Feb. 19, 1929. 1,702,968

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CARBON RECOVERY SYSTEM AND APPARATUS

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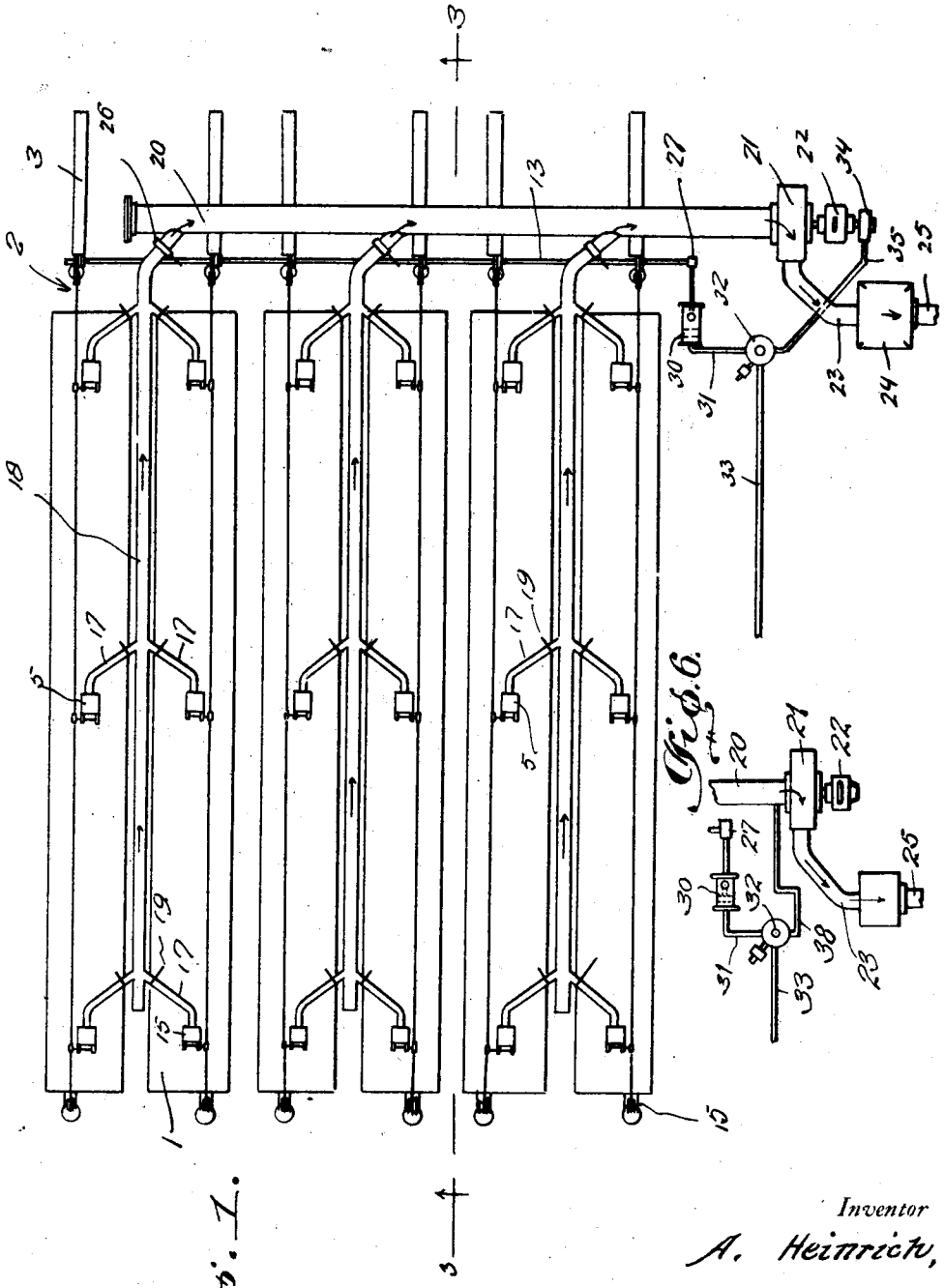


Fig. 1.

