

No. 689,723.

Patented Dec. 24, 1901.

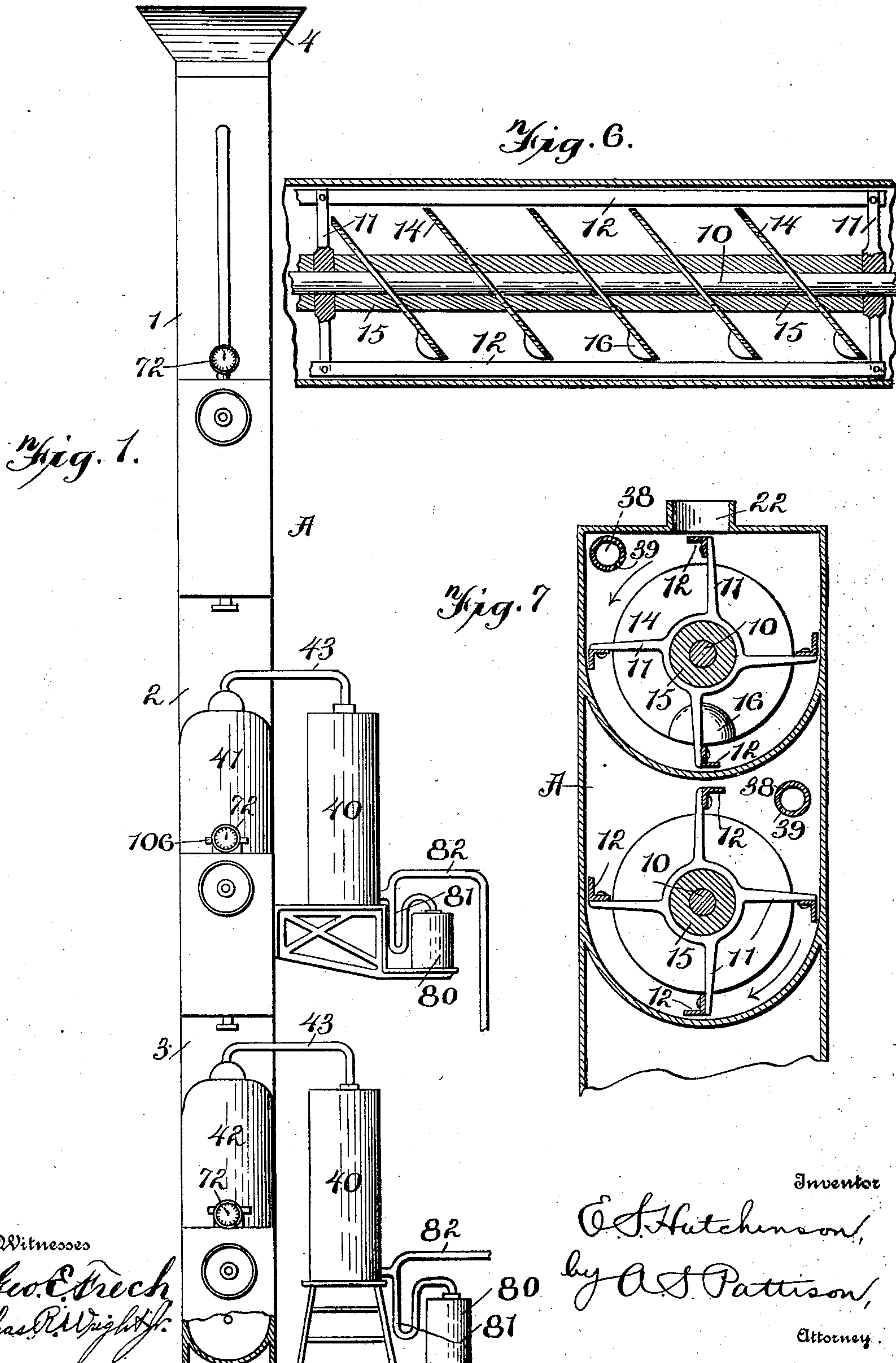
E. S. HUTCHINSON.

APPARATUS FOR DISTILLING SAWDUST.

(Application filed June 24, 1901.)

(No Model.)

