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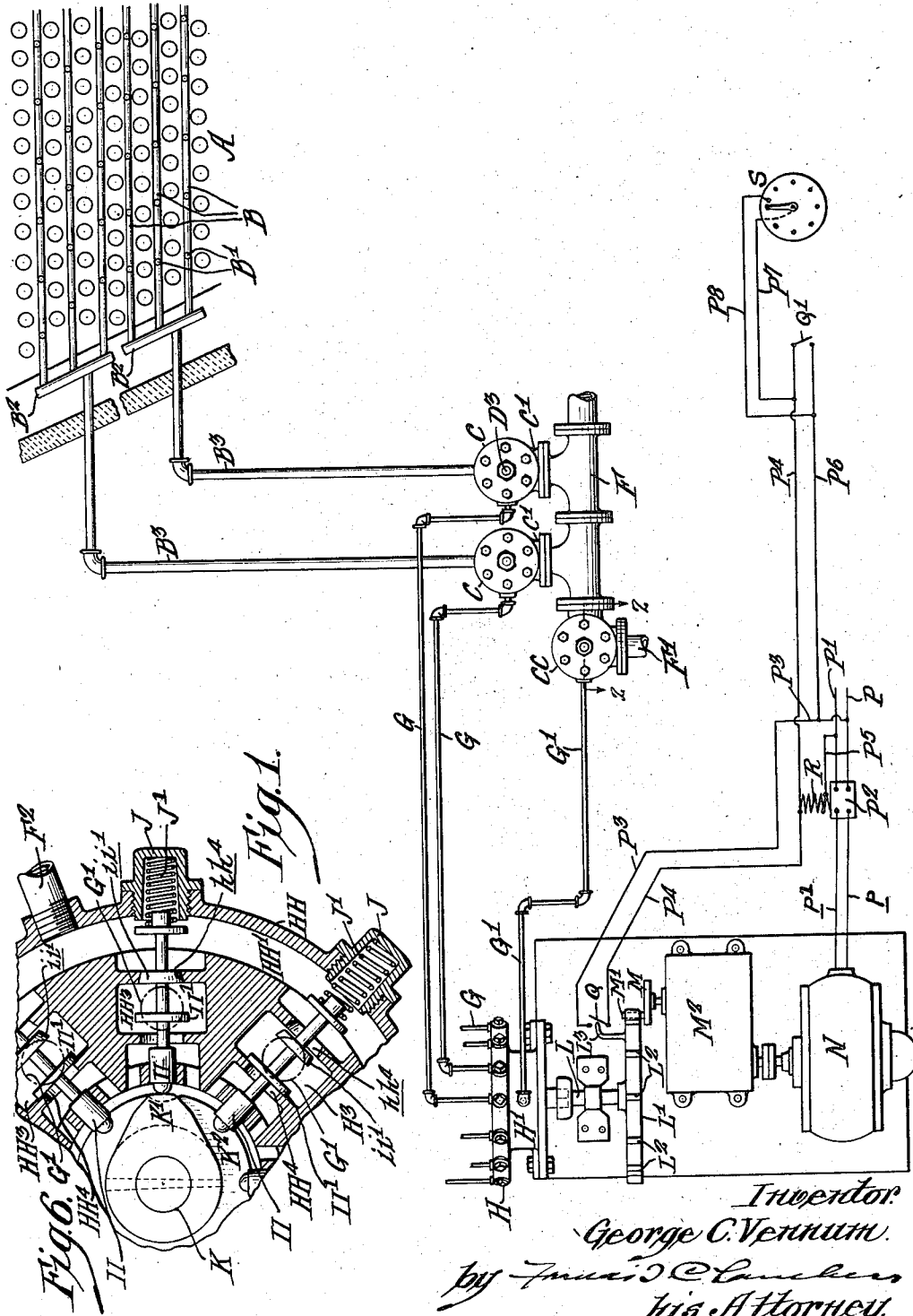
1,652,845

