Oct. 6, 1931. N. CHRISTIANSEN 1,826,273

POWER PLANT

Filed Jan. 20, 1928

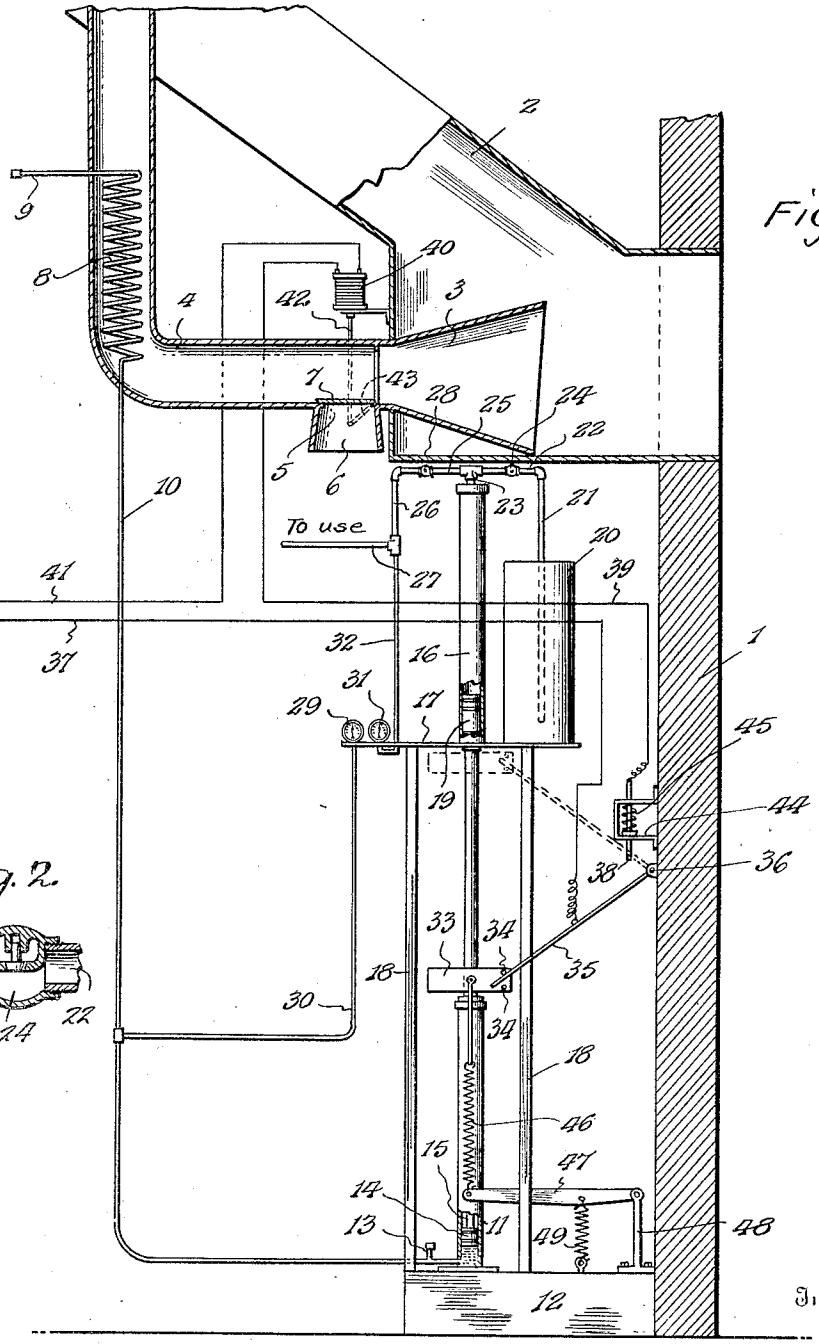


Fig. 1.

Fig. 2.