5 Sheets—Sheet 1.





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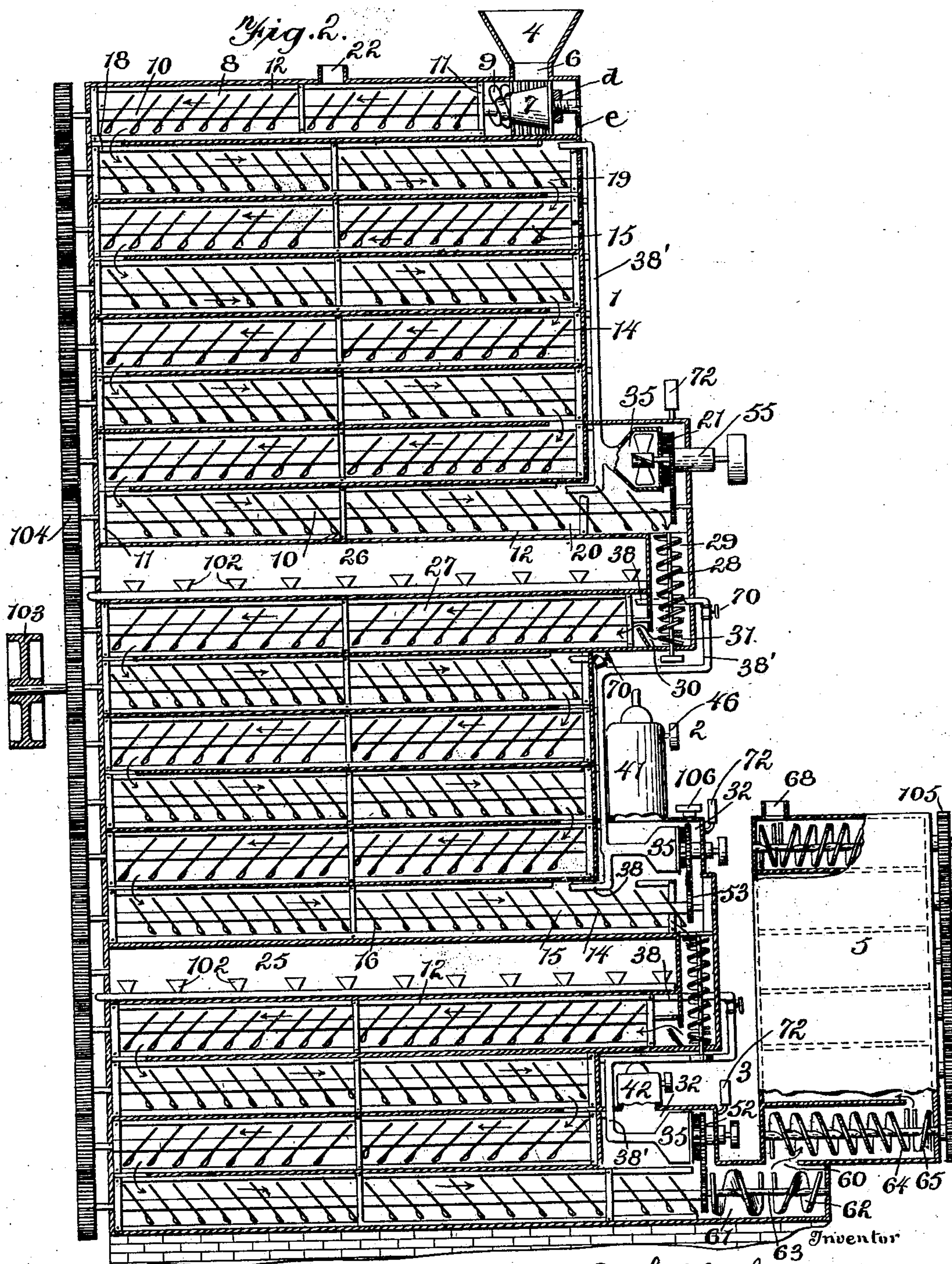
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## APPARATUS FOR DISTILLING SAWDUST.

(Application filed June 24, 1901.)

(No Model.)