G. C. VENNUM

SOOT BLOWING SYSTEM

Filed Oct. 13, 1924

3 Sheets-Sheet 1



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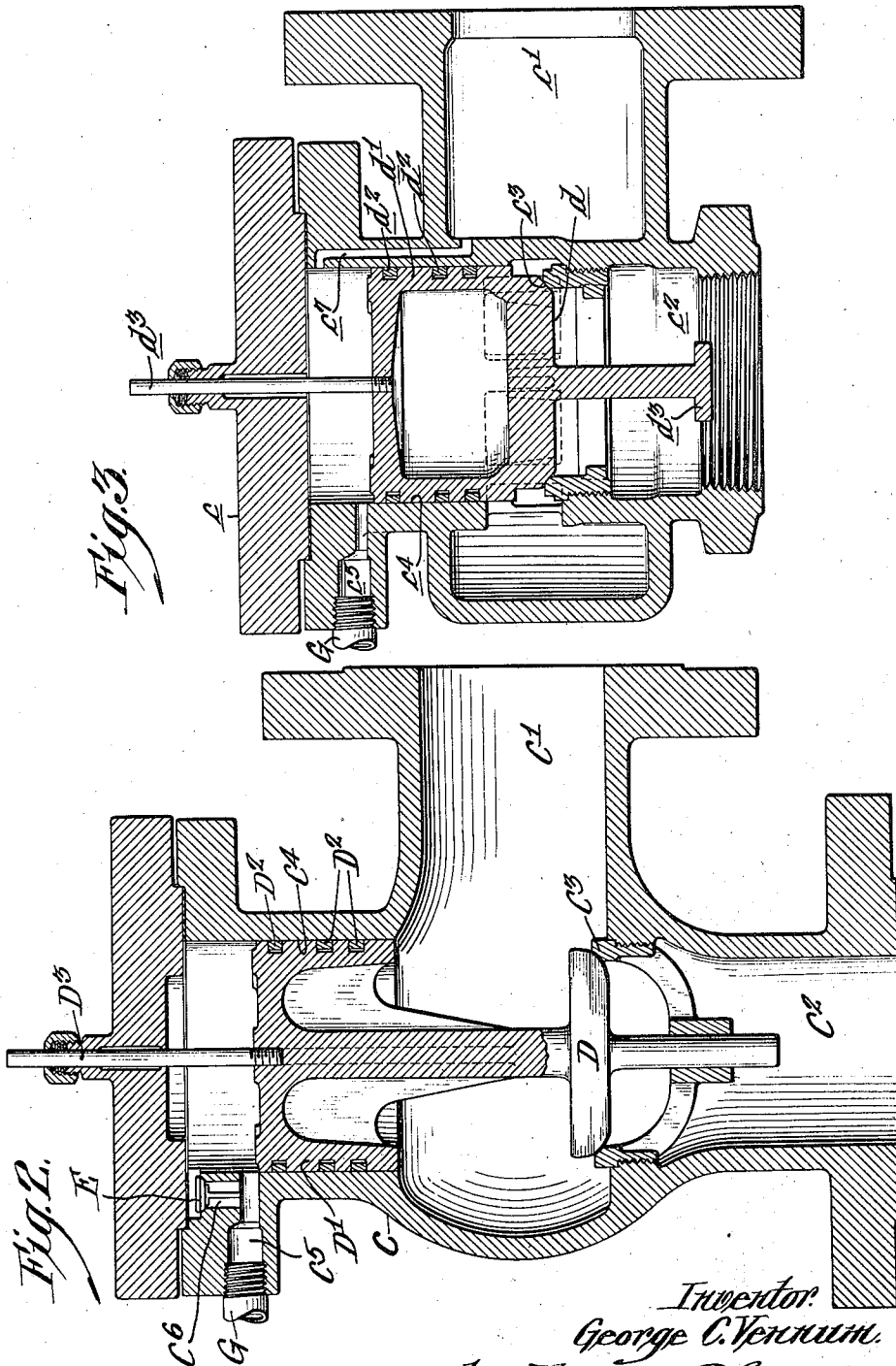
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 4.

