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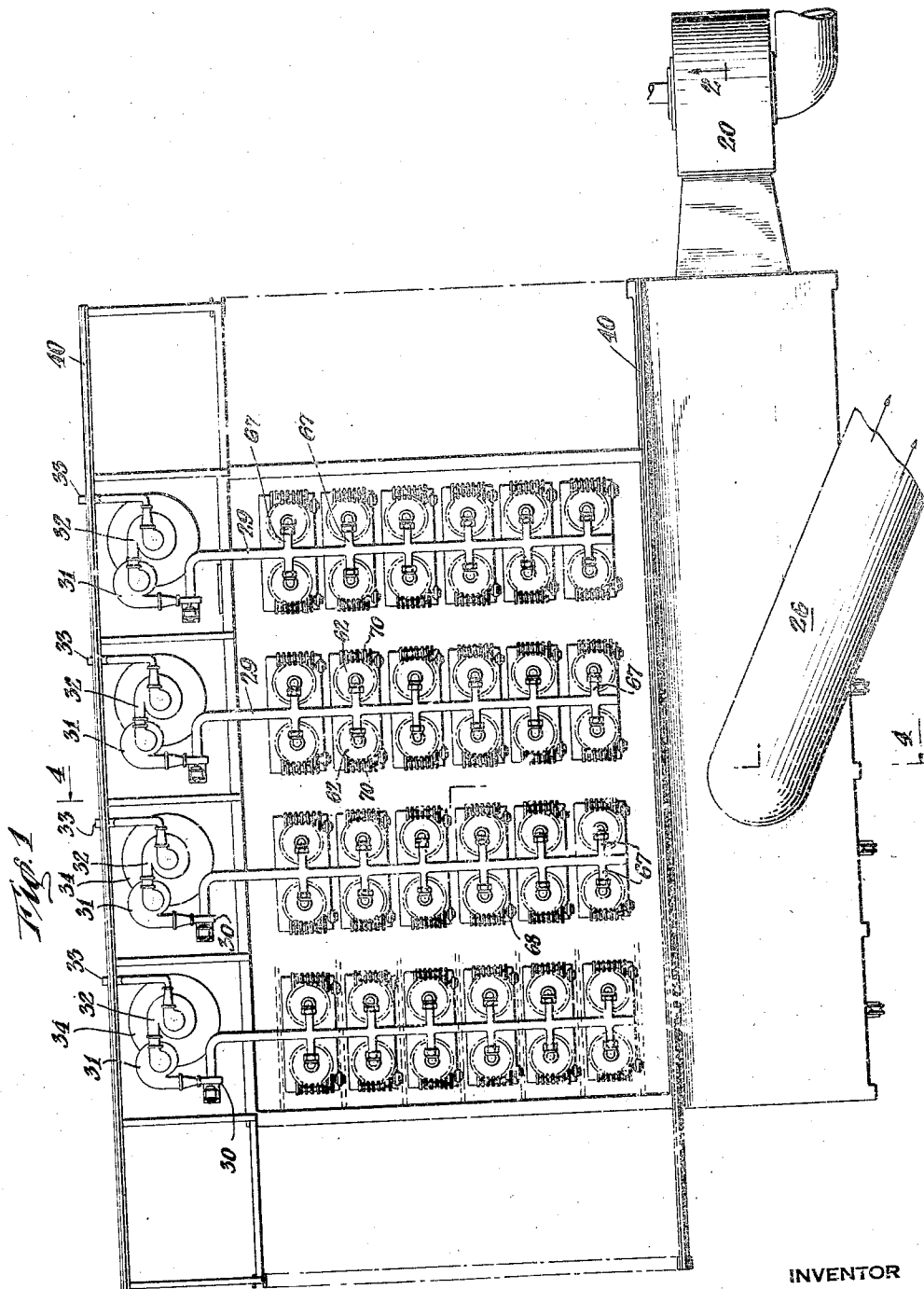
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FILTERING SYSTEM