Fig. 6.

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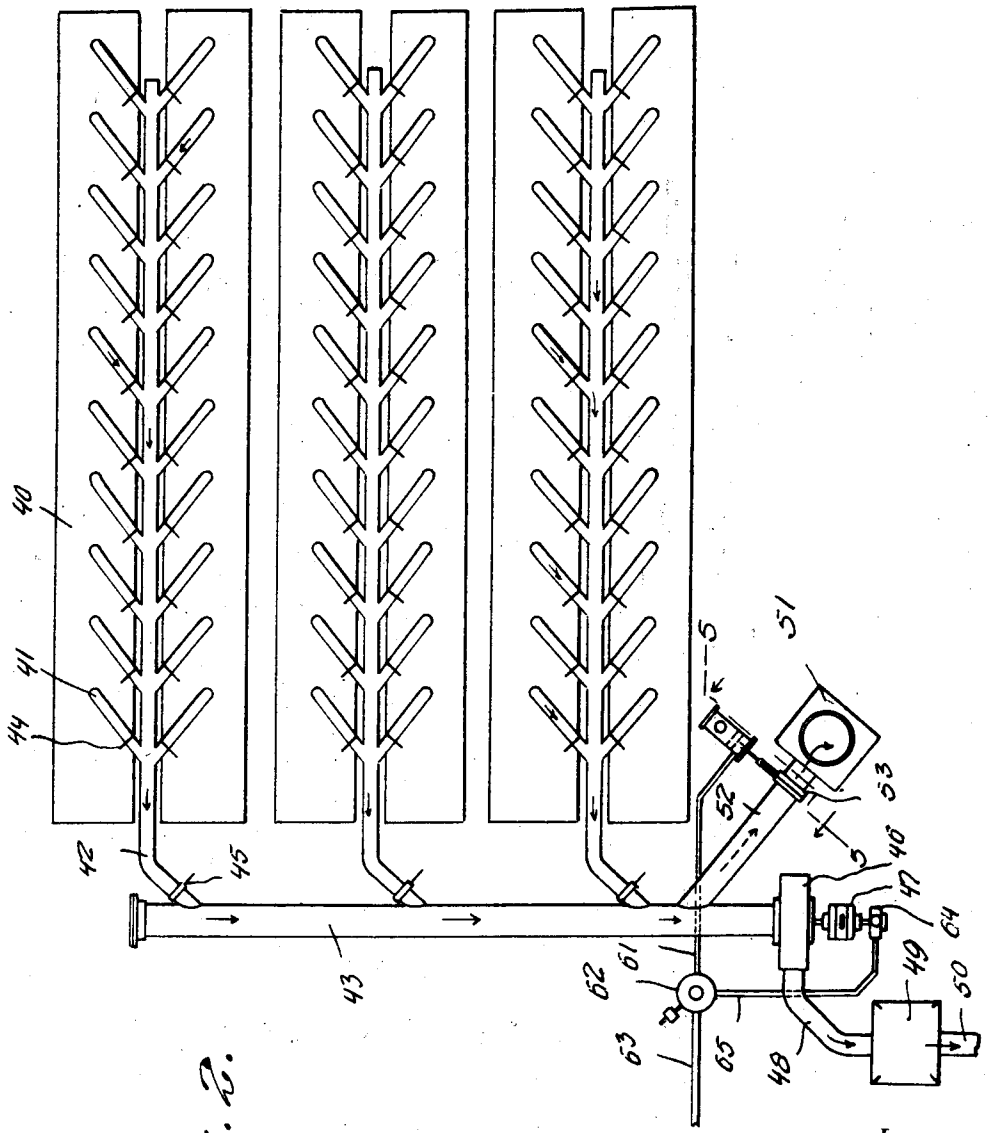


Fig. 2.

