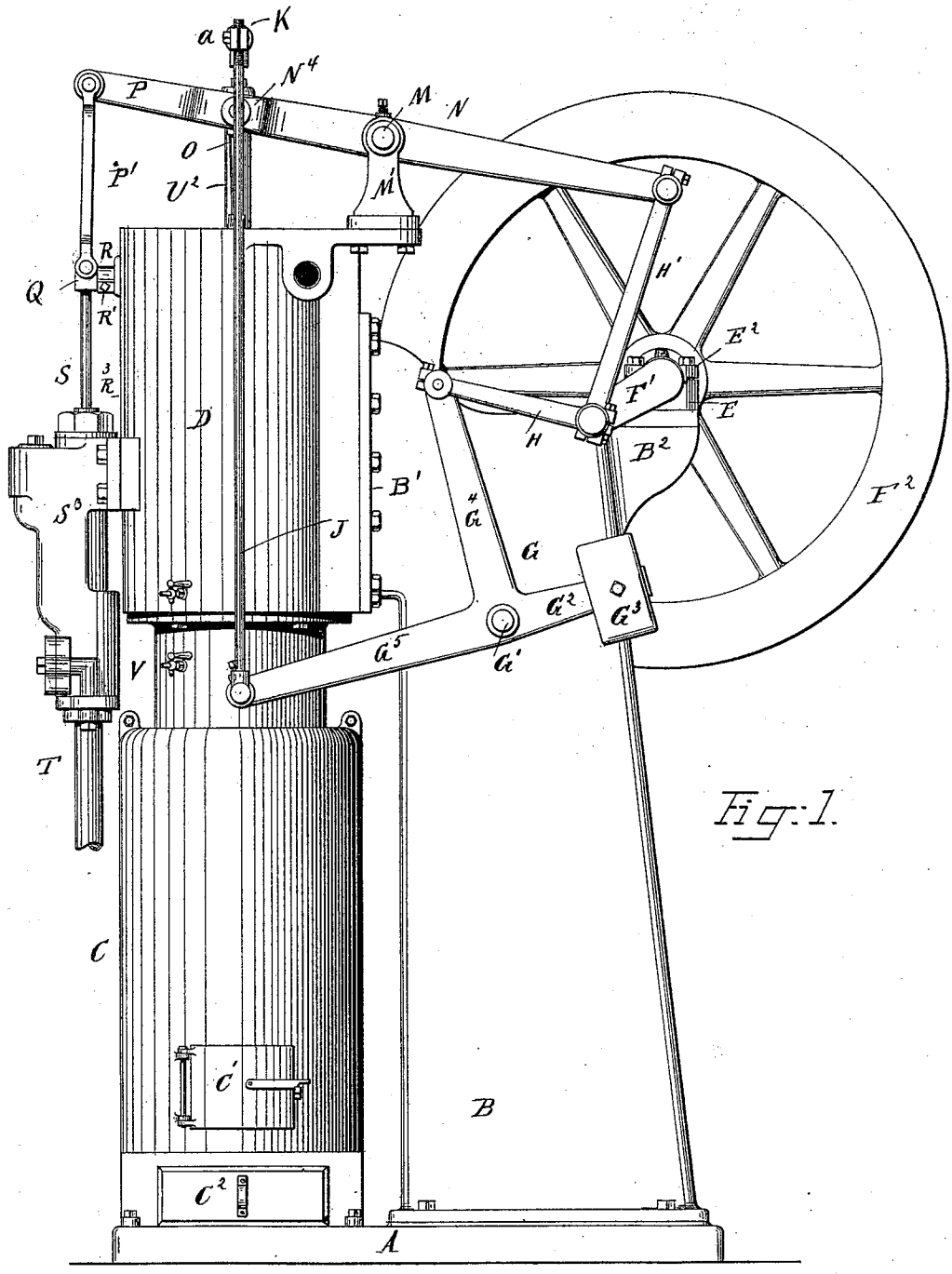

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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