**5 Sheets—Sheet 2.**



Witnesses

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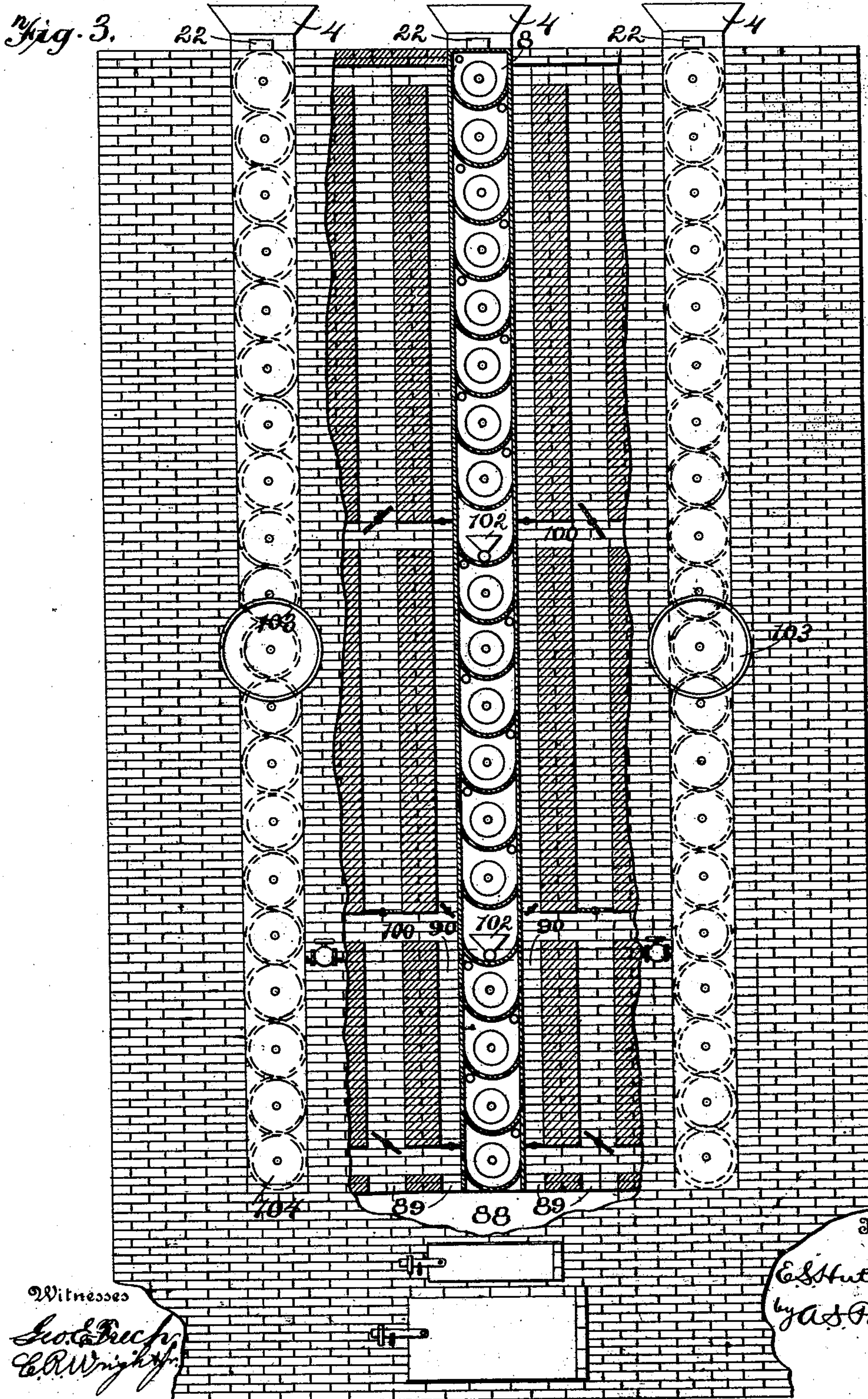