Filed July 11, 1932

6 Sheets-Sheet 1



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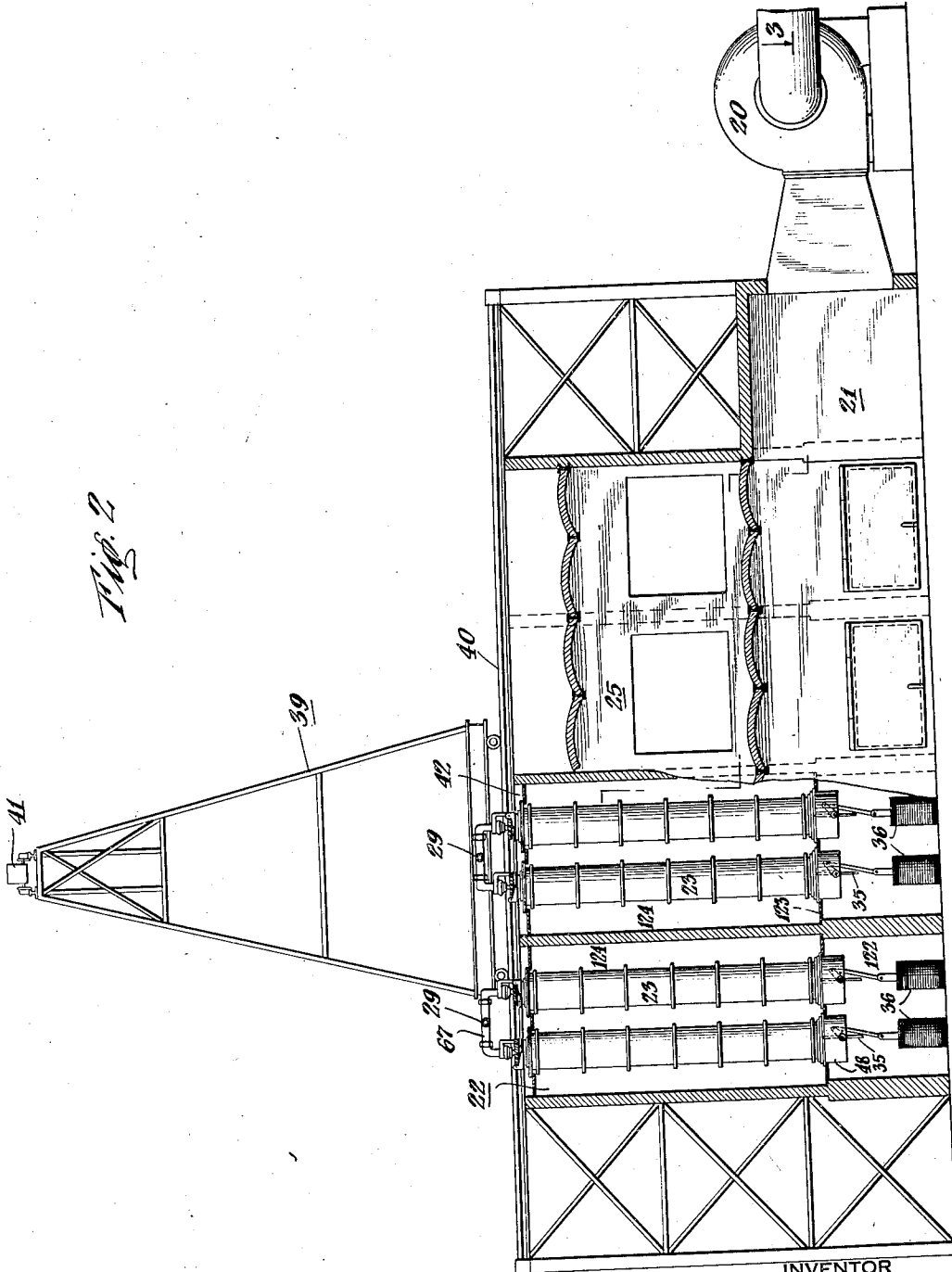
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Fig. 2



