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C. L. COLE.

MEANS FOR UTILIZING THE WASTE GASES FROM FURNACES.

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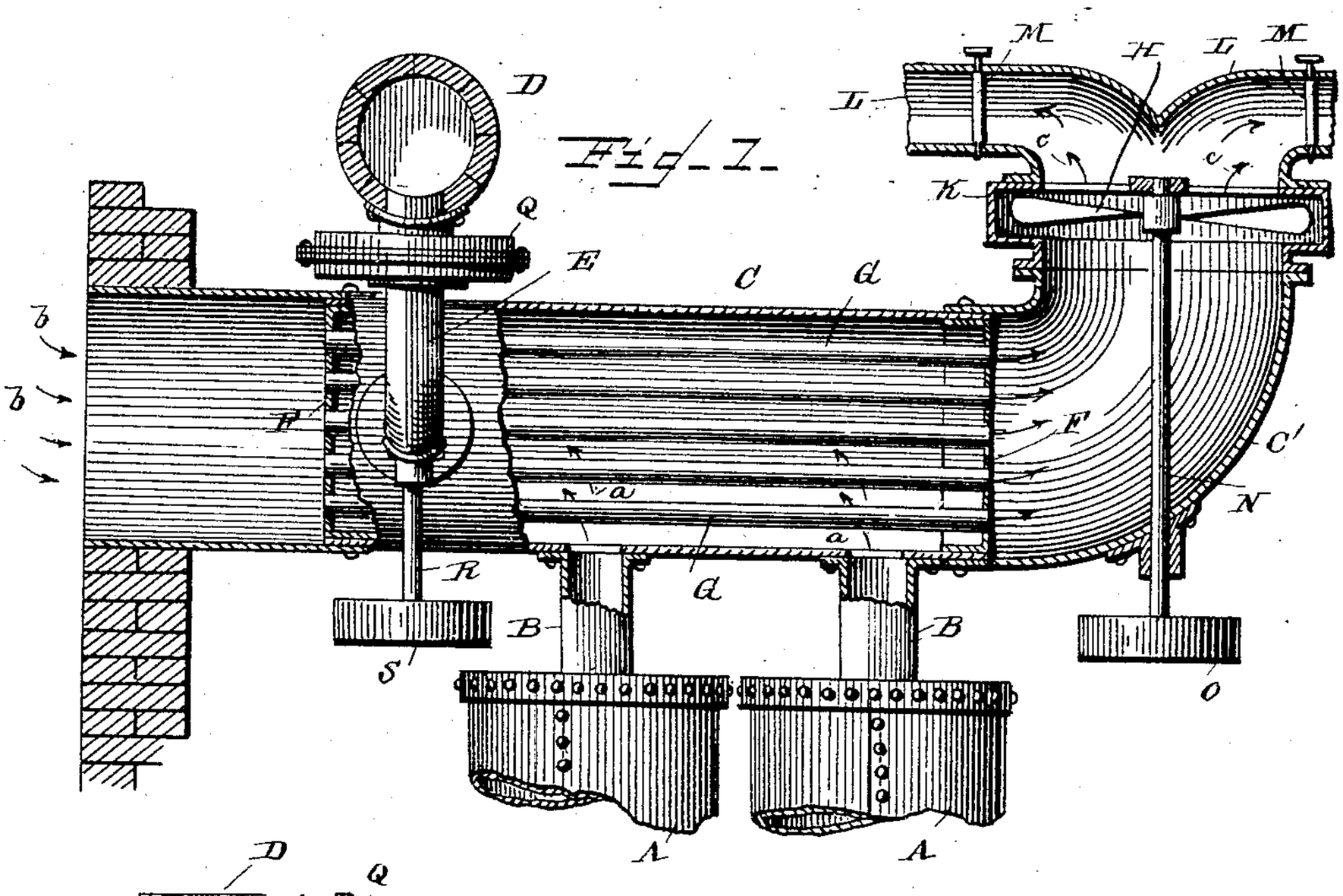

Fig. 1.