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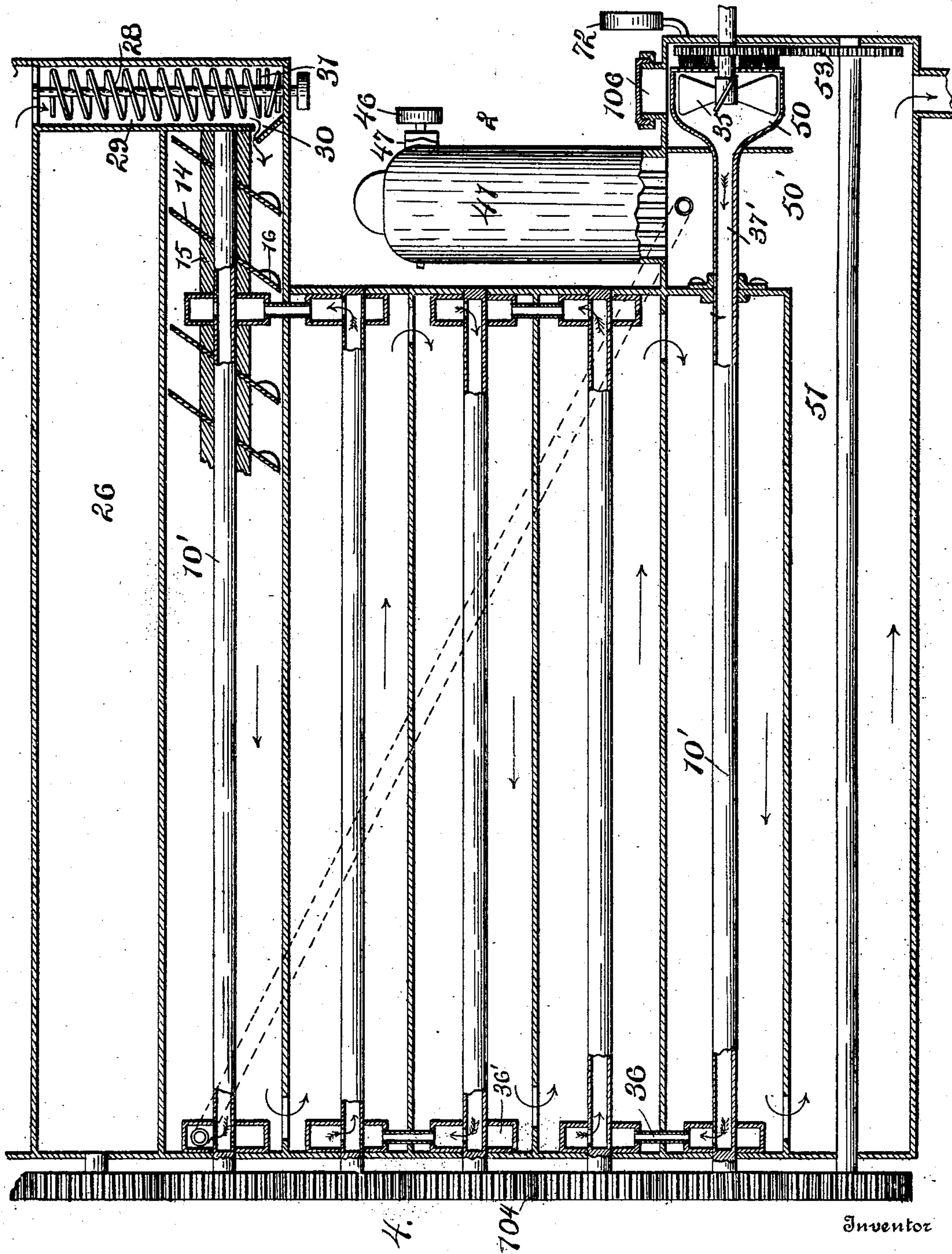
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(No Model.)