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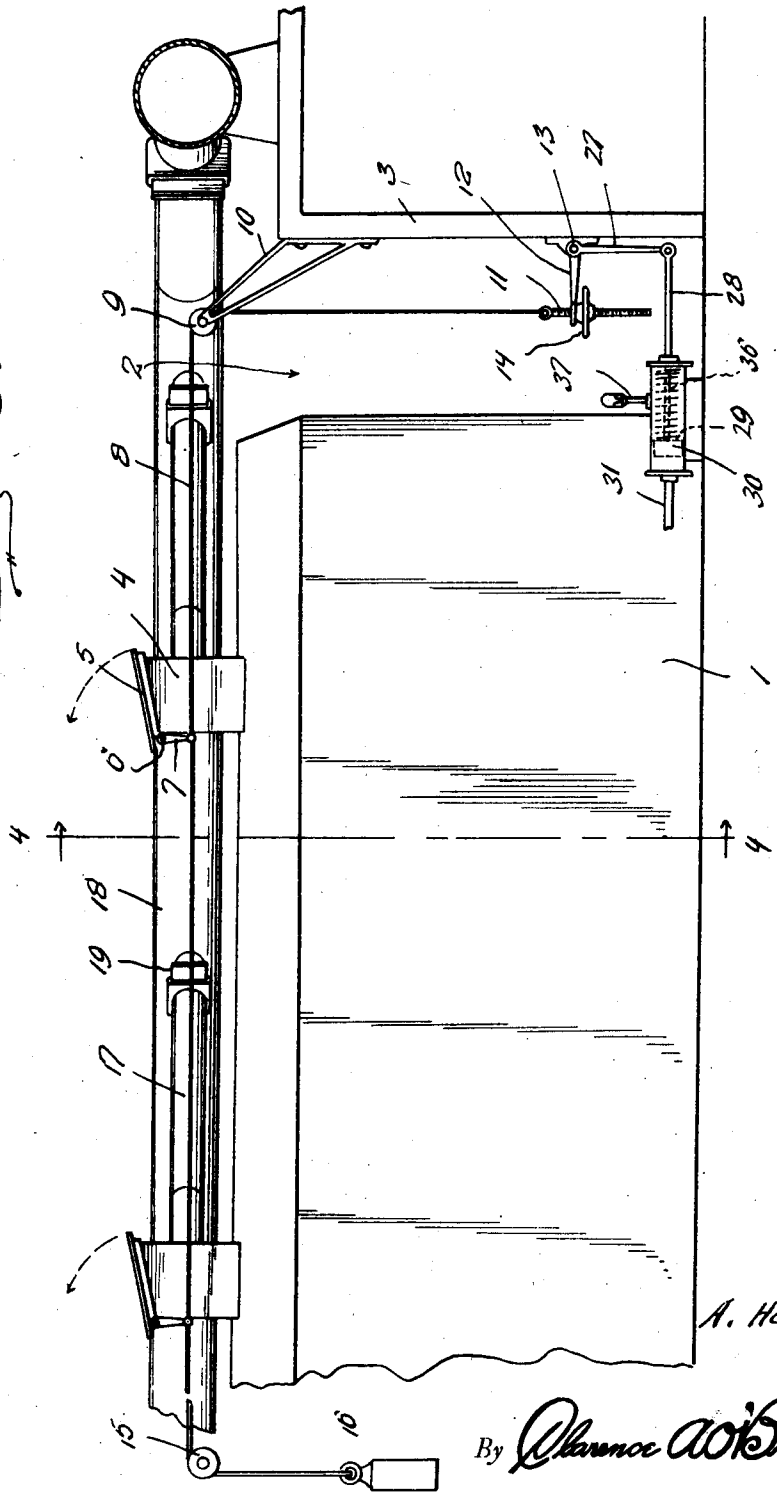
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Fig. 3.