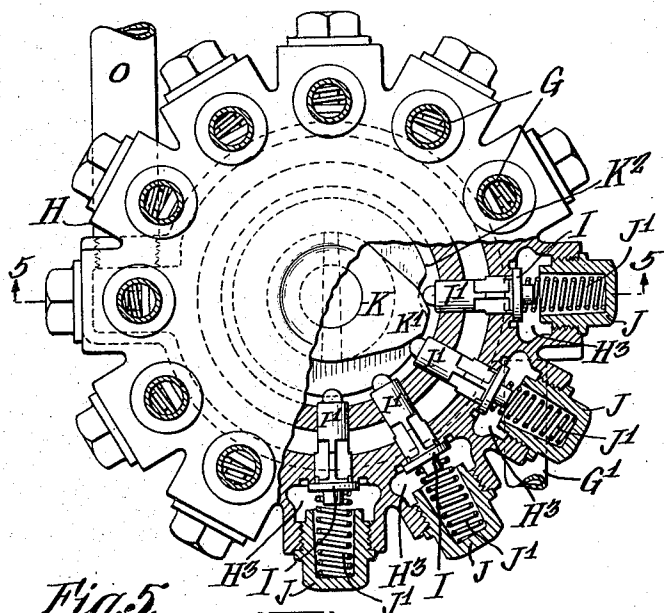
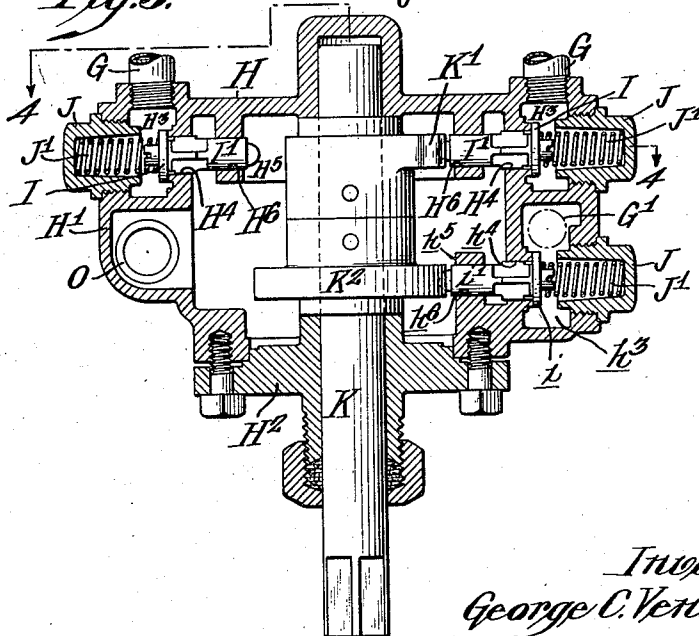


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SOOT-BLOWING SYSTEM.

Application filed October 13, 1924. Serial No. 743,251.

My invention relates to soot blowers for boilers and has for its object to provide a soot blowing system in which a multiple series of groups of soot blowing elements 5 are brought into operation successively and by automatic means controlling the opening and closing of valves which effect the admission and cut off of steam to the different groups. The valves which I have devised 10 for controlling the steam admission to the groups are so constructed as to be self opening, that is, to tend to open under the pressure of steam admitted to the valve casing and are provided with means by which the 15 admission of pressure fluid to a second chamber in the casing effects the closure of the valve. Another important feature of my invention is the provision of a valve, generally similar to the valves controlling 20 the steam admission to the separate groups, and which valve controls the admission of steam to a series of such groups and cuts off the admission of steam after the separate group valves have been successively operated. Another important feature of my 25 invention is the provision of a series of pilot valves which operate to control the fluid pressure in the second chambers of the valves already mentioned.

30 The nature of my improvements will be best understood as described in connection with the drawings in which

Figure 1 is a diagrammatic view showing groups of soot blowing elements, their controlling valves, a valve controlling the admission of steam to a group of controlling valves, a pilot valve system and mechanism for imparting motion to the cams which in turn control the motion of the pilot valves. 35

40 Figure 2 is a sectional elevation of one of my group controlling valves.

Figure 3 is a similar elevation of a modified form of group controlling valve.

45 Figure 4 is a plan view partly in horizontal section of the pilot valve structure adapted for use with central valves such as are shown in Fig. 3, and

50 Figure 5 is a cross section on the line 5—5 of Fig. 4.

Figure 6 is a sectional plan view of a modified system of pilot valves adapted for use with control valves of the construction shown in Fig. 2.

A indicates the water tubes of a boiler.

B, B, etc., soot blowing elements provided 55 with the usual nozzles B' and united in the groups by means of headers B² which receive their steam through steam pipes B³ through group valves C from a steam supply pipe F; F' indicating the main supply 60 pipe through which a number of supply pipes F can receive steam and CC, indicating a valve of the general character of the valve C which controls the flow of steam from the pipe F' to the conduits F. 65

The valve C consists of a casing having a steam inlet port C' and an outlet port C² separated by a valve seat C³ immediately in line with which there is formed in the casing a cylinder C⁴ of somewhat greater diameter than the valve seat C³ into which leads 70 a port C⁵ having a branch port C⁶ leading to the top of the cylinder C⁴ and provided with a non-return valve indicated at E. Located in the casing of the valve C is the 75 valve D guided so as to move to and away from the seat C³ and firmly secured to a piston D' working in the cylinder C⁴ and provided with snap rings, as indicated at D², which rings are so located that when the 80 piston moves up the opening of the port C⁵ into the wall of the cylinder lies between two of the snap rings. It is advisable that when the valve D is closed the top of the piston D' should be practically flush with the 85 port C⁵ as shown in Fig. 2.