5 Sheets—Sheet 4.



Witnesses

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Fig. 4.

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Fig. 5.

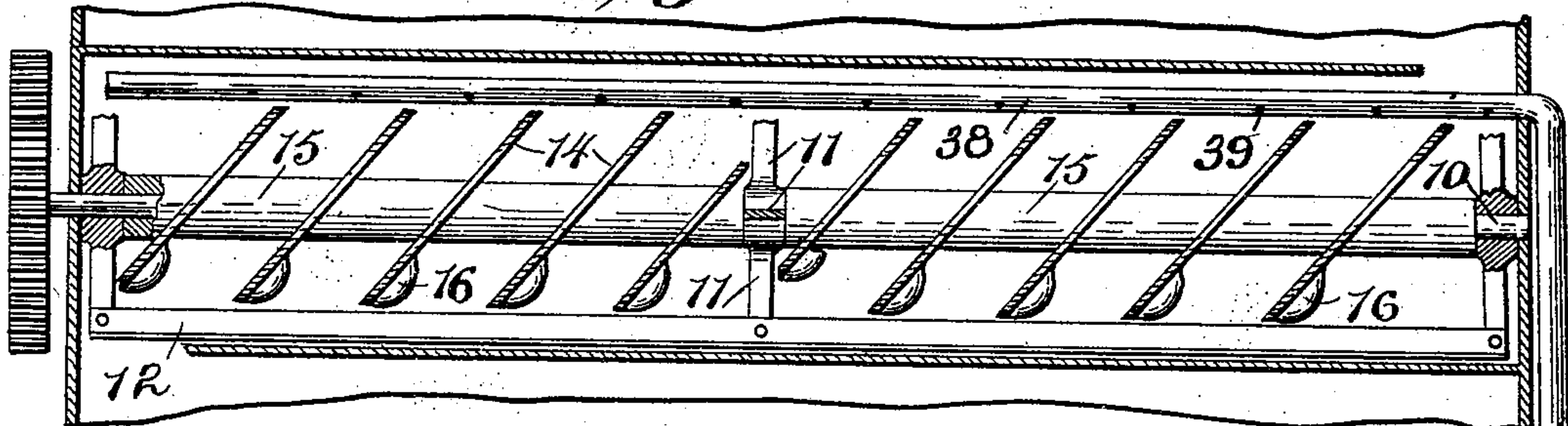


Fig. 8.

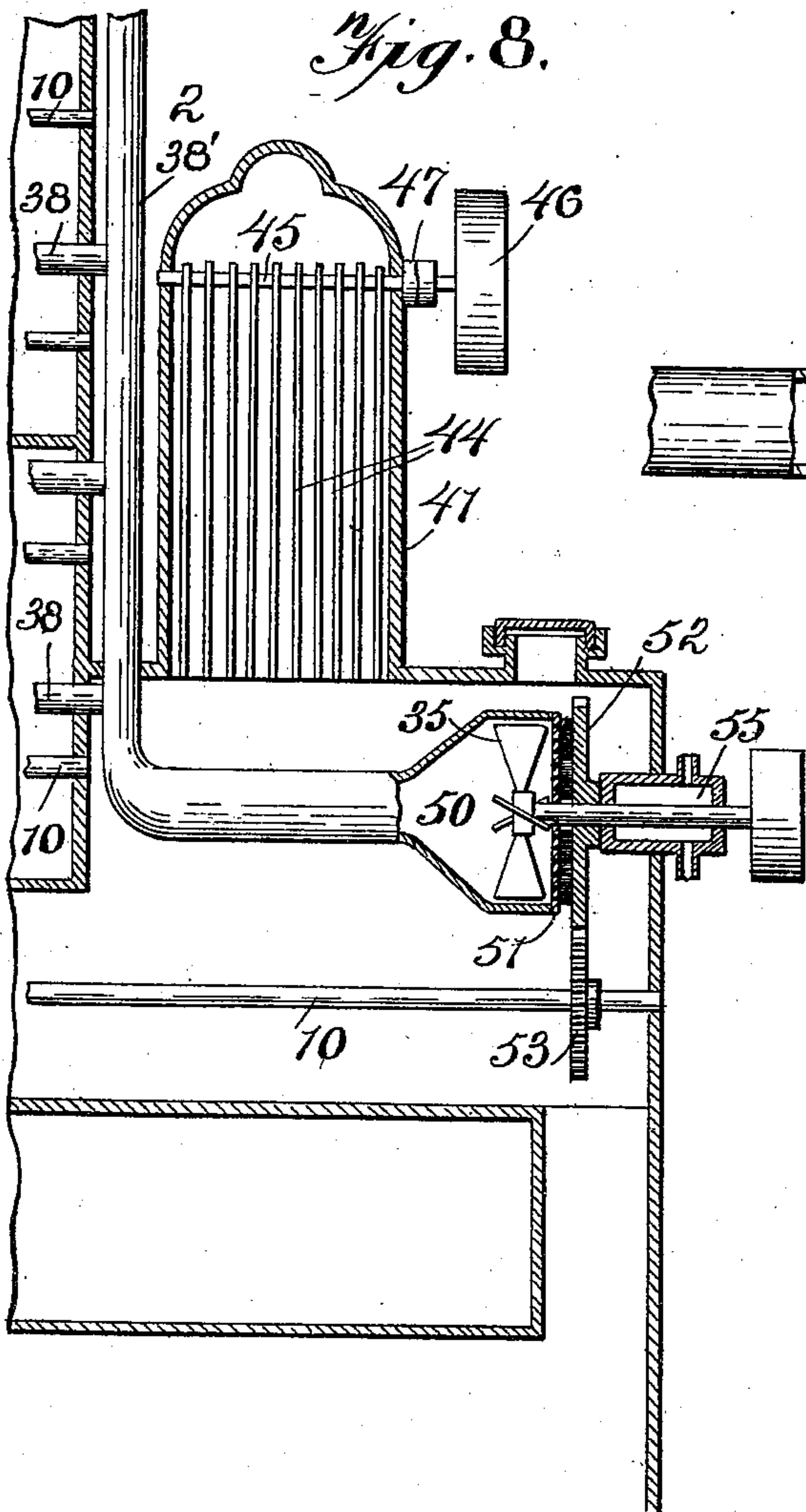


Fig. 9.