Inventor

N. Christiansen.

By Lacey & Lacey, Attorneys

Patented Oct. 6, 1931 1,826,273

UNITED STATES PATENT OFFICE

NIELS CHRISTIANSEN, OF NEWPORT NEWS, VIRGINIA, ASSIGNOR OF ONE-HALF TO CHARLES H. SHEPLER, OF RIDLEY PARK, PENNSYLVANIA

POWER PLANT

Application filed January 20, 1928. Serial No. 248,209.

The object of this invention is to utilize the waste heat of furnaces or other heat-generating instrumentalities for the creation of power whereby useful work may be performed. The invention provides means whereby the hot gases escaping from a furnace, or other waste heat outlet, after having performed their primary purpose may be diverted so as to act upon an element responsive to changes in temperature whereby to operate a pump or other working mechanism. One embodiment of the invention is illustrated in the accompanying drawings and will be hereinafter fully described, the novel features being particularly pointed out in the appended claims.

Fig. 1 of the accompanying drawings is a sectional elevation of a mechanism embodying the present invention.

Fig. 2 is a detail section of a check valve.

In the drawings, the reference numeral 1 indicates a portion of a furnace from which a smoke stack or flue 2 extends to carry off the waste products. In carrying out the present invention, the stack is provided with an opening in one wall to receive a nozzle 3 forming an inlet for a by-pass tube or pipe 4 which extends laterally from the stack and then upwardly, as shown, the upwardly extending portion of this tube being carried to any desired height past the stack or being inset in the stack as may be preferred under any given circumstances. The intake nozzle 3 is preferably flared toward the furnace wall, as shown, so that the escaping gases and hot air will have a comparatively wide opening presented in their path and the diversion of the hot currents will be effectual. At the outer side of the stack, an opening 5 is formed in the bottom of the tube or pipe 4 and a depending nozzle 6 may be formed around said opening. Immediately adjacent the nozzle, a damper 7 is pivoted within the tube in such manner that in one position it will extend over the opening 5 to close the same and in another position it will extend across the tube at the end of the nozzle and prevent the inflow of hot gases to the tube. This damper is operated automatically as will presently appear. Within the tube 4 and preferably extending axially of the upright portion thereof is a coil 8 having its upper end extended through and laterally beyond the tube, as shown at 9, and having its lower end merged into a tube 10 which extends to and opens into a cylinder 11 having a closed lower end and firmly supported upon a foundation 12 which may be the foundation of the furnace or may be built adjacent the same. The function of the coil and the tube 10 is to serve as a container for the working fluid and the coil form is adopted to provide a maximum surface. Near the lower end of the cylinder 11, the tube 10 is equipped with a filling nipple 13 whereby oil or other fluid which is susceptible to temperature changes may be poured into the pipe so as to fill the same and the coil 8. The lateral branch 9 of the coil constitutes a vent for any air which might otherwise be trapped in the coil and the vent is sealed after the pipe 10 and the coil have been completely filled with the oil or other fluid, the filling operation being performed when the pipe and coil are cold. Within the cylinder 11 is a piston 14 which fits snugly but slidably therein and which is adapted to reciprocate within the cylinder, the lowest limit of the movement of the piston being above the point of attachment of the pipe 10 to the cylinder, as will be understood upon reference to the drawing. A piston rod 15 rises from the piston through the upper end of the cylinder and extends into an upper cylinder 16 which is rigidly supported upon a platform 17 mounted upon columns 18 rising from the foundation 12. Upon the upper end of the piston rod is secured a plunger 19 which fits closely but slidably within the cylinder 16.

From the description thus far given, it will be understood that, with the damper 7 in the position shown, the hot gases and other waste products escaping from the furnace may flow through the nozzle 3 and tube 4 and play directly upon and circulate along the coil 8 and will thereby raise the temperature of the coil and of the fluid therein. The coil and the pipe 10 having been completely filled and the upper end of the coil sealed, the fluid can expand only in one direction, that is, upwardly

within the cylinder 11, and this expansion will lift the piston 14 in an obvious manner. If the damper 7 be swung upwardly so as to cut off the flow through the nozzle 3, the further entrance of hot currents into the tube 4 will be arrested and cold atmospheric air may flow through the opening 5 into the tube and pass through the tube around and along the coil 8 so as to reduce the temperature of the coil and effect contraction of the fluid therein. The contraction of the fluid will, of course, result in descent of the piston 14. The piston 14 can, therefore, be obviously arranged to perform useful work.