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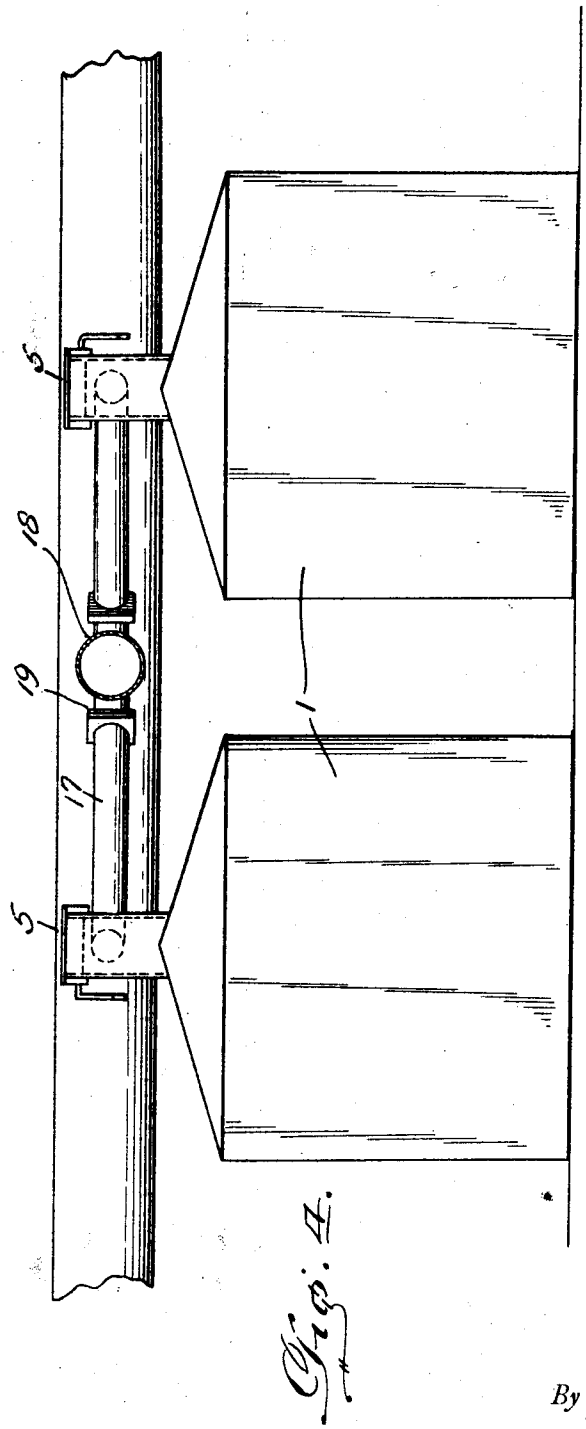


Fig. 4.

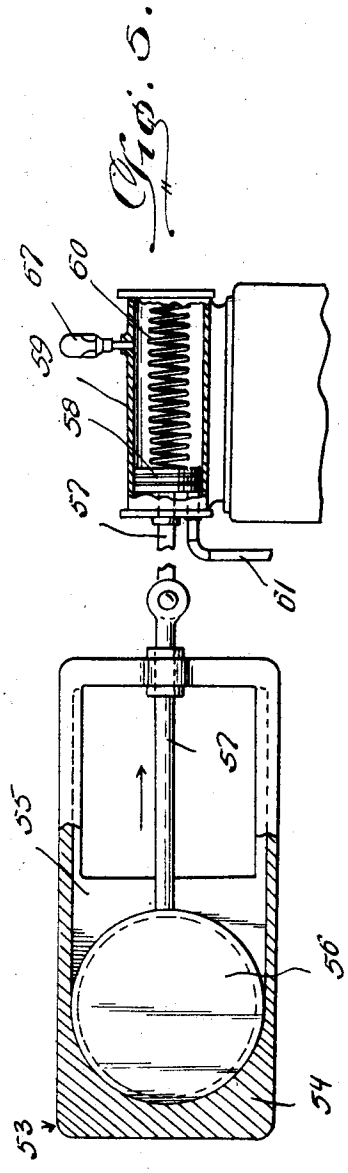


Fig. 5.