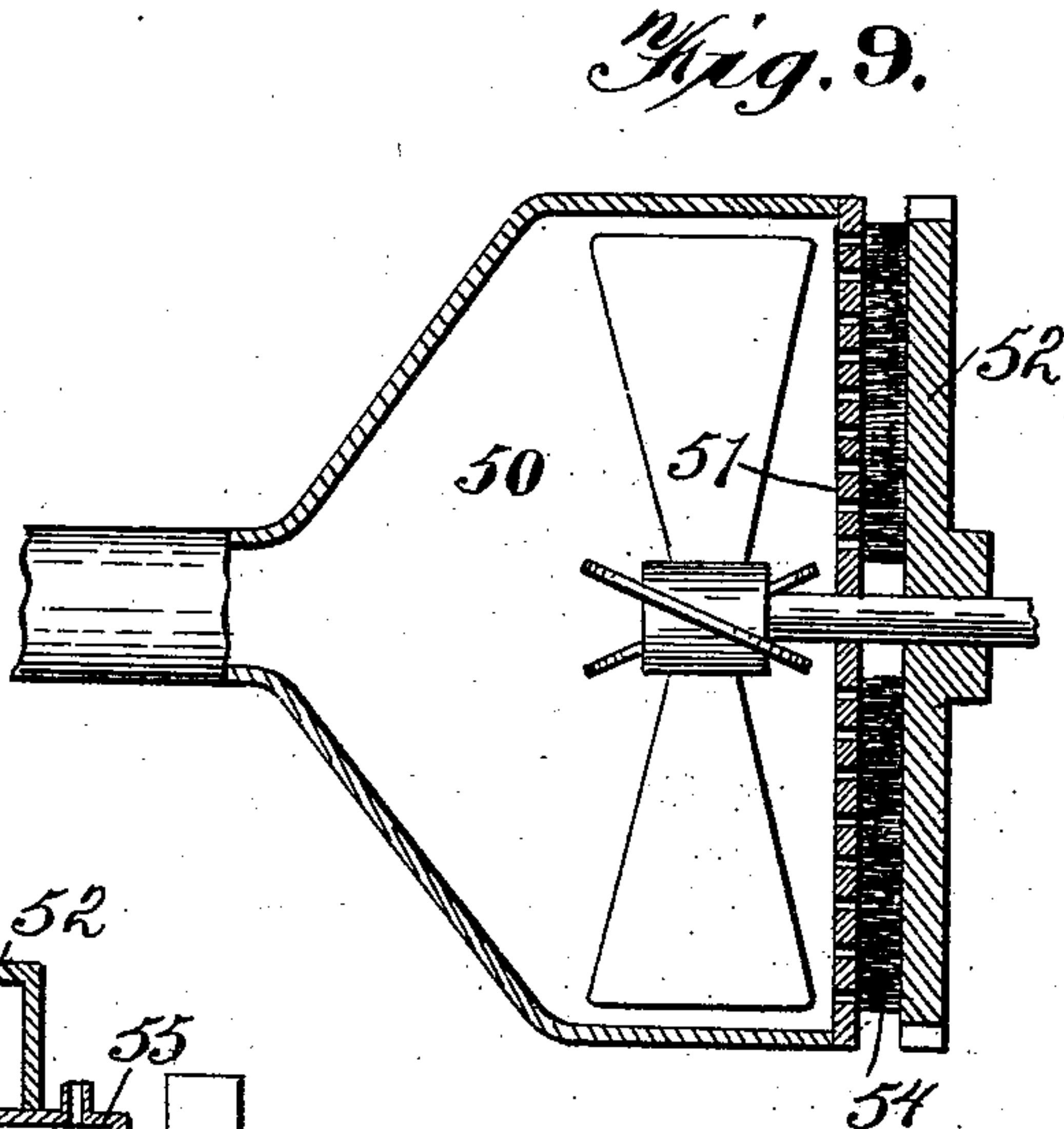
