Jan. 21, 1930. W. E. MARSHALL 1,744,562

SMOKE CONSUMER

Filed April 25, 1927 2 Sheets-Sheet 1

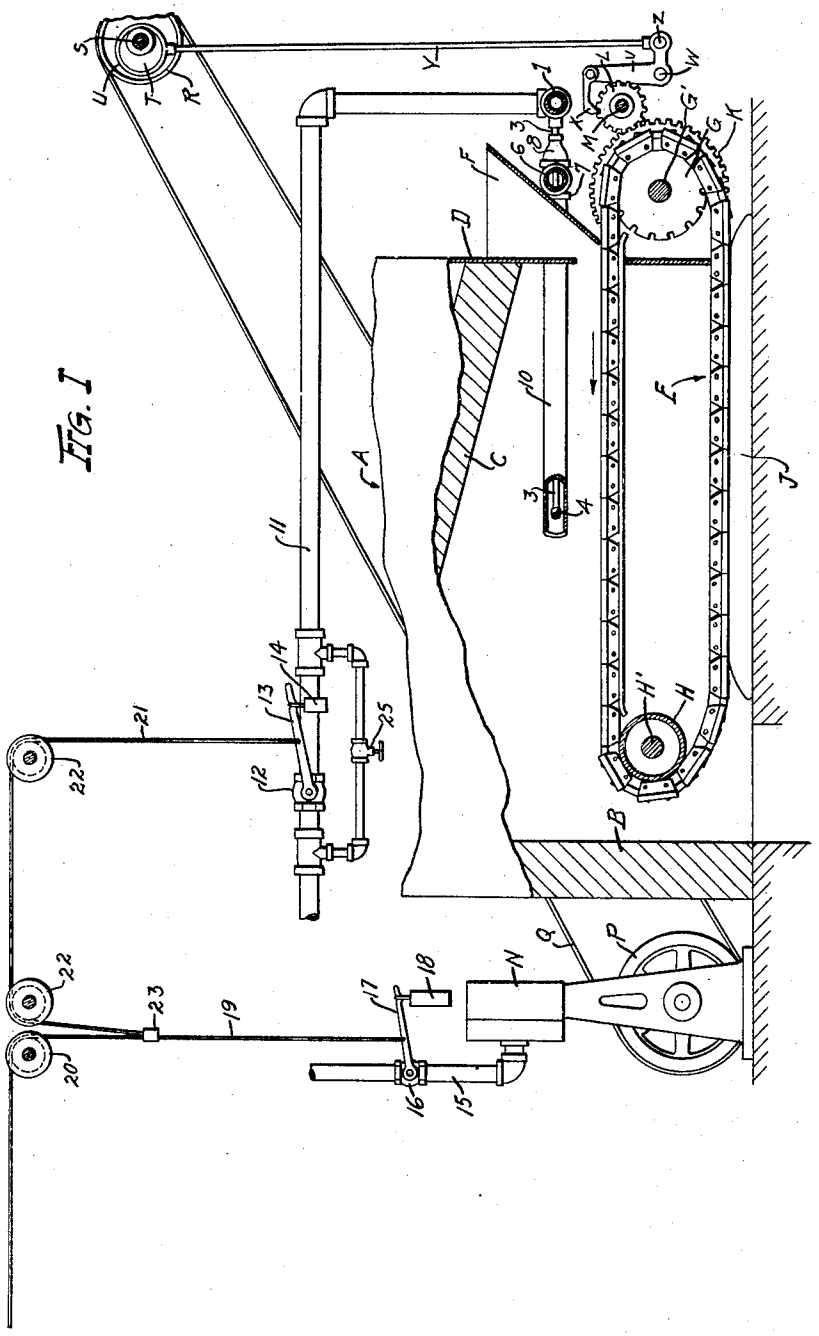


FIG. 1

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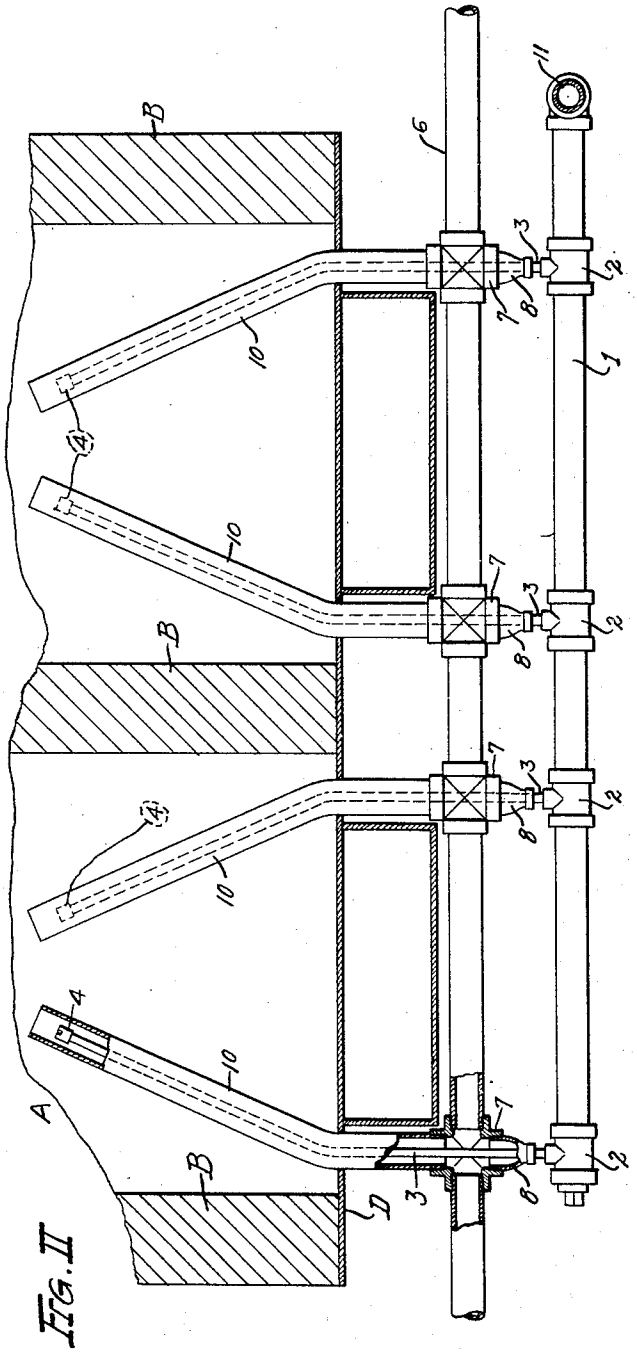


FIG. II



FIG. IV

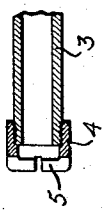


FIG. III

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UNITED STATES PATENT OFFICE

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SMOKE CONSUMER

Application filed April 25, 1927. Serial No. 186,243.

This invention relates generally to smoke consumers, and particularly to an improved apparatus adapted to be associated with a furnace in such manner that air may be introduced into the furnace at a point immediately above the bed of burning fuel, whereby unburned gases arising from said bed of fuel which usually pass from the furnace in the form of smoke may be ignited and burned.

It is a well known fact that much of the visible volatile matter that arise from burning coal and which is usually referred to as "smoke" is, in reality, of a combustible nature and its discharge into the outer atmosphere, in addition to being highly obnoxious because of its tendency to endanger the health of persons who are forced to breathe air which is contaminated by it, is objectionable because it is a waste of matter which is capable of serving a useful purpose. The purpose of the present invention, therefore, is to provide means whereby the combustible gases referred to may be ignited and burned within the furnace, where the heat resulting from such burning may be utilized, and also said burning of said gases will reduce to a minimum the discharge of smoke from the stack.

Fig. I is a view showing in more or less diagrammatical form a stoker-equipped furnace provided with my improved smoke consumer.

Fig. II is a fragmentary horizontal section of a portion of my improved apparatus associated with a furnace.

Fig. III is a fragmentary sectional detail of the end portion of one of the steam pipes forming parts of the invention.

Fig. IV is an end elevation of the pipe cap shown in Fig. III.

In the drawings, A designates a furnace which, for the sake of simplicity, has been shown in more or less diagrammatical form, said furnace being provided with the usual walls B and having the customary fire arch C. The furnace A is provided with a metallic front wall D through which mechanical stokers E are extended, and F designates coal hoppers by means of which fuel to be burned is fed onto the upper flights of the traveling chain grates of the stokers E. The chain grates of the stokers E are each supported by a plurality of toothed wheels G mounted on a shaft G′ at one of its ends and at its opposite end by a smooth drum H mounted on a shaft H′. Also the lower flight of each of the chain grates of the stoker is supported by a plurality of stationary shoes J along which said chain grate slidingly travels. Fixedly mounted on the shaft G′ is a gear wheel K, and arranged in mesh with said gear wheel K is a relatively small gear wheel L mounted on a shaft M.