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UNITED STATES PATENT OFFICE.

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CARBON-RECOVERY SYSTEM AND APPARATUS.

Application filed March 2, 1927. Serial No. 172,192.

This invention relates to a method and apparatus for recovering carbon from the waste gases discharged from burning houses and the like, and in eliminating discharge to the atmosphere of dirt-laden air of such houses.

This invention is designed to operate in conjunction with burning houses for exhausting the carbon and dirt-laden air from the houses in a desired manner by providing a construction in the discharge conduit for withdrawing the air from the housing, and in forcing this dirt laden air through a suitable filtering apparatus for separating the dirt from the air, and in the provision of automatic means controlling the operation of the apparatus so that the discharge from the burning houses may be opened to the atmosphere, upon failure of the discharge or filtering apparatus.

A further object of the structure resides in providing a combination in which suitable suction creating means is adapted to withdraw through conduit connections the air from the burning houses for discharge into the filtering device adapted to separate the dust and carbon from the air, and suitable control means governed by the operation of the suction creating means for controlling the operation of the apparatus in such a manner that when the suction means fails of operation, the stacks to the burning houses will be open to the atmosphere to permit their continued operation.

The invention further comprehends the provision of an apparatus assembly adapted to carry out the operation of withdrawing the air from the burning houses and providing an efficient control mechanism for directing the entry of the air from the burning houses into the suction conduit and filtering mechanism or its release to the atmosphere.

The invention comprehends numerous other objects residing in the particular construction and relation of the parts which are more particularly pointed out in the detail in the following description and claims directed to the preferred form of the invention, it being understood however, that various changes in the size, shape and relation of the parts may be made without departing from the spirit and scope of the invention as herein set forth.

In the drawings forming part of this application,

Figure 1 is a plan view of a row of burning houses showing one form of the present invention applied thereto.

Fig. 2 is a plan view showing another form of the invention applied to a row of burning houses.

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 3, the burning house being shown in elevation.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 2.

Figure 6 is a fragmentary plan view of a modified arrangement for connecting the regulator in advance of the fan.

The burning houses are indicated at 1 which are usually arranged in rows at opposite sides of an alleyway 2 in the central portion of which are usually mounted the alley bents 3 on which suitable apparatus for controlling the burning houses is adapted to be mounted. These burning houses are usually provided with a plurality of stacks or outlet pipes in the roof for discharging gases into the atmosphere. These gases are heavily laden with carbon and other similar material which deposits a disagreeable and undesirable dust and dirt deposit over the surrounding territory in the usual operation of the houses as now carried on in the art.

This invention is designed to eliminate this disagreeable discharge of dust, carbon and other matter, into the atmosphere and to recover the same so that it may be subsequently placed to some useful purposes. For the purpose of this invention, each of the houses as shown in Figs. 1, 3 and 4, are provided with stacks 4, mounted at predetermined intervals on the roof and extending upwardly therefrom and terminating in a beveled upper end, formed to provide a valve seat for the stack valve 5 pivotally mounted on the lower adjacent edge portion of the upper end as clearly shown in Fig. 3, as indicated at 6.

These stack valves are attached to a suitable shaft which is rotatably mounted so that the rotation of the shaft will operate the valves, and on the end portion of each shaft are mounted arms 7 which are connected by suitable cables or the like 8 adapted when moved to open or close the stack valves as desired, in the alley 2 between the rows of burning houses, one end of the cable 8 terminating in the alley way 2 after passing over the roller 9 and is secured to the end of

the threaded rod 11 carried by the bell crank lever 12 mounted on a suitable operating shaft 13 journaled in bearings mounted on the alley bent 3.