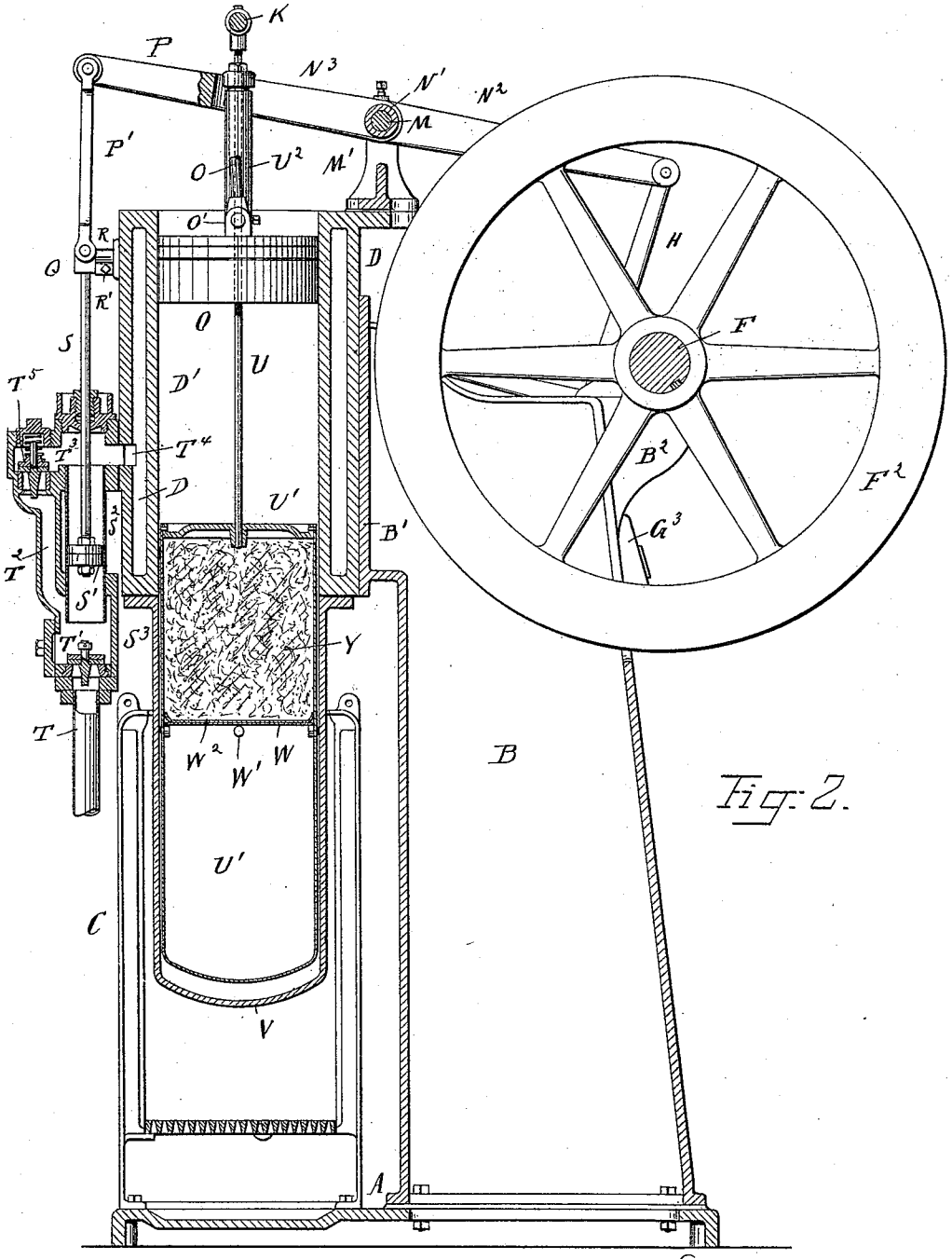

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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HOT AIR PUMPING ENGINE.

