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MACHINERY FOR PRODUCING MOTIVE POWER.

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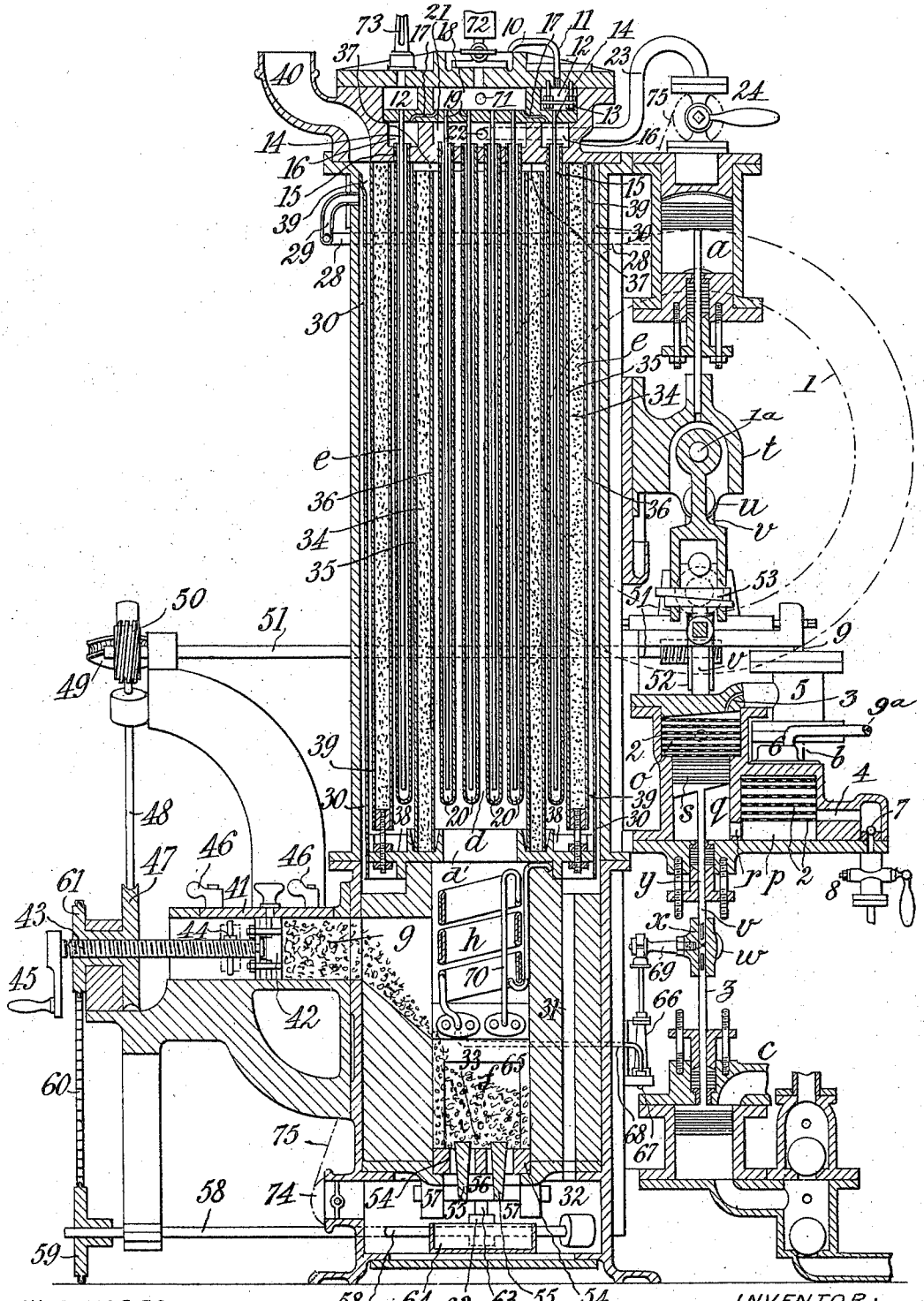

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MACHINERY FOR PRODUCING MOTIVE POWER.

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Application filed May 25, 1905. Serial No. 262,290.

To all whom it may concern:

Be it known that I, CHARLES TELLIER, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Machinery for Producing Motive Power, of which the following is a specification.

This invention relates to machinery for the production of motive power based on the employment of air compressed isothermically and superheated, by the combustion of fuel either directly or indirectly. I will describe the same with reference to the accompanying drawing which shows a vertical section of an apparatus in which solid fuel or non-volatile combustible liquids are employed.

The apparatus shown in the drawing is assumed to be applied to the raising of water; it may, however, be equally well applied to other purposes for which motive power is required. The object of this particular construction is to show that it can be worked automatically without requiring to be supplied with fuel except at long intervals of time, such as twelve hours or longer.

The following are the principal devices of the construction. *a* is the motor cylinder, *b* is an air compressing pump, *c* the water pump, *d* a group of re-heating tubes, *e* the heating tubes, *f* the combustion chamber, *g* the fuel-feeding device, *h* a steam coil.