In the embodiment of the invention which is illustrated in the drawing, the cylinder 16 constitutes a pump barrel and the plunger 19 working therein constitutes a ram. The particular arrangement shown includes a tank 20 filled with liquid. Disposed within the tank and rising therefrom is a suction pipe 21 having its upper end connected to a branch 22 extending above the pump barrel 16 and in communication therwith through a T-coupling 23, a check valve 24 of any standard or approved form being interposed in the branch between the suction pipe and the T-coupling, as shown. From the opposite side of the T-coupling, a branch 25 extends to a discharge pipe 26 which is shown as having a portion 27 extending laterally to a point of use. A check valve 28 of the same form as the valve 24 is inserted in the branch 25 and cooperates with the check valve 24 so that upon the down stroke or suction stroke of the plunger 19 liquid will be sucked into the pump barrel and upon the reverse stroke will be forced therefrom into the discharge pipe.

In order that the pressure conditions within the apparatus may be easily noted, I have provided a pressure gage 29 connected by a pipe 30 with the fluid pressure side of the apparatus and a second pressure gage 31 connected by a pipe 32 with the discharge pipe 26.

In order to insure positive descent of the piston 14 and the plunger 19 when the working fluid is contracting, a crosshead 33 is attached to the piston rod 15 above the cylinder 11, and this crosshead is of such weight that it will act as a balance to insure an even steady movement of the parts. Upon the side of the crosshead adjacent one end thereof are vertically spaced studs 34 between which is received the end of a circuit-closing arm 35 which may be pivoted upon the furnace wall, as indicated at 36. This circuit-closing arm is connected, as shown, with one of the trunk lines 37 supplying electric current from a generator or other convenient source of supply. This circuit-breaking and closing arm 35 is arranged in the vertical plane of a contact 38 supported in any suitable manner upon the side of the furnace wall and connected by a conductor 39 with the winding of a solenoid 40 which is suitably supported upon the smoke flue 2 and has its other terminal connected to the feed wire 41. The core 42 of the solenoid extends downwardly therefrom and is connected to a crank 43 fixed to one end of the pivot of the damper 7, and it will be seen at once that, when the solenoid is de-energized, the core will be in its lowest position and the damper 7 will be in the position shown in the drawings to permit the hot gases to flow through the tube 4. When the piston 14 rises under the expansion of the fluid in the coils 8, the crosshead 33 will, of course, move upwardly at the same time and this upward movement of the crosshead will cause the lever or arm 35 to swing upwardly, as indicated by the dotted lines in the drawings. When the lever moves upwardly, it will move against the contact 38 and thereby close the circuit through the solenoid so that the latter will be energized and its core attracted and raised to close the damper 7 and thereby cut off the flow of the hot gases through the tube 4, simultaneously admitting outside air to said tube so that cooling and contraction of the fluid in the coil will ensue. In order to avoid jamming of the contact 38 under the impact of the arm 35, the contact is slidably mounted in the supporting bracket 44 and is yieldably held in its lowered position by a spring 45 acting thereon in an obvious manner. As the cooling of the coil 8 and the resultant contraction of the fluid therein proceeds, the crosshead 33 will descend and will effectually return to its initial lowest position, this movement of the crosshead effecting a return rocking of the arm 35 and release of the same from the contact 38 so that the solenoid circuit will be broken and the core thereof permitted to drop to return the damper 7 to the position shown. A constant reciprocation of the piston 14 will be thereby effected.