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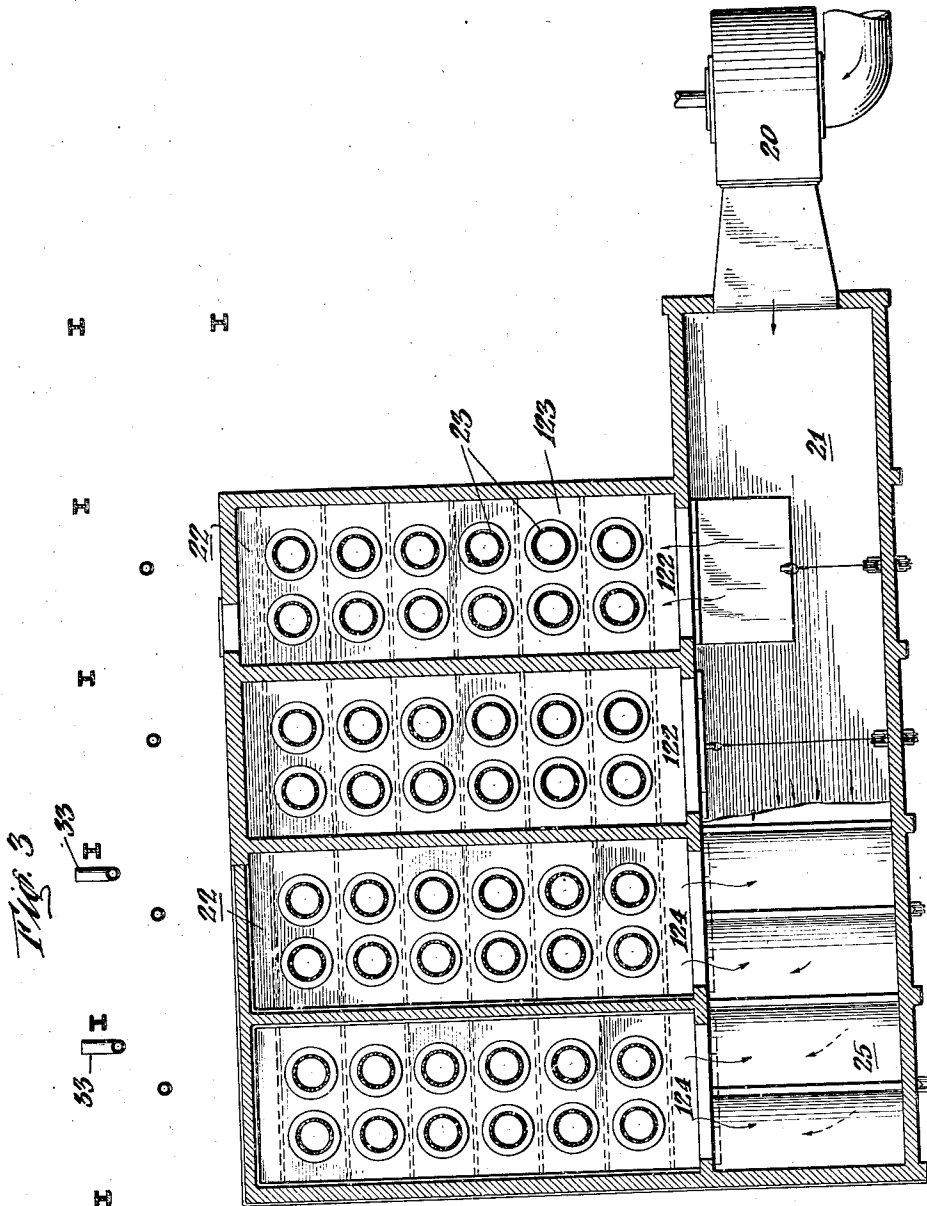
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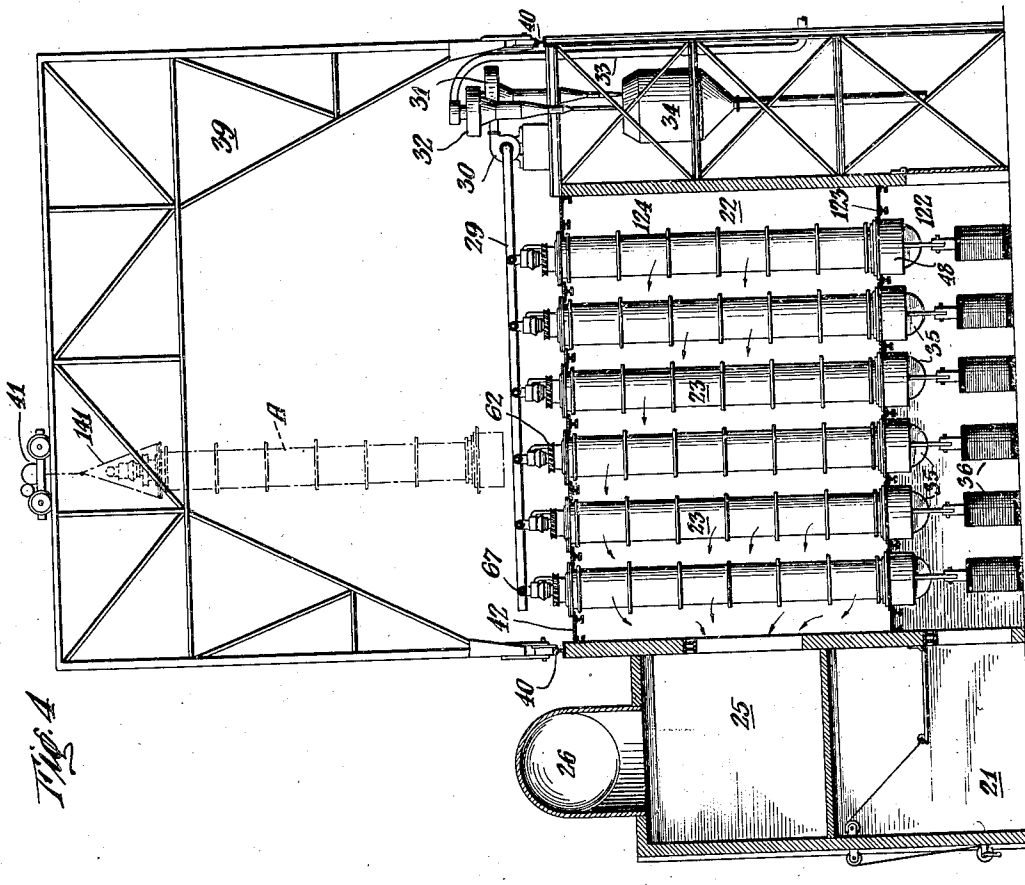