In the modified construction of group control valves the steam enters through the port c' and passes out through the port c². The valve seat c³ lies in the casing between 90 these ports and, as in the other form of valve, a cylinder c⁴ is formed in the casing above the valve seat or in line with the valve seat and the fluid port c⁵ enters the side of the cylinder c⁴. In this construction, how- 95 ever, a restricted port c⁷ extends from the steam entrance side of the valve into the upper portion of the cylinder c⁴. d is the valve which is here shown as virtually an extension of the piston d' and is provided 100 with a downwardly extending arm with a flange d³ at its end.

G, G, and G', are pipes connecting the control valves with individual pilot valves of the system to be described. This pilot valve 105 system shown in Figs. 4 and 5, which is adapted for use in connection with valves such as are shown in Fig. 3, consists of a cas-

ing H having a centrally located chamber H' connected to exhaust through a pipe O. This casing is closed at bottom by a closure H² through which, and a stuffing box secured to it, passes a shaft K carrying the cams to be described. In the upper part of the casing are formed a number of chambers H³, H³, etc., to which are connected the pipes G which connect with the exhaust chamber of the casing by valve seat ports indicated at H⁴, as shown. These chambers H³ are disposed in a circuit with the ports H⁴ extending radially inward and opposite to these ports I provide an annular rim H⁵ having radial guide-ways H⁶ in line with the radial ports H⁴. The casing H is also provided at a lower level than the level of the chambers H³, with one or more steam chambers h³ having valve seated ports h⁴ connecting with the inside of the casing and the casing is provided with a rim h⁵ with a valve guiding perforation h⁶ lying in line with the port h⁴. The chamber h³ connects with the pipe G'. I, I, etc., and i are valves adapted to seat on the ports H⁴ and h⁴ and having stems I' and i' which extend through and are guided by the perforations H⁶ and h⁶, the ends of these stems being so disposed as to lie in the path of the rotating cams, to be described. The chambers H³ and h³ are shown as having screwing into them the caps J containing springs J' which normally keep the valves I and i closed.

Secured to the shaft K are the cams K' and K². The cam K' is shaped so as to successively open and close a series of valves I and the cam K² is formed so as to open the valve i and keep it open during the period when the cam K' is acting on the series of pilot valves I, permitting it to close after all the pilot valves have been successively actuated.

In the pilot valve system of Fig. 6, which is adapted for use with control valves such as are shown in Fig. 2, and operated as in the described system of Figs. 4 and 5, by cams K' and K, the casing HH is formed with an annular live steam chamber HH' supplied with steam through a pipe F² and with a series of chambers HH³ arranged in a circle and connecting with the steam chamber HH' through ports hh⁴ and to exhaust through ports HH⁴. Through each chamber HH³ extends a radial valve stem having secured to it valves II' and ii' and by means of springs J' in caps J the valve stems are pressed inward so as to seat valves II' on ports HH⁴ and hold valve ii' away from ports hh⁴. As cam K' contacts with each valve stem II the valve II' opens exhaust port HH⁴ and valve ii' closes steam port hh⁴. Each chamber HH³ has leading into it one of the pipes G leading to a control valve casing.

The pilot valves are actuated, as shown in Fig. 1, by an electric motor N actuating

a gear train indicated at M² by means of which motion is given to a pin wheel M which in turn engages a Geneva drive L' secured to a shaft L which engages the shaft K. The motor is connected to a battery, not shown, through line wires P, P', a switch box P² and wires p, p'. The switch is actuated to connect the wires P, p, and P', p', by an electro-magnet R connected to wire P' by a wire P⁵ and to wire P by a circuit P³, P⁴, having a normally closed switch Q which is opened at each revolution of the Geneva drive L' by the finger L³. Another circuit is formed by the wires P⁴ and P⁶ and the normally open switch Q' which can be closed to start the motor, or this can be done automatically by a clock actuated switch S connected to the wires P⁷ and P⁸ which connect with circuit wires P⁶ and P⁴.

In operation and considering first a system provided with valves such as are shown in Fig. 3 and pilot valves, as shown in Figs. 4 and 5, the pilot valve shaft K is brought to a rest in a position in which the cam K² permits the valve i to remain closed and the cam K', as shown in Fig. 4, does not open any valve I. In this position of the pilot valves the piston d of valve CC, Fig. 1, is held closed by steam admitted to the top of cylinder c⁴ through the restricted port c⁷.