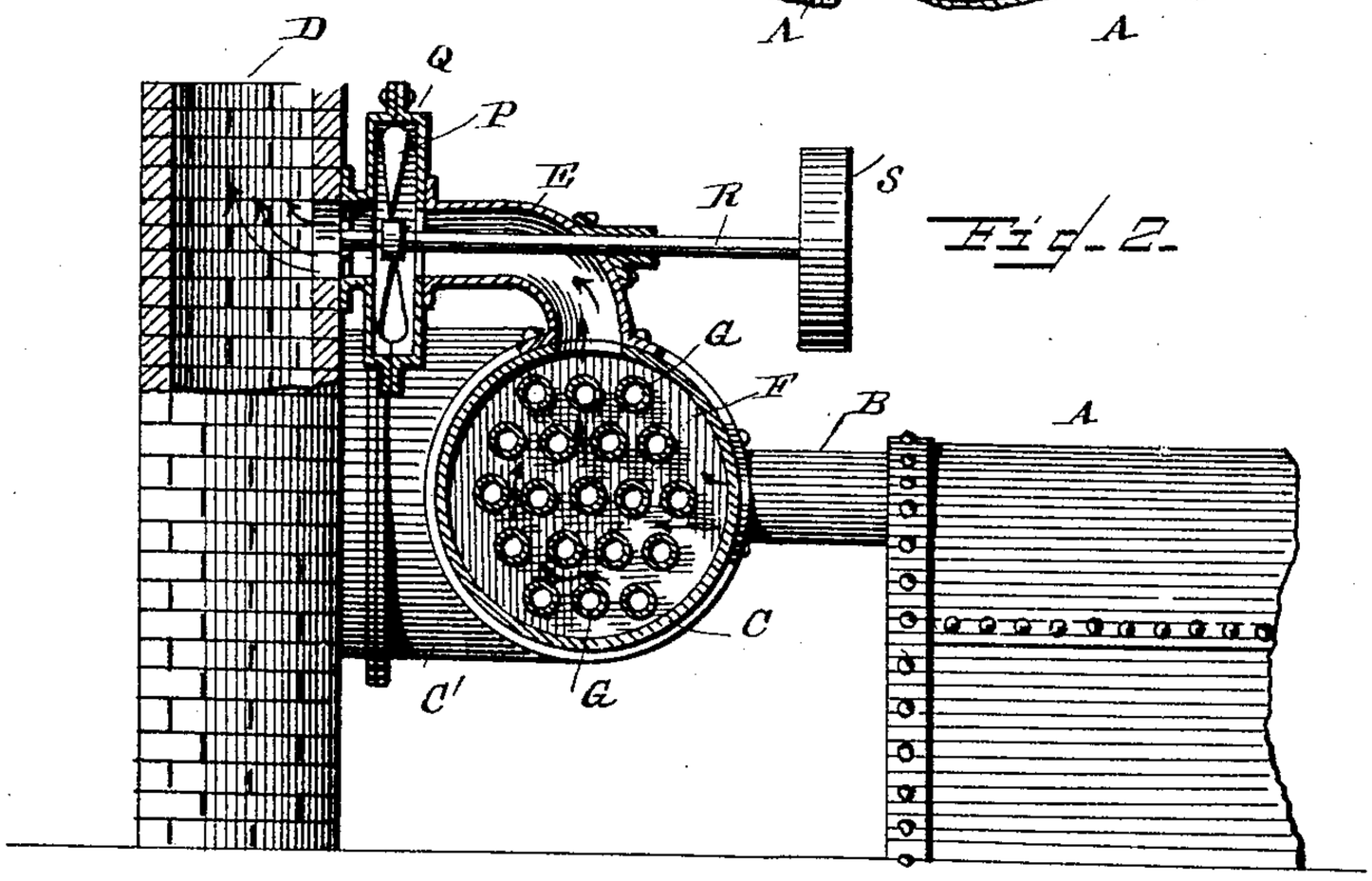

Fig. 2.

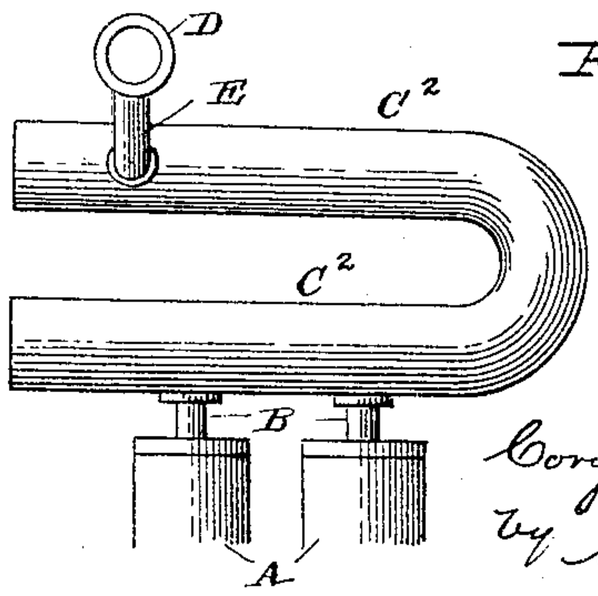

Fig. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

CORYDON L. COLE, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE WASTE HEAT UTILIZING COMPANY, OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF MINNESOTA.

MEANS FOR UTILIZING THE WASTE GASES FROM FURNACES.

SPECIFICATION forming part of Letters Patent No. 779,769, dated January 10, 1905.

Application filed February 6, 1903. Renewed December 5, 1904. Serial No. 235,549.

To all whom it may concern:

Be it known that I, CORYDON L. COLE, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Means for Utilizing the Waste Gases from Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates generally to air-heating systems, and particularly to a system of heating atmospheric air for use in factories, dry-rooms, malt-kilns, or other places where pure dry heated air is required; and it has for its object to provide means whereby the air may be heated by the waste products of combustion escaping from furnaces or boilers before they reach the stack; and it consists in the parts and combinations of parts hereinafter described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a plan view of the rear or discharge end of a pair of steam-boilers with my improved air-heating device connected thereto, the latter being partly in horizontal section; Fig. 2, a side elevation, partly in vertical section, of the same; and Fig. 3, a plan view showing a modified form of my invention.