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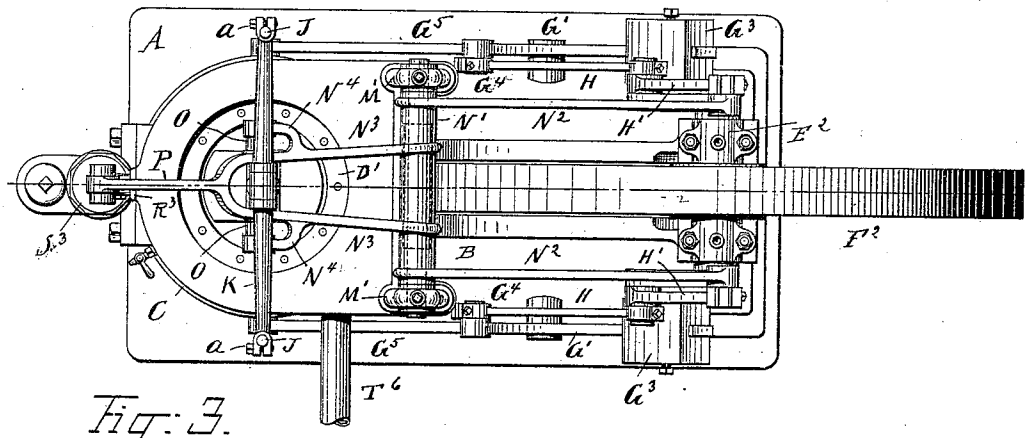

Fig. 3.

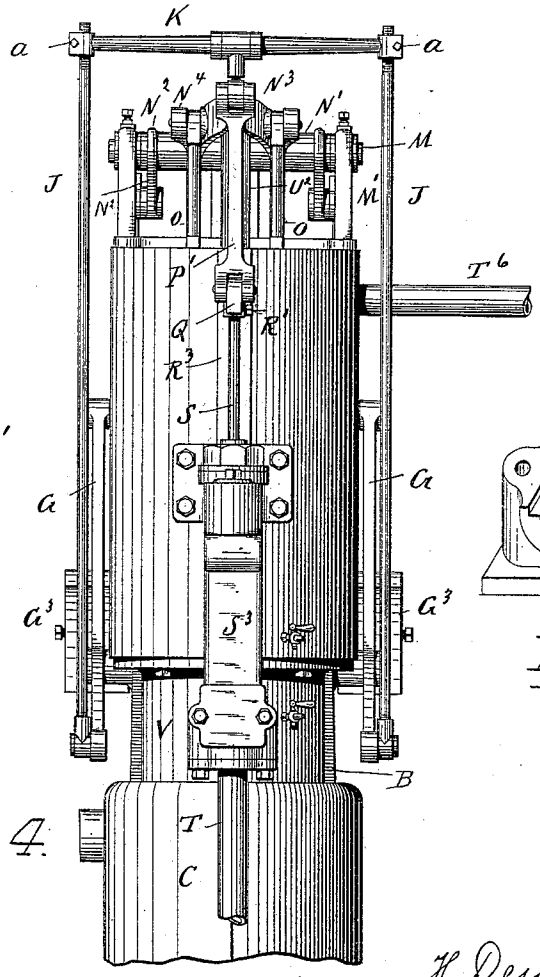

Fig. 4.

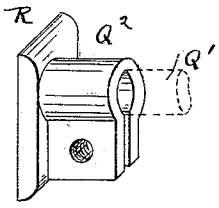

Fig. 5.

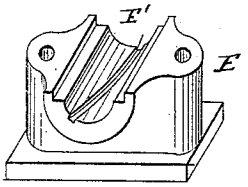

Fig. 6.

Witnesses
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UNITED STATES PATENT OFFICE.

HARMER DENNEY, OF NEW YORK, N. Y.

HOT-AIR PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 538,068, dated April 23, 1895.

Application filed February 1, 1895. Serial No. 537,014. (No model.)

To all whom it may concern:

Be it known that I, HARMER DENNEY, a citizen of the United States, and a resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Hot-Air Pumping-Engines, of which the following is a specification.

This invention relates to improvements in hot air pumping engines.

The object of my invention is to provide a new and improved engine of this kind which is simple in construction, strong and durable, and effective in service and use.

The invention consists in the novel construction and in combination of various parts and details as will be fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings forming a part of this specification, and in which drawings, similar letters of reference indicate like parts in all the figures, Figure 1 is a side view of my improved hot air pumping engine. Fig. 2 is a vertical longitudinal sectional view of the same, parts being shown in side elevation. Fig. 3 is a plan view of the same. Fig. 4 is a front end view of the upper part of my improved hot air pumping engine. Fig. 5 is a perspective view of the guide block for the pump-piston rod. Fig. 6 is a perspective detail view of one of the self oiling pillow blocks for the main or crank shaft.