N designates a suitable prime mover which is adapted to impart motion to the traveling grates of the stokers E, said prime mover being provided with a pulley P to which the rotary motion is imparted by the operation of the prime mover and over which a power transmission belt Q operates. The end of the belt Q opposite to the end thereof which passes over the pully P passes over a smaller pulley R, which is fixed to a shaft S, and fixed to the shaft S so that it will rotate therewith is an eccentric T about which an eccentric strap U is arranged.

Located adjacent to the gear wheel L is a bell crank lever V pivoted at W which has pivotally fixed to the upper end of the long leg thereof a pawl X, said pawl being arranged so that the nose portion thereof engages between adjacent teeth of the gear wheel L. The short leg of the bell crank lever V is connected to the eccentric strap U by a rod Y, said rod and said short leg of said bell crank lever being pivotally connected together at Z.

During the operation of the prime mover the pulley P is rotated, and through the instrumentality of the belt Q rotary motion is transmitted from the pulley P to the pulley R, whereby the shaft S is rotated. The rotary motion of the shaft S, because of the action of the eccentric T and eccentric strap U, imparts upward and downward movement to the lower end of the rod Y, and because of the pivotal connection Z between said rod and the bell crank lever V the pawl X, fixed to the long leg of said bell crank lever, will rotate the gear wheel L step by step. The result of this movement of the gear L will be that intermittent movement will be trans-

mitted to the chain grates of the stokers E, and as the chain grates are moved in the direction indicated by the arrow in Fig. I, fuel will be fed onto said grates from the fuel hoppers F and said fuel will be burned as it passes through the furnace toward the rear of the stokers.

Arranged transversely of the furnace A at the front thereof is a steam conductor 1 provided with a plurality of T-shaped reducers 2, and connected to the reduced portions of said reducers is a plurality of steam pipes 3. The furnace construction shown in Fig. II is a double arrangement, that is to say, the furnace is provided with a pair of fire boxes arranged side by side, and it will be noted that a pair of steam pipes 3 is extended into each fire box of the furnace. It will be noted also by referring to Fig. II that the steam pipes associated with each of the fire boxes comprise portions located between the steam conductor 1 and the front wall D of the furnace, which are approximately parallel with the longitudinal axis of the firebox and portions located within the firebox which converge toward each other. Each of the steam pipes 3 is provided at its inner end with a cap 4 provided with internally arranged screw-threads, so that it may be screwed on the end of the associated steam pipe. Also, the end wall of each of the caps 4 is provided with a steam discharge opening, which I prefer to form by providing said end wall of said cap with intersecting slots, as shown at 5 in Fig. IV.

Intermediate of the steam conductor 1 and the front wall D of the furnace, and in parallelism with said steam conductor 1, I arrange an air conductor 6 which is provided with a plurality of T-fittings 7. The T-fittings 7 are so arranged with respect to the air conductor 6 that one of the steam pipes 3 passes through each T-fitting, as shown clearly in section at the lefthand end of Fig. II, and each T-fitting has a reducer 8 screwed into its forward leg, the reduced portion of which is adapted to closely embrace the peripheral face of the associated steam pipe 3 whereby the passage of air into the T-fitting through said reducer is prevented. Screwed into each of the T-fittings 7 is an air pipe 10 which passes through an aperture in the front wall D of the furnace and extends into the furnace. The air pipes 10 correspond in shape to and are arranged to surround the steam pipes 3, and because the air pipes 10 are each of considerably greater diameter than the associated steam pipe, there is an annular space within each air pipe between the inner face thereof and the outer face of the steam pipe enclosed thereby. The air pipes each extend inwardly into the furnace a slight distance beyond the cap 5 on the associated steam pipe, as shown in Fig. II.

11 designates a steam conductor which leads from a suitable source of steam supply and communicates with the steam conductor 1, said steam conductor 11 being provided with a valve 12 whereby passage of steam through said steam pipe may be controlled. The valve 12 is provided with a handle 13 for controlling the operation thereof, and said handle is provided adjacent to its outer end with a weight 14 which tends to draw said handle downwardly and thus operate the valve.

15 designates a conductor by means of which steam or other fluid fuel is conducted to the prime mover N, said conductor being provided with a valve 16 arranged to control passage of fuel through the conductor 15, and said valve being provided with an operating handle 17 from the outer end portion of which a weight 18 is suspended which tends to draw the handle downwardly to operate the valve 16.