The shaft K is then rotated by the mechanism described, set in operation by closing switch Q or clock switch S which promptly results in the closing of switch Q, and the cam K² opens valve i permitting the steam in cylinder c² of valve CC, to exhaust through pipe G', chamber h³ and port h⁴ whereupon the steam in casing c acting on the piston d' opens valve d, permitting steam to pass from main F' to conduit F and into casings CC. The flow of steam into casings CC, etc. does not open the valves d because it finds its way through restricted passages c⁷ into the tops of cylinders c⁴ and acting on the piston d' holds the connected valves seated until the cam K' opens, as it does successively, the series of pilot valves I, I, etc. As each pilot valve I is opened the corresponding cylinder c⁴ is connected to exhaust with the result that the valve d in the connected casing c is opened as described and successively closed as the cam K' permits its pilot valve I' to close and the cylinder of the casing c is recharged with steam through the passage c⁷. I provide the valve d with the flanged disc d³ extending into the outlet passage c² for the reason that it, being pressed upon by the flowing current of steam, helps in the closing of the valve d.

In the modified construction of Figs. 2 and 6, each chamber HH³ of the pilot valve structure is connected through a pipe G with the port C⁵ of a valve casing C and through a normally open port hh⁴ with the live steam

chamber HH' so that the valves D are normally held seated by the live steam in cylinder C⁴ and as the area of piston D' exceeds that of valve D the admission of steam to casing C does not open valve D. As cam K² revolves it successively closes the ports hh⁴ by valves ii' and opens ports HH⁴ to exhaust by opening valves II', whereupon the steam in connected cylinder C⁴ exhausts through chamber HH³ and the pressure in casing C acting on the lower side of piston D' opens valve D. As the cam K² leaves contact with the valve stem II the valve II' closes and valve ii' opens admitting steam to chamber HH³ and through connected pipe G to port C⁵ and through branch port C⁶ to the top of cylinder C⁴ with the effect of forcing downward piston D' and closing valve D. The effect of the location of non-return valve E in port C⁶ is to prevent the escape of steam from the cylinder through this port and insure a steam cushion in the top of the cylinder to check the upward motion of the piston in the opening of the valve D.

At the completion of a full rotation of cams K' and K² the finger L³ on Geneva drive L' opens switch Q and breaks the circuit so that the cams come to a rest through the stopping of the motor N.

It will be obvious, of course, that my device will work equally well with compressed air as with steam and I wish my claims to be understood as applied to the use of the specified mechanism with either air or steam as the soot blowing medium.

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

1. In a soot blowing system comprising a plurality of groups of soot blowing nozzles and steam supply pipes leading to each group, means for successively opening and closing the connections between the supply pipes and said groups comprising a valve casing in each supply pipe having a valve containing chamber and a second chamber separated from the first by the valve actuating means, a valve and valve actuating means in each casing, said means being operated by fluid pressure and tending to open the valve when steam is admitted to the part of the casing in which the valve is situated and to close the valve when pressure fluid is admitted to the second chamber of the casing, a series of pilot valves, one for each valve casing, connected with the second chamber of the casings and acting to control the pressure in the second chamber and means for successively opening and closing said pilot

valves so as to successively open and close the valves in the casings.

2. In an apparatus having the features of claim 1, the use in combination therewith of a main valve of like construction to the valves of the supply pipes controlling the flow of steam to a group of supply pipes, a pilot valve for said main valve and means for actuating said pilot valve to open it in advance of the operation of the means acting on the pilot valves controlling the operation of the supply pipe valves and close it after said pilot valves have functioned.

3. In an apparatus having the features of claim 1, the special construction in which the pilot valves are arranged in a circular arc and the means for actuating said pilot valves consists of a rotating cam successively contacting with the valve spindles as it rotates.

4. In an apparatus having the features of claim 1, the special construction in which the second chamber of the casing consists of a cylinder connected to the pilot valve by a port which is closed by the piston when the valve in the casing is fully open and in which the valve actuating means consists in a piston working in said cylinder.

5. In a soot blowing system comprising a plurality of groups of soot blowing nozzles and steam supply pipes leading to each group, means for successively opening and closing the connections between the supply pipes and said groups comprising a valve casing in each supply pipe having a valve containing chamber provided with a valve seat and a cylindrical chamber in aligned relation to said valve seat, a valve and a valve actuating piston attached thereto and working in the cylindrical chamber, said piston tending to open the valve when steam is admitted to the valve chamber and to close the valve when pressure fluid is admitted to the cylinder, a conduit for pressure fluid opening into the cylinder at a distance from its rear end, a bypass conduit opening into the rear end of the cylinder, a nonreturn valve in said bypass arranged to prevent flow from the cylinder, a source of fluid under pressure, a series of pilot valves one for each valve casing connected to the cylinder of the casing and to the source of fluid under pressure said pilot valves acting to connect the cylinders to the source and to exhaust and means to successively open and close said pilot valves so as to successively open and close the valves in the connected casings.

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