The motor cylinder *a* can be worked with any known system of slide or other valves, either arranged for variable expansion or not. The motor cylinder *a* arranged as described, receives compressed and superheated air by means which I will proceed to describe. The pump *b* operating with isothermic compression, which has to supply the compressed air, is composed of two spaces *o p* which may be either cylindrical or rectangular and which communicate with a cylindrical chamber *q* and an opening *r*. In the chamber *q* is a piston *s* which is actuated by the motor cylinder *a* by means of twin connecting rods connected to the head *t* of a slide by means of a pivotal connection at *u*, the one connecting rod is shown at *v v* passing behind the piston rod, and the compression pump, being connected at *w* with the junction piece *x*, which connects the piston rod *y* of the pump *b* with the piston rod *z* of the water pump. Any other arrangement for establishing the said connection may be employed. The pistons of the cylinders *a* and *b* can be connected by means of a crank shaft.

A fly wheel is mounted on the motor shaft 1^a, as indicated in dotted lines at 1, for equalizing the motion. Pulleys or other transmission devices can also be fixed on the same motor shaft which can thus be made to distribute the motive power in any desired manner, such motive power being applicable to a great variety of purposes.

Referring to the compression pump *b*, the chambers *o p* are filled with perforated metal plates 2 2 situated at from 3 to 4 mm. apart, suitable distance pieces such as rivets being provided on the plates for maintaining them apart; during the suction period of the pump, water enters the chambers *o* and *p* through the passages 3 and 4. During the pressure stroke this water, which fills the whole pump with the exception of the air chamber formed by the displacement of the piston *s*, is forced, together with the compressed air, through the discharge valves; each of these discharge valves is arranged together with an air suction valve, on the one hand in the box 5 of the chamber *o*, and on the other hand in a box indicated at 6 of the chamber *p*. These valves may be of any known construction.

The water supplied to the pump, under a slight pressure, is introduced during the suction period through the channels 3 and 4, at the same time that air is drawn in through the suction valves at 5 and 6; each of the water channels is provided with a check valve, that for 4 being shown at 7; a cock 8 is provided on the supply pipe for regulating the supply. If no head of water for the supply is available it is forced in by means of a small pump driven by the motor.

The advantages afforded by the above described compression pump are as follows:—

1. By means of the perforated metal plates 2, 2, which at each stroke of the pump have the water current passing through them, the entire heat of the air compression is absorbed by the water and carried to the outside.

2. There are no dead spaces as all the spaces of the pump are filled by the water passing through.

3. No escape of water through the stuffing box is possible as this is also covered by water, which is also the case with the valves.

4. The chambers *o p* can be made of any

desired size, the larger the capacity the slower will be speed of the water and the freer will be the passage for the air. The air compressed by the pump *b* issues by the pipe 9 and through a similar pipe 9ª below. This air being mixed with water is conveyed into an automatic separator arranged behind the apparatus, and therefore not shown. It may be of any known construction and need not be further described. The water discharged from the same being under a certain pressure, can be utilized in any suitable mechanism.

The air escaping from the separator passes through a pipe 10 shown at the top of the apparatus with bend 11 into the annular heating space 12. A plate 13 placed under the inlet for the air facilitates the uniform distribution thereof to all the heating tubes. Into the annular space 12 open the upper ends of the inner tubes 14 which pass down to near the closed lower ends of the outer tubes 15 which are heated externally as will be presently described; the compressed air consequently passes from the chamber 12 down the tubes 14 and issues thence into the annular space between these and the tubes 15 in rising through which it comes into intimate contact with the heated walls of 15. From the upper ends of the tubes 15 the air passes into a second annular space 16 with which communicate several channels 17 leading the compressed air into the central upper chamber 18. Into this chamber open other tubes 19 passing down to the closed lower ends of the outer tubes 20, which are heated externally directly by the fire heat, so that the air passing up through the same becomes superheated to the required extent and issues into the central chamber 21 whence it passes through the opening 22 and pipe 23 to the admission valve 24 by means of which it is admitted to the motor cylinder *a*. After performing work in the motor cylinder the expanded air issues through a pipe 28, preferably having a part formed in elastic material such as caoutchouc, that will yield to a certain extent to the pulsations of the escaping air so as to prevent concussions as the air escapes with some pressure.

The pipe 28, as indicated in dotted lines, is provided with several branches 29 through which the expanded air enters the narrow annular space 30. The air descends in this space and issues at the bottom thereof into a conduit 31, which leads it into the space 32 of the furnace. From this space it passes up through the grate 33 into the combustion chamber charged with fuel. The hot gases resulting from the combustion pass upward through an opening *d'* into the central space surrounding the group of tubes *d*, and inclosed by a cylindrical wall 34 formed of two concentric sheet iron cylinders 35, 36, the annular space between which is filled with ashes or other bad conductor of heat. Or the cylindrical wall might be constructed of fire clay. Thus the hot combustion gases in rising up between the tubes 20 impart a great portion of their heat thereto and after issuing at top into the narrow space 37, they again descend through the annular space in which are situated the tubes *e* to which they impart a further portion of their heat. At the lower end of the said annular chamber the combustion gases pass into a passage 38, from which they pass into the narrow annular space 39, communicating at the upper end with a chimney flue 40, through which they escape into the open air. If necessary a further quantity of heat might be taken up from the combustion gases by arranging in the chimney, or otherwise, a suitable counter current apparatus, of known arrangement, for imparting heat to a fresh supply of air.