Fig. 4

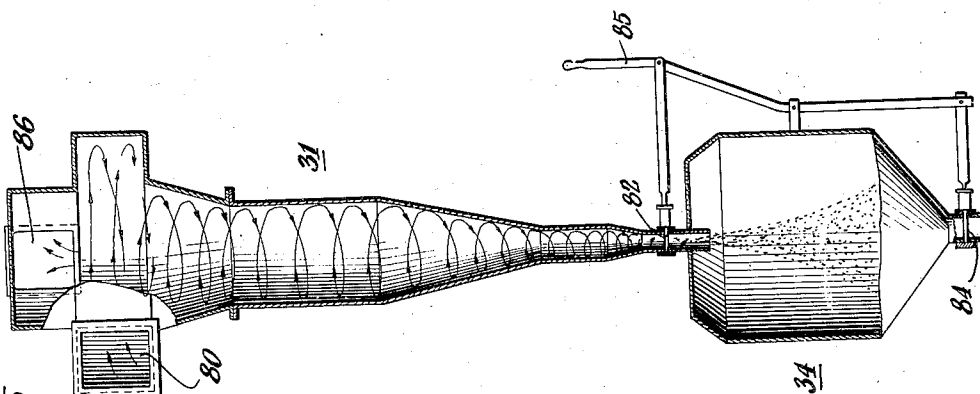


Fig. 5

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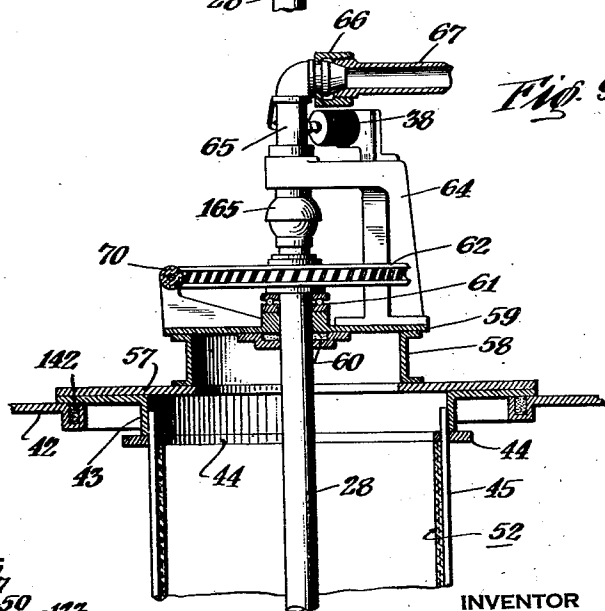
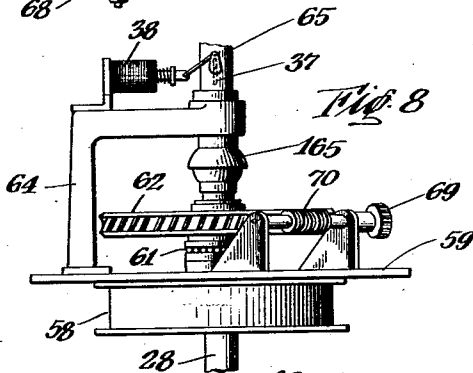
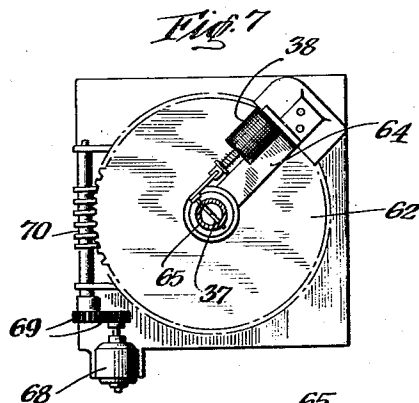
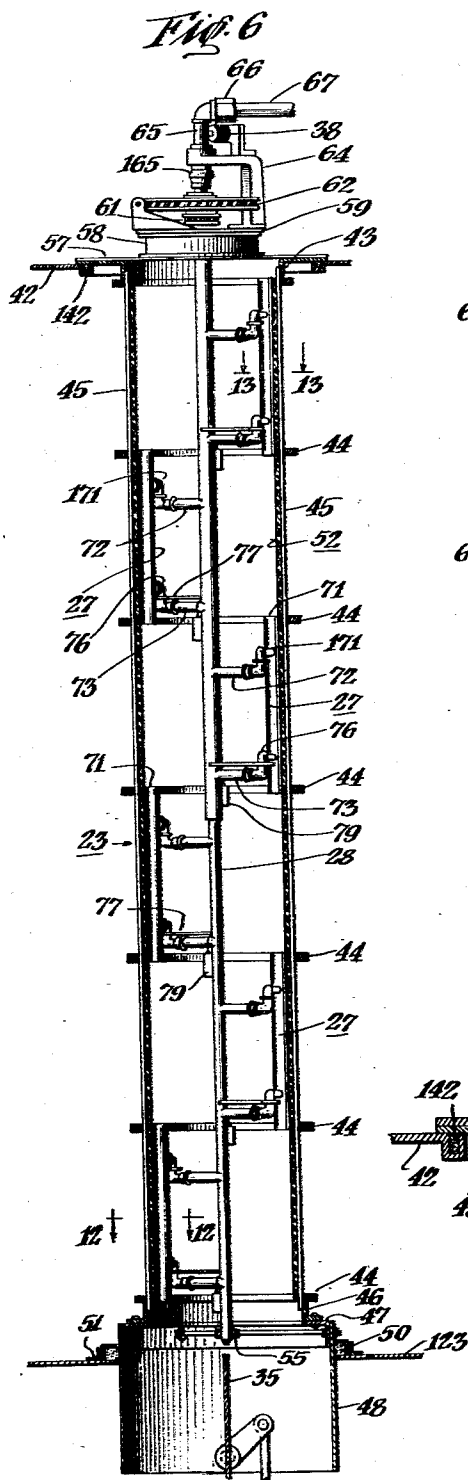
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FILTERING SYSTEM