The entire engine rests upon the base plate A, which is of sufficient size to receive and support the cast hollow standard B, and the vertical cylindrical furnace C provided with the fuel door C′ and the ash door C^2 below the same.

The standard B, is provided at one side and at the top with a straight and vertical smooth face B′ against which a correspondingly shaped face of the water jacket D of the vertical cylinder D′, fits, said jacket being cast integral with the cylinder and bolted to the face B′ of the standard B so that said cylinder is supported entirely by the standard and is located vertically above the furnace C.

The standard B is provided at the top and at the side opposite the face B′ with the brackets B^2 to the tops of which the pillow blocks E for the main or crank shaft F are bolted. Said pillow blocks are each provided in their semi-cylindrical grooves, for receiving the shaft, with an inclined or spiral groove E′ for receiving a strip of felt or suitable material for receiving and retaining a suitable lubricant so that the bearings for the crank shaft are self lubricating. Caps E^2 are bolted on the pillow blocks and with the same form the bearings for the crank shaft.

The crank shaft F is provided at each end, outside of the pillow blocks with a crank F′ and between the pillow blocks it carries the fly wheel F^2 which extends into a recess formed in the top and side of the standard B, as shown in Fig. 3. From each side of the standard B a pivot G′ projects and on each pivot G′ an angle lever G is mounted to rock at the angle, the said angle lever having an extension G^3 beyond the pivot, in the line of the lower arm, which extension carries on its end a counterbalancing weight G^3 for the transfer piston.

The free end of the upwardly projecting arm G^4 of each angle lever G is connected by a link H with the pin of crank F′ on the same side of the standard and the free end of the lower arm G^5 of each angle lever G is connected with the lower end of a connecting rod J having its upper end connected with one end of the transfer piston rod cross head K there being one connecting rod J at each side of the cylinder. Each crank F′ is pivotally connected with the lower end of a link H′ having its upper end pivotally connected with the beam N. The beam is composed of the hub N′, the two arms N^3 projecting in one direction from the same and slightly inclined toward each other and the two arms N^2 projecting in opposite direction and preferably arranged parallel to each other, the ends of said arms N^2 being connected with the links H′ previously mentioned.

The bore of the hub N′ is cored out as shown in Fig. 3 in dotted lines, to form a lubricant chamber and through said hub the shaft M passes on which the beam rocks, said shaft being held on at its ends in the standards M′ projecting upward from the top of the cylinder jacket D.

The arms N^3 of the beam are each provided on the outer side and at the outer united ends with the side brackets N^4 extending in the same direction as the arms and between said

brackets and the sides of the arms, the upper ends of the two links O are pivoted, the lower ends of said links being pivoted to the lugs O′ on the upper surface of the air piston O^2 in the cylinder D′.

From the united end of the arms N^3 of the beam N the arm P projects and to the free end of the same, the forked upper end of the link P′ is pivoted, the forked lower end of which is pivoted to the head Q provided with a pin Q′, shown in dotted lines in Fig. 5, and projecting into the split socket Q of the block R mounted to slide on a planed vertical track R^3 on the outside of the cylinder jacket D. Said split socket is provided with threaded holes for receiving a clamping screw R′ by means of which the pin Q′ can be clamped in the socket, and can be adjusted accordingly as the parts wear off.

The head Q is fastened on the upper end of the pump-piston rod S, to the lower end of which the pump piston S′ is fastened, that works in the pump cylinder S^2 secured in the pump casing S^3 which is bolted to the front of the cylinder jacket D. The bottom of the casing S^3 is connected with the suction pipe T at the top of which the puppet valve T′ is arranged. A channel T^2 in said casing leads from below the pump cylinder to the top chamber T^3 which by means of the port T^4 is brought in communication with the water jacket D surrounding the cylinder D′. A spring pressed puppet valve T^5 is arranged at the top of the channel T^2 as shown in Fig. 2.

The water after having passed through the jacket D passes off through the discharge pipe T^6 connected with the jacket D. The piston rod U of the transfer piston U′ passes through a neck U^2 projecting upward from the air piston O^2 and has its lower end secured to the top head of the transfer piston U and its upper end is secured to the cross head K. The transfer piston works in the cylinder D′ and in the cylindrical heater V which is open at the top and closed at the bottom and which has its open top bolted to the open bottom of the cylinder D′, the lower half of said heater being within the furnace C.