Similar letters refer to similar parts throughout all the views.

It is well known to engineers that the products of combustion which escape through the stack from steam-boilers after having imparted a certain degree of heat to the water contained therein and are wasted are of a greater or higher degree of temperature than the water which has been heated thereby. Therefore the loss of heat contained in the products of combustion and escaping through the stack is very great. It is the object of my invention to utilize such heat, and this I accomplish by arranging a suitable device between the source of combustion and the point of escape of the products of combustion to the atmosphere through which all the gases generated in the furnace must pass, and thereby heat a current or currents of air passing through said device, said current or currents being then directed to the point where the heated air is to be utilized.

Referring to the drawings, A represents a pair of steam-boilers arranged side by side and connected by pipes B to a shell or casing C, into which said pipes discharge, whereby the products of combustion pass directly from the boilers to the interior of the shell or casing and escape therefrom to the stack D through a pipe E.

The shell or casing C is preferably cylindrical and is provided with the heads or tube-sheets F, one of which is arranged in the shell at a point some distance from the receiving end of the same and the other at the opposite end at the point where the elbow-pipe C′ is secured to said shell or casing. In the heads F the ends of tubes G are expanded or otherwise secured, through which the air is drawn from the outside of the building in which the plant is housed by a fan or blower H, located in a drum K at the end of elbow-pipe C′, which forms a continuation of casing C and discharging into the air distributing or conveyer pipes L, the latter being provided with dampers or cut-offs M, whereby the currents may be regulated or cut off, as desired. The fan or blower H is mounted on a shaft N, supported by the pipe C′ and operated from any suitable prime mover by a belt therefrom to the pulley O on said shaft. The products of combustion escape to the stack through the pipe E, preferably arranged near one end of the shell or casing and opening into the stack at the other end, the draft being induced by means of a fan or blower P, arranged in a drum Q, secured in the pipe E intermediate the casing C and the stack, said fan P being operated by the shaft R, supported by the pipe E, which is driven by the pulley S, connected to any suitable power.

From the above description it will be understood that the gases pass from the boilers through the pipes B in the direction of the arrows *a* and circulating around the tubes C

are drawn through the pipe E and into the stack by the fan P. Thus it will be seen that the circulation of the gases around the tubes G will raise the latter to a high degree of heat. The pure air is drawn through the open end of the casing C, as indicated by arrows marked *b*, by the fan or blower H and enters the tubes G and while passing therethrough are heated to a high degree of temperature. It will be observed that the air enters the tubes at a point removed from the inlet for the products of combustion and near the discharge-opening for said products, and as the temperature of said products is somewhat reduced the air is gradually heated until it reaches its highest temperature at its point of discharge from the tubes. Thus the hottest parts of the tubes not being exposed to the cold air maintain their high temperature and impart the highest temperature to the air just before the same escapes from the tubes. The air then passes through the elbow-pipe C′ and through the drum K and enters the distributing-pipes L, as indicated by the arrows *c*, and is directed as desired by the dampers or cut-offs to the point of use.

It will be observed that when the device is in operation the pure air is heated and then delivered under such pressure as desired to any part of the building for heating purposes or for drying or any other desired purpose at comparatively small expense. It will also be noted that the device is very simple and inexpensive in construction and not liable to be easily broken or become disarranged and is extremely economical in use.

In Fig. 3 I show the shell or casing bent on itself to form a U shape, said casing being lettered C^2, with the pipes B from the boilers entering at the side of one branch or leg of the casing, the other leg being connected by the pipe E with the stack D. The casing C^2 is provided with heads at each end and tubes similar to casing C, and it is connected to an elbow or other discharge-pipe provided with a fan, as described above, for the purpose of delivering the air to conveyer-pipes.

The tubes G may be straight, as shown, or they may be coiled, if it is desired to impart a high temperature to the air.

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

1. The combination, with a steam-boiler, of a shell or casing having tube-sheets or heads arranged therein, tubes connecting said sheets or heads and having one end open to the atmosphere, a pipe for delivering the products of combustion direct from the boiler to the shell or casing at a point removed from the air-receiving end of said shell or casing, an escape-pipe for the products of combustion near said receiving end, means for inducing currents of air through the tubes, and means for conveying the heated air from the tubes.

2. The combination, with a steam-boiler, of a shell or casing having one end open to the atmosphere, tube-sheets or heads secured in said shell or casing, a series of tubes secured in and connecting said tube-sheets or heads, a pipe connecting said boiler and shell or casing at a point removed from the outer end of said shell or casing to deliver the products of combustion thereto, an escape-pipe for said products located near the outer end of said shell and provided with means for inducing a draft, a pipe connected to said shell or casing to receive the heated air from the tubes, a fan for inducing a draft through said tubes, distributing or conveyer pipes, and means for controlling and directing the currents of air therethrough.

In testimony whereof I affix my signature in presence of two witnesses.

CORYDON L. COLE.

Witnesses:
F. H. FORBES,
DAVID B. JOHNSON.