A suitable handle wheel 14 is threaded on the rod 11 and adapted to adjust the position of the rod in the levers 12. The opposite ends of the cables 8 extend over rollers 15 at the rear ends of the burning houses which are journaled in brackets secured to the ends of said burning houses, while the ends of the cables have suitable counter-weights 16 attached thereto for normally operating the cable in one direction over the rollers 9 and 15 and adapted to normally maintain an operation of the levers 7 so that the flap valves 5 are held in closed position as shown in Fig. 3.

A branch pipe or conduit 17 is attached to each stack 4 and communicates with the supplemental exhaust pipes or conduits 18, there being one of the conduits 18 for adjacent pairs of burning houses as clearly illustrated in Fig. 1. Suitable valves 19 control communication between the stack and supplemental exhaust conduit 18, so that any stack may be shut off from communication with the conduit. This supplemental exhaust conduit communicates with the main exhaust pipe 20 which is mounted over the alleyway 2 in a suitable manner, and at one end is attached to the exhaust fan 21 driven by a suitable motor or the like indicated at 22, which may be an electric motor or any other type of power unit found desirable for the purpose.

The exhaust from the fan is through the pipe 23 from which the air is discharged into the filtering device 24 for removing dust or other solid particles from the air, the final exhaust of the purified air being thru the pipe 25, and communicating with the atmosphere, each of the supplemental exhaust conduits 18 adjacent the point of connection with the main exhaust pipe 20 are provided with suitable controlling valves 26 in order that when the burning houses on any one supplemental exhaust pipe are not in operation, the valve may be closed, while the system is still in use during the operation of the remaining burning houses.

An operating arm 27 is mounted on the end of the operating shaft 13 as shown in Figs. 1 and 3, and has the piston rod 28 pivotally connected to its free end and which carries the piston 29 at its opposite end reciprocable in the cylinder 30. The piston and cylinder form a control unit for the valves 5 on the burning houses in order that they may be opened to permit exhaust through the stack to the atmosphere in a manner which will now be described upon failure of operation of the exhaust fan 21.

A conduit 31 is connected to the cylinder 30 at one end and communicates with a regulator 32 of any suitable and desired type as well known and used in the art for controlling the flow of fluid pressure in a pipe line. A pipe 33 is connected to the regulator and with a suitable source of fluid under pressure which is not illustrated for supplying the operating fluid for admission to the cylinder 30 to operate the piston and the operating shaft 13 in order to open the valves 5.

The operation of the regulator 32 is preferably controlled in accordance with the operation of the exhaust fan 21, and for this purpose, a pump 34 is preferably operated by the drive motor 22 for the fan or attached to the shaft of the fan for operation to pump fluid or fluid pressure through the pipe 35 from a suitable reservoir contained in the pump to the regulator in order to exert the proper pressure in the regulator for normally maintaining the supply of fluid from the pipe 33 cut off from supply to the cylinder 30, while simultaneously the regulator provides for connection of the conduit 31 to an exhaust for permitting pressure within the cylinder to be exhausted to the atmosphere. The regulator may be of any suitable type well known in the art, as for instance, similar to that shown in Figure 3, of prior Patent #961,787. This condition will preferably exist when the fan 21 is operating at the proper speed and creating the proper suction in the main exhaust pipe 20, so that the gases from all of the burning houses attached on said line are immediately withdrawn and forced into the exhaust pipe 23 and through the filter 24 for the separation of solid matter, dust and the like from the gases, these gases being discharged through the outlet 25 to the atmosphere.

As it is necessary to constantly maintain the exhaust from each of the burning houses, open and free at all times to prevent explosion, fires, and other damage to the apparatus in the burning houses, and the effective operation of the plant, it will be seen that should the fan 21 for any reason fail to maintain the proper suction in the main exhaust pipe 20, there will be no sufficient outlet for the gases from the burning houses, as this would be likely to cause damage to the apparatus in the burning houses and in addition to preventing the operation thereof.

This invention therefore provides in addition to the exhausting and filtering of the gases from the burning houses, means for automatically controlling the operation of the exhausting and filtering systems should a failure in the operation of the fan 21 cause a decrease in the required suction in the main exhaust pipe 20.