When the cylinder 11 is arranged in an upright position, the crosshead 33 may be made heavy enough to suffice to return the piston to its lowest position as the fluid contracts. It may not be possible, however, in all cases to arrange the cylinder in a true upright position and in such event retractile springs may be provided to effect the return movement. Such an arrangement is illustrated and comprises a coiled spring 46 connected at one end to the crosshead and at its opposite end to an equalizing lever 47 which is fulcrumed upon a post 48 fixed upon the foundation 12, a spring 49 being arranged between and attached to the foundation and to the lever. When the piston is moving through its expansion stroke, the springs will be put under tension so that, when said stroke ceases and the contraction stroke is to occur, the springs will retract and move the crosshead and the piston steadily and evenly in the reverse direction.

It is to be understood that, while I have, by way of example, shown and described a pump operated by the working piston, the utility of the apparatus is not confined to pumping operations but it may be applied in various ways to perform desired work. The apparatus is exceedingly simple and by its use heat which is now permitted to escape to the open air after having performed its mere heating function may be diverted so as to create power at an exceedingly low cost. While I have illustrated and described the damper 7 as being operated electrically, it may be operated mechanically or otherwise, the only essential being that it operate in the described relation to the action of the piston.

Having thus described the invention, I claim:

1. The combination with the smoke flue of a heat generator, of a by-pass tube in communication with the smoke flue and having an opening to establish communication with the atmosphere, a closed coil within said tube containing a temperature responsive fluid, a piston arranged to be actuated by expansion and contraction of said fluid, a damper within the by-pass tube controlling the admission of the atmosphere and of the gases from the smoke flue, and means whereby said damper will be operated with the movements of the piston.

2. The combination with the smoke flue of a heat generator, of a by-pass tube in communication with the smoke flue and having an opening to establish communication with the atmosphere, a damper pivoted within the tube at said opening and adapted to extend across said opening to shut off the atmosphere or to extend across the tube to shut off the gases from the smoke flue, a closed coil within the tube, a cylinder, a piston within the cylinder, a temperature responsive fluid within the coil and extending into the cylinder below the piston whereby expansion of the fluid will lift the piston, means for lowering the piston as the fluid contracts, and means for shifting the damper with the movement of the piston.

3. The combination with the smoke outlet of a heat generator, of a by-pass tube in communication with said smoke outlet and having an opening whereby to establish communication with the atmosphere, a closed coil within the tube, a cylinder in communication with said coil, a temperature responsive fluid in the coil and entering the cylinder, a piston within the cylinder influenced by the fluid, means acting on the piston in opposition to the fluid to return the piston to initial position, and means for moving the damper with the movement of the piston.

4. The combination with the smoke outlet of a heat generator, of a by-pass tube in communication with the smoke outlet and having an opening to establish communication with the atmosphere, a damper within the by-pass tube to extend across the tube or cover said opening, a cylinder, a piston therein, a closed coil within the by-pass tube having one end connected with the cylinder below the piston, a temperature responsive fluid within the coil acting by expansion to lift the piston, a solenoid operatively connected with the damper, and means operated by the piston for energizing and de-energizing the solenoid.

5. The combination with the smoke outlet of a heat generator, of a by-pass tube in communication with the smoke outlet and having an opening to establish communication with the atmosphere, a damper within the tube to cover said opening or extend across the tube, a closed coil within the tube, a cylinder connected with the coil, a piston in the cylinder above the point of connection of the coil therewith, a temperature responsive fluid in the coil, a solenoid having its core operatively connected with the damper, a contact arranged in the circuit of the solenoid, a pivotal arm arranged to engage said contact, and means whereby the movement of the piston will rock said arm to make or break the circuit of the solenoid.

6. The combination with the smoke outlet of a heat generator, of a by-pass tube in communication with said outlet, means for closing said tube to the smoke outlet and to the atmosphere alternately, a closed coil within the tube, a cylinder in communication with the coil, a temperature responsive fluid in the coil, a piston in the cylinder movable in one direction by the expansion of said fluid, and spring devices acting on the piston in opposition to said fluid.

In testimony whereof I affix my signature.

NIELS CHRISTIANSEN.