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6 Sheets-Sheet 5



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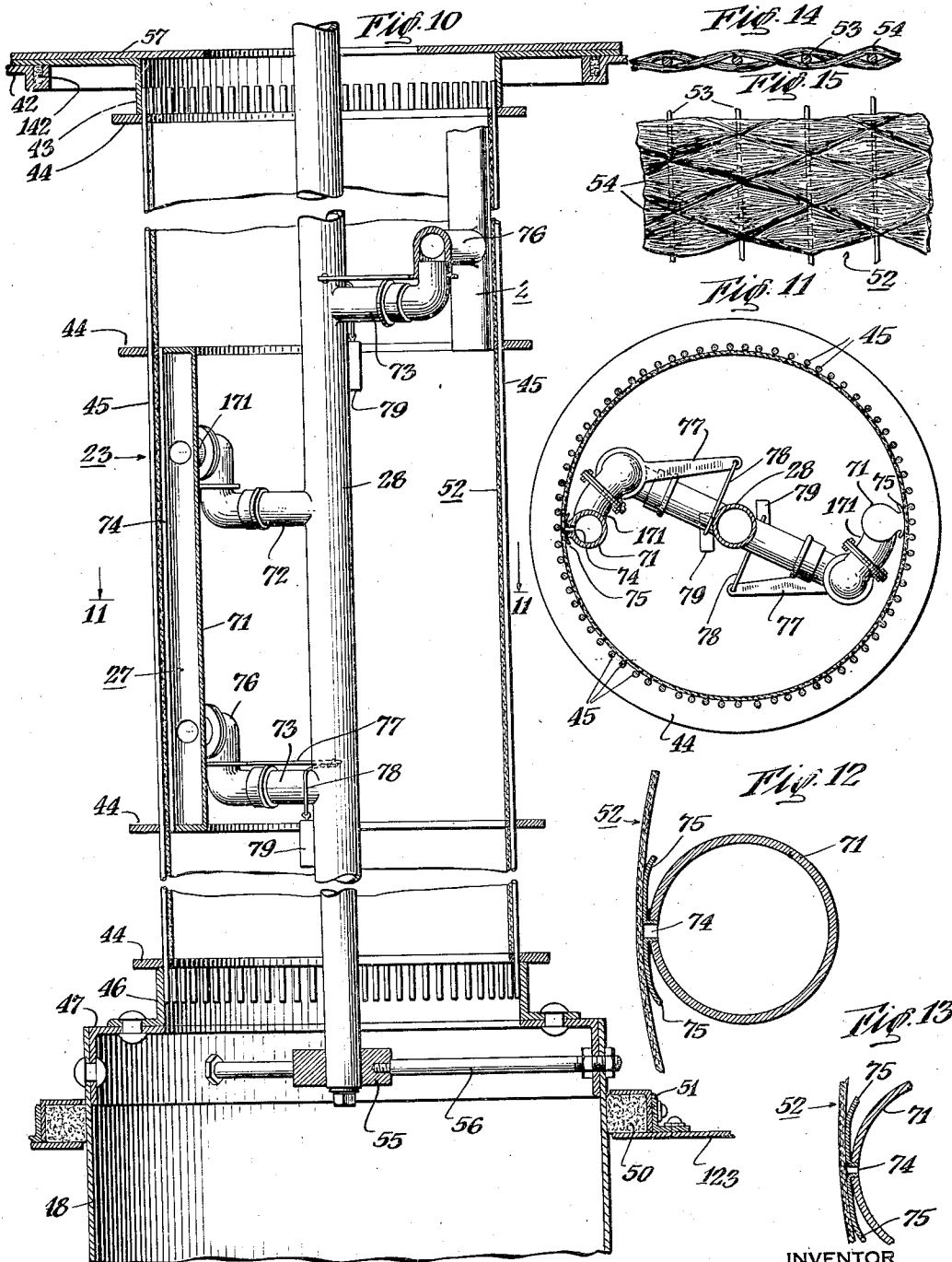
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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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FILTERING SYSTEM

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Application July 11, 1932, Serial No. 621,876

5 Claims. (Cl. 183—57)

The invention relates to the separation of solids from fluids in which they are suspended, and more particularly to bag houses such as are used in connection with the smelting and refining of metals.