The transfer piston U′ consists of a long cylindrical hollow body of an exterior diameter about one quarter of an inch less than the interior diameter of the heater and cylinder D′ which have the same internal diameter. A short distance above, about half the height of the transfer piston, an iron disk W rests upon rivets W′ projecting from the inner surface of said piston and upon said disk a sheet W^2 of asbestos is placed which has its edges turned up against the inner surface of the transfer piston and the space between said sheet of asbestos and the top of the transfer piston is filled with cotton Y, for the purpose of preventing the transmission of heat from the lower to the upper part of the transfer piston.

The ends of the cross head K are split vertically and provided with clamping screws *a* for clamping the upper threaded ends of the connecting rods J, which are screwed through the threaded apertures in the ends of the said cross head.

To adjust the connecting rods J, the screws *a* are loosened the lower ends of the rods J are disengaged and then said rods are screwed up or down as much as necessary and then clamped in place by means of the screws *a*.

The engine operates in the usual manner. The air being compressed in the upper cold part of the cylinder D′, is then transferred to the lower part of the heater where it is heated and expanded.

The cranks, links, &c., are all double as one is provided on each side. The beam has a bearing throughout the length of its hub and as it has double arms projecting from its hub in opposite directions, it can be made light but at the same time very stiff and rigid.

The pivots and bearings are not subjected to any side or twisting strains and all parts run very smoothly. As the power cylinder is supported by the rigid standard the entire device is held firmly and securely and cannot work loose.

In case any parts of the heater or power cylinder become deranged or require adjustment or repairs they can easily be detached without in any way disturbing the other parts of the engine.

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

1. The combination with a cylinder, piston and a crank shaft, of a rocking beam connected with said piston and crank shaft, and composed of a hub having four arms arranged in two pairs, said two pairs extending in opposite directions substantially as herein set forth.

2. The combination, with a fixed shaft, of a hub mounted to rock on the same, two pairs of arms on said hub and extending in opposite directions, a piston connected with one pair of arms and a crank shaft connected with the other pair substantially as herein set forth.

3. The combination with a cylinder, piston and a crank shaft having two cranks, of a rocking beam, means for connecting the beam with the piston and two links connecting the beam with the two cranks of the crank shaft, substantially as herein set forth.

4. The combination with a cylinder, of an air piston and a transfer piston in the same, a rocking beam connected with said air piston, a crank shaft provided with two cranks, a link for each crank and connecting the same with the beam, an angle lever connected with each crank, each angle lever being also connected with the rod of the transfer piston and a counterbalancing weight on each angle lever for counterbalancing the transfer piston, substantially as herein set forth.

5. The combination with a cylinder, of an air piston, and a transfer piston in the same, of a rocking beam connected with the air piston, a piston rod on the transfer piston, a cross

head on the upper end of said transfer piston rod, which cross head has its end split and provided with screw threaded apertures, clamping screws in said split and threaded ends, connecting rods having threaded upper ends screwed through the appertures in the cross head, rocking angle levers with which the lower ends of the connecting rods are pivotally connected a crank shaft with which said angle levers are connected and means for connecting the crank shaft with the beam substantially as herein set forth.

6. The combination, with a cylinder, piston, a rocking beam and crank shaft, of a pump fastened on the cylinder, a block mounted to slide on the outside of the cylinder and connected with the pump piston rod, and a link connecting said block with the rocking beam, substantially as herein set forth.

7. The combination, with a cylinder, piston, rocking beam and crank shaft, of a pump secured on the cylinder, a block mounted to slide on the outside of the cylinder and provided with a split socket, a clamping screw in said socket a pin in said socket, a head from which said pin projects, a pump piston rod, to the upper end of which said head is fastened, and a link connecting the pump piston rod with the rocking beam, substantially as herein set forth.

8. In a hot air engine, the combination with a base, of a standard on the same, which standard is provided with a vertical recess in its top and side, a crank shaft mounted on said standard, a fly wheel mounted on said shaft and projecting into said recess, a cylinder secured to the side of said standard and means for rotating the crank shaft from said cylinder, substantially as herein set forth,

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 15th day of January, 1895.

HARMER DENNEY.

Witnesses:
OSCAR F. GUNZ,
D. PETRI PALMEDO.