From the above description, it will be understood that the pump 34 therefore forms a means for governing the operation of the system so that when the fan decreases in speed, and as a result the suction decreases below a predetermined amount, the pressure

in the line 35 from the pump and in the regulator will correspondingly decrease and permit the operation of the regulator to permit fluid under pressure, to enter the pipe 31 from the conduit 33, and be admitted to the cylinder 30 for operating the piston. This admission of fluid under pressure for operating the piston 29 will project the piston thru the cylinder for moving the piston rod outwardly through the cylinder and rotating the operating shaft 13 as a result for moving the operating arm 12 downwardly to operate cables 8 and in turn move the valves 5 on their pivots in the direction of the arrows in Fig. 3 to the open position.

The operation of the piston 29 is cushioned through the medium of the bumper spring 36, as shown in Fig. 3. At the time the piston is projected to the outer end of the cylinder for opening the valve 5, as above set forth, the piston will uncover a port to the signal 37 for indicating the failure of the fan 21, and as a result the necessary repair may be made in order to place the fan again in operation for maintaining the proper exhaust of the gases, and as a result, the operation of the regulator 32 will connect the cylinder 30 with the exhaust and permit the parts to assume the position shown in Fig. 3, by the operation of the counter-weights 16 in normally tending to retain the parts in this position.

The hand wheel 14 permits the proper adjustment of all the cables and valves 5 so that they will be operated in a uniform manner.

If desired, the regulator 32 may be controlled directly by the suction in the main exhaust pipe 20 instead of through the pump 34 as indicated in Fig. 6, through connecting the regulator with a pipe 38 to the main exhaust pipe in advance of the fan. With this connection, the regulator will be controlled directly by the suction created by the fan and when it decreases below a predetermined amount, will permit operation of the regulator as above described for permitting pressure to the cylinder to open the valves 5.

Fig. 2 shows the invention applied to a slightly different type of burning house, the burning houses being indicated at 40 and provided with a large number of small outlet connections 41 instead of the stacks which are all connected to the supplemental exhaust conduit 42 which in turn communicates with the main exhaust conduit 43 similar to the conduit 20. Each of the outlet connections 41 is controlled by a suitable valve indicated diagrammatically at 44 while each of the supplemental exhaust conduits 42 are controlled by a valve indicated at 45 positioned adjacent the connection of the conduit with the main exhaust conduit 43 in order that the valve may be closed when the burning houses on the particular supplemental conduits are not in operation.

One end of the conduit 43 is connected to the exhaust fan 46 exactly similar to the fan 21, which is driven by the motor 47 so as to discharge the exhaust gases through the exhaust pipe 48 into the filter 49 in which the solid matter is separated from the gases and the purified gas discharged into the atmosphere through the exhaust 50.

With this type of burning house as illustrated in Fig. 2, it is necessary to provide a common discharge for the gases which is usually in the form of a chimney 51 as illustrated and shown in Fig. 2, and in connection with this invention, the main exhaust pipe 43 is connected by the branch 52 with the chimney 51, in order that a draft may be created for exhausting the gases from the several burning houses through the main exhaust conduit.

In effecting the control of the exhaust thru the operation of the fan 46, a valve structure as indicated at 53 in Fig. 2, and more particularly in detail in Fig. 5 includes a body portion 54 secured to the branch conduit 52 which is provided with a guideway 55 for the slidable disk valve 56. One portion of this valve is secured to the rod 57 slidably mounted in a bearing in the end of the body 54 as clearly shown in Fig. 5, while the free end has the piston rod 57 carried by the piston 58 attached thereto. The piston 58 is operable in the cylinder 59 so that a control for the valve 56 is provided in this way, the movement of the piston and valve being cushioned by the coiled spring 60 at the end of its stroke.

A suitable pipe connection 61 extends from the cylinder 59 to the regulator 62, for controlling the admission and exhaust of fluid under pressure from the cylinder 59. The pressure supply pipe is indicated at 63 in Fig. 2.