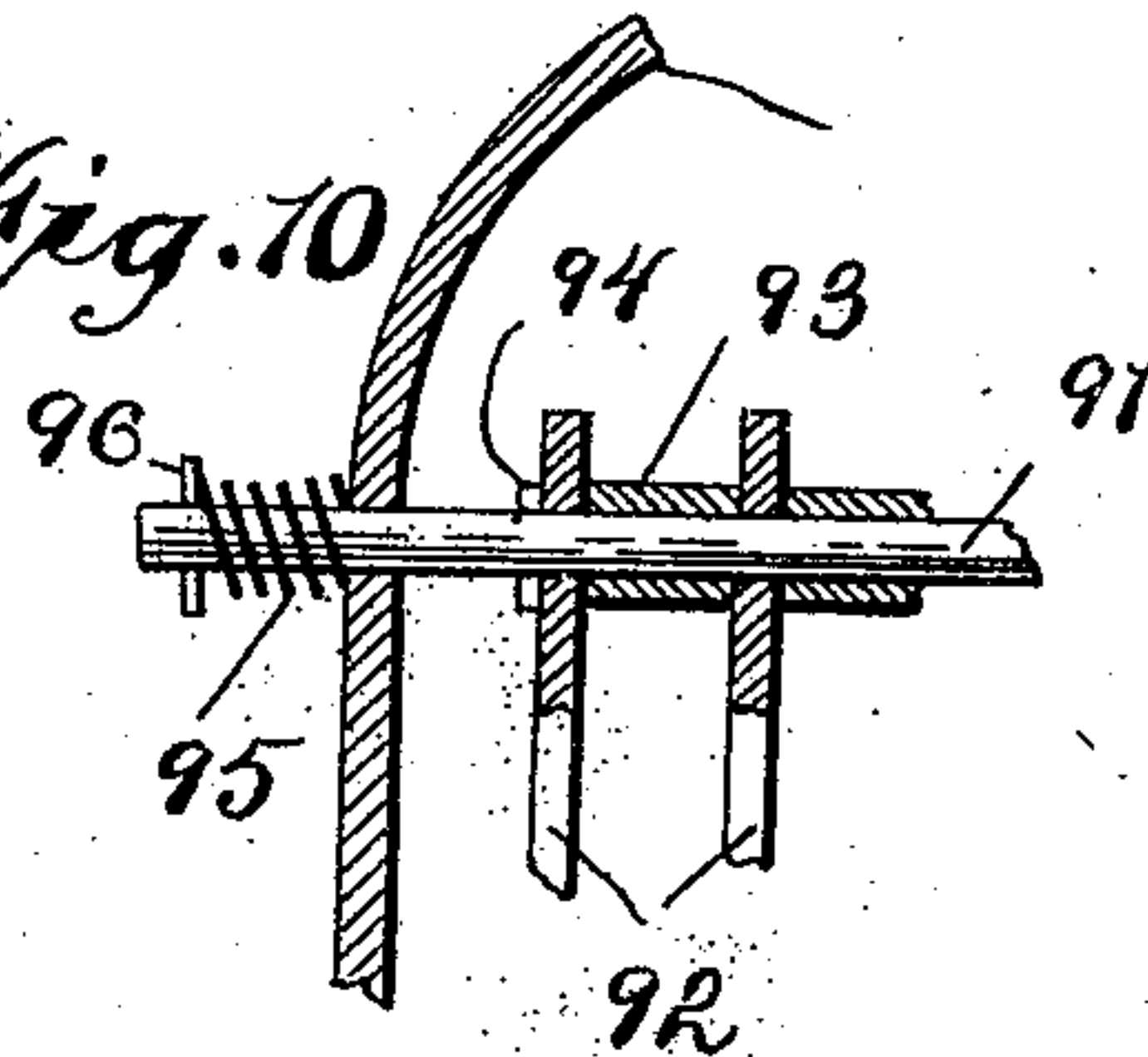