The fuel supply for the furnace is contained in a chamber *g* which is filled therewith through a movable plate 41, the feeding piston 42 of this chamber being at that time drawn back by means of the screw spindle 43, the backward turning of which is facilitated by releasing a locking device 44, which locks it to the piston 42, so that it is then free to be turned by means of the crank handle 45. The chamber *g*, having been filled with fuel, the screw spindle 43 is again locked to the piston so as to be prevented from rotating, and the plate 41 is again secured in position by means of screw nuts 46. For feeding the fuel into the furnace the screw spindle, and with it the piston are advanced very slowly by means of a screw sleeve mounted thereon which is rotated by means of a worm wheel 47 fixed thereon, which is engaged with a worm on a shaft 48 rotated by a worm wheel 49 and a worm 50, mounted on a shaft 51 receiving rotary motion by means of a worm wheel 52 gearing with a worm 53 which receives motion from the driving shaft in any suitable way. The forward motion of the screw spindle is so regulated by the above described gear that the fuel falls continuously in very small quantities into the combustion chamber so as to be very effectually burned without producing smoke. In place of the above described feeding gear any other suitable automatic feed apparatus such as a revolving feed worm may be employed.

The fire grate is constructed of a fixed part consisting of the bars 54 and a movable part consisting of bars 55 combined with a transverse bar 56 which can slide in guides 57. A shaft 58 extending below the bar 56 carries at its outer end a chain wheel 59 geared by a chain 60 with a chain wheel 61

fixed to the before mentioned screwed sleeve of the spindle 43, so as to be rotated thereby and thus impart a slow rotation, such as two or three revolutions per hour, to the shaft 58. This has a tappet 62 which at each revolution comes in contact with a projection 63 on the bar 56 and lifts this together with the grate bars 55, and then allows them to drop again. By this motion of the grate bars the cinders and clinkers are broken up, and made to fall through the grate into the ashpit 64, whence they are removed through a suitable door near the bottom. The door 65 is for removing stones or clinkers from the furnace.

Over the combustion chamber is arranged a coil *h* which is supplied by a small pump 66 through a pipe 68 with a very small quantity of water drawn by a pipe 67 from a suitable tank. The rod of the pump 66 is connected by an arm 69 to the connecting sleeve *x* of the piston rods *y* and *z;* it could, however, be worked otherwise, such as by an eccentric on the motor shaft. The water forced into the coil *h* is converted into steam which passes through pipe 70 and through an external pipe connected therewith into the before mentioned upper space 18 of the heating apparatus which it enters through the opening 71, and in which it mixes with the compressed heated air and in passing with the same through the tubes 20 becomes superheated and coöperates with the air in the motor cylinder. This steam will become condensed during the expansion of the air, and will impart its heat to the latter so that its expansion will take place approximately isothermically.

The pump *c* for raising water may be of any suitable known construction; it may be replaced by an air compressing pump serving to raise water by compressed air in the known manner.

The starting of the apparatus may be facilitated by means of a chamber 72 having a cock at each end, into which water is introduced and whence it is allowed to descend into the heating apparatus by opening the lower cock, so that by being there converted into steam and then passing to the motor cylinder, it suffices to start the apparatus. A safety valve is provided at 73.

When setting light to the fuel in the combustion chamber the valve 74 closing the chamber below the grate is opened. As, however, it requires to be closed during the working, its axis carries a chain wheel connected by a chain 75 to a chain wheel on the axis of the starting valve 24, so that on opening this for starting the motor, the closing of valve 74 is automatically effected.

It will be readily understood that the details of the apparatus above described can be variously modified without departing from the nature of my invention.

I claim as my invention:—

An apparatus of the class described, including a heater having a furnace with a cylindrical body arranged above it, said cylindrical body containing an annular space and a central space, a cylindrical refractory wall separating said spaces, and a series of tubes depending in said spaces, a cover from which said tubes depend and containing compartments with which said series of tubes communicate at their upper ends, a second series of tubes into which the first series plunge and which are closed at their lower end and open at their upper end into other compartments arranged in said cover, and connections between said compartments such that the cold air comes into contact with the furnace gases which are least hot, and the air already partly heated comes into contact with the furnace gases which are hottest, so that the air may be highly heated with constant volume.

In witness whereof I have hereunto signed my name this 11th day of May 1905, in the presence of two subscribing witnesses.

CHARLES TELLIER.

Witnesses:

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