The regulator is controlled in exactly the same manner as the regulator 32 through the supply of fluid pressure from the pump 64 through pipe 65 connected to the regulator, the pump being operated by the motor 47 directly connected with the shaft operating the fan, so that a decrease in the speed of the fan beyond a predetermined amount will reduce the pressure in the regulator to an extent that its operation will be permitted for admitting pressure to the cylinder 59 to operate the piston 58 against the tension of spring 60 and open the valve 56 to permit the draft in chimney 51 to exhaust gases from the main exhaust pipe 43 through the branch 52, to the atmosphere.

Under the normal operation of the fan 46, it will be understood that the spring 60 normally maintains the valve 56 in closed position as shown in Fig. 5, in order that all of the gases will be forced by the fan through the filter 49 for the separation of solid matter therefrom.

When pressure is admitted to the cylinder

59 and the piston 58 moves so that the valve 56 is in the open position, a port to the signal 67 will be uncovered in order to indicate the failure of operation of the fan, and the operation of the automatic control apparatus, and as soon as repairs have been made to the fan, and its normal operation for exhausting the gas from the main exhaust pipe 43 is obtained, the regulator will be again operated as heretofore described to permit the exhaust of fluid pressure from the cylinder 59 so that the valve 56 will close and the gases will be forced through the filter 49 in the usual operation of the apparatus.

The release of the pressure in the cylinder 59 permits the spring 60 to operate the piston in order to move the valve 56 in closed position.

It will therefore be understood from the above description, that this invention provides for the recovery of carbon and other solid matter carried in small particles in suspension in air discharged from the burning houses in order that the same will form a valuable by-product of the burning houses and the deposit of this dirt over the surrounding territory obviated. This, as it will be understood, is obtained through creating the suction in the main exhaust pipe which draws all of the gases from the burning houses into said pipe, and then discharges them into a suitable form of air filter of any character well known in the art, for separating the carbon particles and dust, and other solid matter from the air, so that the air and burnt gases may be subsequently discharged to the atmosphere in a clean condition, and in which the operation of the entire apparatus is controlled automatically in order that the failure of operation of the fan to properly exhaust the gases from the burning houses, will not interrupt the operation thereof, or cause any resultant damage from the failure of the fan to operate.

Having thus described my invention, what I claim as new is:—

1. In combination, a burning house having gas outlets, means for withdrawing the gas from the burning house through said outlets, an atmospheric discharge for the gas independent from said outlets and means controlling the passage of gas through either said atmospheric discharge or said outlets, and responsive to a predetermined variation in the force of said first named means.

2. In combination, a burning house having gas outlets, means for withdrawing the gases from the burning house through said outlets, a stack forming an atmospheric discharge for the gas, independent from said outlets, and means governed by the operation of the first mentioned means for controlling the discharge of gas through said stack.

3. In combination, a burning house having gas outlets, power operated exhausting means for withdrawing the gases through said outlets from the burning houses, a stack forming an independent atmospheric outlet for the gas from said burning house, means normally closing said stack when the exhausting means is operating, and power operated means for automatically operating the last named means to open said stack upon the failure of the power operated exhaust means.

4. In combination, a burning house having gas outlets, suction operated means for withdrawing the gases from the burning house through said outlets, a stack forming an atmospheric outlet for the gases from the burning house and means controlling communication through said stack and cooperatively associated with the suction operating means for control thereby in accordance with a predetermined variation in the force of the suction.

5. In combination, a burning house having gas outlets, power operated exhausting means for withdrawing the gases through said outlets from the burning house, a stack forming an independent atmospheric outlet for the gas from said burning house, means normally closing said atmospheric outlet when the exhausting means is operating, power operated means for operating the last named means whereby to open said atmospheric outlet, said last-named power operated means being automatically controlled through the action of the first named power operated means.

In testimony whereof I affix my signature.

AMANDUS HEINRICH.