According to one form of practicing the invention, the bag house may be made up of a plurality of compartments, each compartment having a plurality of vertical bags therein. Extending along the ends of said compartments may be a lower inlet flue and an upper outlet flue, the former connecting with the lower parts of said compartments and the latter connecting with the upper parts of said compartments. A partition is provided in each compartment separating the compartments into upper and lower parts with the bags extending through said partition.

For removing the particles deposited on the inside surface of the bags, each bag may be provided with a rotary suction head comprising one or more separate nozzles. Each compartment may be provided with a suction blower for withdrawing the material deposited on the insides of the bags. Each compartment may furthermore be provided with a primary and secondary centrifugal dust collector receiving the discharge from the suction blower.

Arranged above the compartments may be a Gantry crane which may run lengthwise of the inlet and outlet flues. The crane may be provided with a carriage running lengthwise of the compartments for raising any particular bag for inspection or repair purposes.

If desired, each bag may be provided with a damper in the bottom thereof for closing off that bag from filtering action. Furthermore, the suction apparatus of each bag may be provided with a valve for closing off the suction in that particular bag. These valves may be suitably operated by remote control, such as, by solenoids so that, if desired, the filtering action of any one or more bags may be stopped and the cleaning action of any one or more bags may be also controlled.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in

connection with the accompanying drawings forming a part thereof, in which

Fig. 1 represents a plan view of a bag house according to the invention with the crane removed;

Fig. 2 is a section on the line 2—2 of Fig. 1 showing the crane in position;

Fig. 3 is a section on the line 3—3 of Fig. 2 illustrating the relation of the bag compartments and the inlet and exhaust flues;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a detail illustrating the construction of the centrifugal dust collectors;

Fig. 6 illustrates the construction of one of the bags;

Fig. 7 is a plan view of the top of one of the bags;

Fig. 8 is a detail of the apparatus on the top of one of the bags;

Fig. 9 is a further detail of the upper part of one of the bags;

Fig. 10 is an enlarged view illustrating the construction of the bag and associated apparatus;

Fig. 11 is a section on the line 11—11 of Fig. 10;

Fig. 12 is a detail of one of the suction nozzles taken on the line 12—12 of Fig. 6;

Fig. 13 is a similar section taken on the line 13—13 of Fig. 6; and

Figs. 14 and 15 are details of the filter mat.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now to the drawings, and more particularly to Figs. 1-4, the bag house and associated apparatus comprises a centrifugal blower receiving the fume laden gases from the metallurgical process or other suitable source, from which it is desired to recover the fume. This gas is fed in the direction of the arrows into the inlet flue 21 which runs lengthwise of the bag house.

Extending transversely from said inlet flue are a plurality of compartments 22 in which are located a plurality of bags 23. The upper parts 124 of these compartments 22 connect with an outlet flue 25 located above the inlet flue 21, as shown,

particularly in Fig. 4. Each compartment is separated into a lower section 122 and an upper section 124 by a wall or partition 123 which connects the lower parts of the bags 23 as shown especially in Fig. 4.

A suitable discharge pipe, indicated by 26, is connected with the outlet flue 25, which carries the cleaned gases to any desired point, such as, through treating apparatus or to waste.

It will be understood that the fume laden gases pass from the inlet flue 21 into the sections 122, thence into the interior of the bags 23 through the porous bags into the upper sections 124, thence into the outlet flue 25.

Each bag is provided with cleaning apparatus for removing the fume deposited on the inner walls thereof. This apparatus may comprise a plurality of suction heads 27 (Figs. 6 and 10) mounted upon a central rotary pipe 28. Each compartment is provided with a suction main 29 (Fig. 1) communicating with the suction heads 27 and leading to a suction pump 30 discharging into a primary centrifugal dust collector 31 which is connected to a secondary dust collector 32. The discharge of gas from the dust collector 32 is led by pipe 33 (Fig. 4) to any desired point, such as, waste or it may be recycled back into the inlet flue 21.

The solids collected by the centrifugal dust collectors 31 and 32 may be dropped into a suitable container 34 from which any desired disposal may be made.

For controlling the supply of fume laden gas to each bag, a separate damper 35 may be provided on the bottom of each bag, controlled by a suitable solenoid 36. For controlling the suction to each bag, a separate suction damper 37 may be provided (Fig. 8) controlled by a suitable solenoid 38.