19 designates a flexible connector, one end of which is attached to the handle 17, said connector being passed over a direction pulley 20, as shown in Fig. II. The opposite end of the connector 19 is suitably arranged so that it may be pulled to draw the handle 17 upwardly, it being plain also that when the tension on said connector 19 is released the weight 18 will draw the handle downwardly. 21 designates a second flexible connector, one end of which is attached to the handle 13, the last-mentioned flexible connector being passed over direction pulleys 22 and its end opposite to the end attached to the handle 13 being secured to the connector 19 by means of a suitable clip 23. In view of this arrangement, it is obvious that when the end of the connector 19 remote from the end thereof which is attached to the handle 17 is moved longitudinally, both of the valve-operating handles 13 and 17 will be operated to regulate the valves 12 and 16 and thereby simultaneously control passage of fluid through the steam conductors 11 and 15.

During the operation of a furnace provided with my improved smoke consumer, steam will be caused to pass through the steam conductors 11 and 1 to the steam pipes 3, from the inner ends of which said steam will be forcibly discharged because of the nozzle effect obtained through the use of the slotted caps 4. The result of this will be that a siphon effect will be obtained, whereby air will be drawn through the air conductor 6 and air pipes 10 and will be discharged into the firebox or combustion chamber of the furnaces at points immediately above the bed of burning fuel. The result of this is that gases, which are arising from the burning fuel and which in the absence of air to support combustion would escape from the stack in the form of smoke, will be ignited due to the presence of sufficient air to support combustion thereof and will be burned

within the furnace, whereby the volume of smoke escaping from the stack will be reduced to a minimum.

Because of the arrangement for providing for simultaneous operation of the valves 12 and 16, it is obvious that when speed of travel of the chain grate of the stoker E is increased or decreased by manipulating the valve 16 the amount of air discharged into the fire boxes of the furnaces will be correspondingly and automatically increased or decreased, due to the control of the steam passing through the conductor 11 by the valve 12, hence the volume of air being introduced into the furnace will always be in proper proportion with respect to the volume of unburned gases in the furnace.

To prevent burning out of the inner end portions of the air pipes 10 I prefer to provide for a slight discharge of steam from the discharge ends of the steam pipes 3 at all times, and to this end I employ a bypass 24 which is associated with the steam conductor 11 and conducts steam around the valve 12. The bypass 24 is provided with a valve 25, whereby the passage of steam therethrough may be controlled.

I claim:

1. In combination with a furnace provided with a mechanical stoker and having a prime mover for operating said mechanical stoker which is provided with a controlling valve, a smoke consumer comprising an air conductor provided with a discharge opening located within the combustion chamber of said furnace at a point immediately above the bed of burning fuel therein, a steam pipe having a discharge aperture located adjacent to the discharge opening of said air conductor, said steam pipe being adapted to discharge steam into said furnace whereby air is drawn from said air conductor into the furnace to cause gases arising from the burning fuel to be ignited and burned within the furnace, a valve associated with said steam pipe to control passage of steam therethrough, and means whereby the last-mentioned valve and the valve associated with said prime mover may be simultaneously operated.

2. In combination with a furnace provided with a mechanical stoker and having a prime mover for operating said mechanical stoker which is provided with a controlling valve, a smoke consumer comprising an air conductor provided with a discharge opening located within the combustion chamber of said furnace at a point immediately above the bed of burning fuel therein, a steam pipe having a discharge aperture located adjacent to the discharge opening of said air conductor, said steam pipe being adapted to discharge steam into said furnace whereby air is drawn from said air conductor into the furnace to cause gases arising from the burning fuel to be ignited and burned within the furnace, a valve associated with said steam pipe to control passage of steam therethrough, and means comprising a flexible connector whereby the last-mentioned valve and the valve associated with said prime mover may be simultaneously operated.

3. In combination with a furnace provided with a mechanical stoker, and having a prime mover for operating said mechanical stoker, means for controlling the operation of said prime mover, a smoke consumer comprising an air conductor provided with a discharge opening located within the combustion chamber of said furnace at a point immediately above the bed of burning fuel therein, a steam pipe having a discharge aperture located adjacent to the discharge opening of said air conductor, said steam pipe being adapted to discharge steam into said furnace, whereby air is drawn from said air conductor into the furnace to cause gases arising from the burning fuel to be ignited and burned within the furnace, a valve associated with said steam pipe to control passage of steam therethrough, and means whereby said valve and the means for controlling the operation of the prime mover may be simultaneously operated.

In testimony that I claim the foregoing I hereunto affix my signature.

WILLIAM E. MARSHALL.