It will be understood that the building forming part of the present system is constructed in the usual way with structural walls forming the flues, compartments, etc. Located on the top of the building may be a Gantry crane 39 running on suitable tracks 40. Located on the bridge of the crane may be a carriage 41 having suitable apparatus 141 for lifting any bag 23 out of its compartment for repairing or other purposes, as indicated by A (Fig. 4) and as will be described hereinafter more in detail. By the movement of the crane lengthwise of the flues 21 and 25, and the movement of the carriage 41 lengthwise of the compartments 22, it will be understood that any bag in the building may be treated.

Each bag 23 is supported by the top wall 42 of the building, as indicated particularly in Figs. 6, 9, and 10. Each bag is provided with a flanged collar 43 which rests upon the top wall 42 and which cooperates with a seal 142 which may be made up principally of steel wool.

Each bag is made up of a plurality of stiff rods 45 suitably welded or otherwise secured to the top ring 43 and passing through holes in a plurality of flat rings 44, as illustrated. The rods 45 are suitably secured to a lower ring 46 at their lower ends.

Since the bag is supported at the top by a gas tight joint, provision is made at the bottom for expansion of the bag. The lower part of the bag has an angular ring 47 connected to the ring 46 and a cylindrical sleeve 48 connected to the ring 47. The sleeve 48 is adapted to slide within a seal 50 of steel wool or other suitable material contained in a holder 51 and mounted upon the par-

tion 123 which separates the upper and lower sections of the compartments.

It will be understood that the stiff wire rods 45 and flat rings 44 are sufficiently close together to provide a stiff rigid assembly to support a filter mat 52 in accurate fixed position. This filter mat is illustrated in Figs. 14 and 15 and may be made as follows:

It may be made up in the form of a cloth or fabric comprising a warp of, for example, #20 copper wire, indicated by 53, and a woof of the strands of steel wool, indicated by 54.

Steel wool in ribbon form is available on the market in strips four inches wide and about one-quarter inch thick (unpressed) of any length desired, with the fibres running substantially parallel.

According to the invention these strips are cut or pulled into strips one-half the original width and rolled into strands about three-eighths of an inch in diameter. These strands form the woof of the fabric, as above described, and may be woven, by hand or otherwise, with the warp wires 53 into a mat. The warp wires may be spaced about three-quarters of an inch apart and stretched between nails driven into a board, if desired, and the woof strands woven over and under in a manner well known in the art of weaving.

When the weaving is finished, the mat may be passed through tinner's rolls several times, which closes all the small interstices and covers the warp wires 53 with a smooth surface of steel wool, the mat then taking the appearance somewhat as indicated in Fig. 15.

This mat is secured to the inside surface of the cylinder made up of the rods 45 by suitable attachment, such as, by fine wire loops at sufficiently close points to properly support the mat. It is better to mount the mat so that the rotary suction nozzles move parallel to the strands of steel wool to prevent roughing up the mat, although satisfactory results have been obtained with the nozzle moving parallel to the warp wires.

As illustrated in Figs. 6 and 10, the central supporting nozzle stem 28 may be made up of sections, the lower end being closed and supported in a suitable bearing 55 which in turn is supported by radial rods extending through the adjacent walls of the bag.

At the top of the bag, the stem 28 passes through a plate 59 having a suitable seal 60. The plate 59 rests upon a collar 58 which in turn rests upon a plate 57 secured to the collar 43.

Keyed to the rotary stem 28 is a worm wheel 62 which rests upon a thrust bearing 61. Driving the worm wheel 62 is a worm 70 which in turn is driven by gears 69 driven by a motor 68.

Mounted upon the plate 59 is a bracket 64 which supports a stationary pipe 65 to which is secured the stationary element 165 of a slip joint, the other part of which is secured to the stem 28. The stationary pipe 65 is provided with a detachable connection 66 with branch pipe 67 secured to the main suction pipe 29 (Fig. 1).

Also mounted on the bracket 64 is the solenoid 38 which operates the damper 37 in the pipe 65, closing off the suction to the suction head of the particular bag.

Thus it will be seen that by disconnecting the connection 66, the entire bag 23 and all associated apparatus may be lifted clear out of the compartment by the crane 39.

Secured to the central rotary stem 28 are a plu-

reality of separate suction nozzles 27. Each nozzle 27 is made up of a cylindrical tube 71 having its ends closed and provided with a longitudinal slot 74. Secured to the edges of this slot 74 are a pair of wide ears or flanges 75 to prevent the suction nozzle from digging into the filter mat and to cut down suction leakage at this point.

Each cylindrical tube 71 is supported by an upper branch 71 and a lower branch 76, each of which is swiveled on corresponding branches 72 and 73 respectively. Each lower branch 76 may be provided with a lever 77 to which is connected a flexible strand 78 having a weight 79 and passing over branch 73 in such manner as to yieldably hold the suction nozzle 27 against the wall of the bag.

It will be noted particularly from Fig. 6 that the suction nozzles are oppositely mounted and that each nozzle bears against a pair of flat rings 44 at its ends, these rings operating as tracks for the nozzles to prevent the nozzles from digging into the mat.

Referring now to Fig. 5, centrifugal separators 31 and 32 may be substantially alike in construction so it is only necessary to describe one in detail. These separators form no part of the present invention except in combination with the rest of the system.

The inlet to which the dust and gas are fed is indicated by 80 and is tangential to the circular body, as shown. The fume laden gases are given a circular motion and they are caused to travel downwardly through the conical and cylindrical portions of the separator, as shown, to the bottom. This action causes the solids to drop out of the bottom of the separator into a suitable container 34.

A valve arrangement comprising an upper valve 82, lower valve 84 and operating mechanism 85 may be provided. The arrangement is such that when valve 82 is open, valve 84 is closed. When both separators empty into the same container 34, the same operating mechanism 85 may also operate upper valve 82 of separator 32, if desired.

The treated gases containing relatively small amount of remaining solid particles pass through the outlet 86 into the corresponding inlet 80 of the next separator 32 which operates in the same manner as the separator above described.

In operation, it will be understood that the fume laden gas is supplied by the centrifugal blower 20 to the inlet flue 21, thence the gas passes to the lower ends of the bags 23 through the filter mat and out the outlet flue 25. For cleaning the fume deposited on the inside of the bags, the suction nozzles 27 are rotated by the separate motors 68 and the separate suction pumps 30 remove the deposited material, feeding it to the centrifugal separators 31 and 32 as above described. The relatively clean gas discharged by the last separator 32 may be wasted or recycled back into the inlet flue. The solid particles collected by the separators drop into the same receptacle or container 34 from which they may be disposed of as desired.

If desired, automatic clockwork (not shown) may be provided for operating the several bag dampers 35 and suction dampers 37. Each bag in a compartment may be cleaned separately during which time its damper 35 may be closed while the suction damper 37 will be open, it being understood that all other suction dampers 37 of the same compartment will be closed and all other

bag dampers 35 of the same compartment will be open. In this way only one bag is out of commission for cleaning at a time.

For repairs it is only necessary to disconnect the suction pipe at the detachable connection 66 and to disconnect the solenoid 36 from the damper 35 after which the bag may be raised to the position indicated by A in Fig. 4, by the Gantry crane 39.

It is thought that the advantages of the present invention will be obvious from the description of the construction and operation above given. The provision of weights 79 for yieldably holding the suction heads against the back wall is excellent in that these weights are not affected by changes in temperature. Furthermore, the rigid construction of the bag frame properly supports the filter mat whose surface can be kept absolutely even with no depressions; and the wide lips on the mouths of the suction heads prevent leakage at these points and in connection with the tracks for the suction heads allow a close contact between suction heads and filter mat without any destructive digging in.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a bag house, a plurality of bags, means for supplying fume laden gas to the interior of said bags, a separate gas supply valve for each bag, a suction nozzle within each bag, a suction pump, a conduit passing out of each bag connecting said suction nozzle to said suction pump, and a separate valve in said conduit for each bag.
2. In a bag house, a plurality of bags closed at the top and open at the bottom, means for supplying fume laden gas at the bottom to the interior of said bags, a separate valve at the bottom of each bag, a suction nozzle within each bag, a suction pump, a conduit passing out of the top of each bag connecting said suction nozzle to said suction pump, a separate valve in said conduit for each bag and a separate solenoid for operating each valve.
3. In a bag house, a plurality of bag compartments, a plurality of bags in each compartment, an inlet flue extending along the bag house, an outlet flue also extending along the bag house, partitions in said compartments connecting the lower ends of said bags, conduits connecting said inlet flue with said compartments below said partitions, conduits connecting said outlet flue with said compartments above said partitions, a suction apparatus disposed in the inside of each bag and passing out through the top thereof said apparatus being movable over the surface of each bag to remove deposited particles therefrom, a motor on the top of each bag for driving said suction apparatus, a suction pump for each compartment, a suction line for each compartment and extending from its particular suction pump to the bags of its particular compartment, and separate detachable connections between the suction apparatus of said bags and said suction lines.
4. In a bag house, a bag compartment, a unitary bag assembly therein comprising a cylindrical filter, a pneumatic cleaning head therein, driving apparatus for said cleaning head, said cleaning head and driving apparatus being unitarily supported with said filter, and means for removably supporting said bag assembly in said

compartment so that the entire assembly including cleaning head and driving apparatus may be removed from said compartment as a unit.

5. In a bag house, a bag compartment, a unitary bag assembly therein comprising a cylindrical open mesh framework, a filter medium within and secured to said framework, a lower bearing secured to said framework, an upper bear-

ing, a support fixedly connecting together the top of said framework and said upper bearing, a central conduit journaled in said bearings, cleaning heads secured to said conduit and riding within said filter medium and a driving device for said conduit resting on the top of said support. 5

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