Fig. 10.



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# UNITED STATES PATENT OFFICE.

ELIAS S. HUTCHINSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

## APPARATUS FOR DISTILLING SAWDUST.

SPECIFICATION forming part of Letters Patent No. 689,723, dated December 24, 1901.

Application filed June 24, 1901. Serial No. 65,834. (No model.)

*To all whom it may concern:*

Be it known that I, ELIAS S. HUTCHINSON, a citizen of the United States, residing at Washington, District of Columbia, have invented new and useful Improvements in Apparatus for Distillation of Sawdust, of which the following is a specification.

This invention has relation to the continuous distillation of sawdust and other like material and the recovery of the by-products, and pertains to the construction and relative arrangement of the parts, involving also new features of operation, whereby the practical difficulties heretofore encountered in appliances of the character mentioned are overcome, thus greatly enhancing the efficiency thereof.

To attain the improved result, it consists in an apparatus embodying certain features of construction, relative arrangement, and operation of parts hereinafter illustrated and described.

Reference is to be had to the accompanying drawings, and to the reference characters marked thereon, forming a part of this specification, the same characters designating the same parts or features in the several views comprised in said drawings.

Of the drawings, Figure 1 is an end elevation, being partly shown in section. Fig. 2 is a vertical central sectional view of the retort portion of my invention, the dust-collecting chambers, and the exit-chamber being shown in elevation. Fig. 3 is a view at right angles to Fig. 2, showing a plurality of retorts arranged side by side, comprising what may be termed a "battery," the central retort being shown in section. Fig. 4 is a sectional view showing one way of heating the retort uniformly throughout. Fig. 5 is an enlarged view of one of the passages of the improved retort, showing the inclined heating and conveying disks. Fig. 6 is a similar view of a portion of one of said passages, the heating and conveying disks arranged to convey the sawdust in a direction opposite to that shown in Fig. 5. Fig. 7 is an enlarged transverse sectional view through two of the passages of the retort, showing one way of heating the retort uniformly throughout. Fig. 8 is an enlarged sectional view showing the dust-collecting chamber and the heat-circu-

lating blower. Fig. 9 is a more enlarged detached sectional view of the blower, showing the means for intercepting the entrance of dust thereto. Fig. 10 is a sectional view of a portion of the dust-collector and its chamber.

My invention involves an externally-heated retort, which retort includes, first, a drying-section, which is heated at a comparatively low temperature to remove the watery vapors therefrom and which may be permitted to escape, as they contain no material proportion of by-products; secondly, a section located below the drying-section in which the material is subjected to a proper relatively higher temperature to expel therefrom the lighter by-products, which are condensed and suitably recovered; thirdly, a lower section, in which the material is subjected to a proper temperature relatively higher than the temperature of the section above to expel and recover the heavy by-products, and, lastly, preferably using a part of the fixed gases passing from the condensers as a means for furnishing heat for the continuous distillation of the material or dust after the retort has been started and sufficient gas is generated for that purpose.

Heretofore in externally-heated retorts for distilling sawdust and similar material the retort has been unevenly heated, a portion of the retort being at so high a temperature as to decompose the acid vapors, with a consequent loss of valuable by-products.

One object of my present invention is to cause an even heating of the retort throughout, keeping a uniform temperature therein, and thereby preventing the loss of the said valuable products caused by the overheating and the consequent decomposition of the acid vapors. My retort being externally heated, it will be noticed that it is distinctive from retorts that are heated by introducing superheated steam or hot gases to effect the desired temperature, the two latter methods being objectionable on account of considerable loss of valuable by-products, which are the result of the distilling of the sawdust or similar materials.

My invention also includes a number of novel constructions having each a specific object in view, all and each of which will appear hereinafter.



Referring now to the accompanying drawings, A indicates my improved retort. This retort is vertically arranged and consists of an upper section 1, an intermediate section 2, and a lower or final section 3. From this description it will be noticed that the sections are located one above the other, which enables me to conveniently and economically convey the material being distilled from one section of the retort to the succeeding one, and therefore conveniently and economically carrying out the steps necessary for the proper distillation separately and in a very efficient manner.

The sawdust or similar material to be distilled is suitably fed to a hopper 4 and from thence passes through the drying-section 1 and from the drying-section to the intermediate initial distilling-section 2, in which the lighter vapors are expelled and conveyed therefrom and recovered, and from the initial section 2 the material is then passed to the lower or final section, in which the heavy by-products are expelled and conveyed therefrom and recovered. From the final or lower section the material in passing from the final section is carbonized and in the form of charcoal is fed into what may be termed an "exit-chamber" 5. This exit-chamber performs an important function for the purpose of removing all of the vapors and by-products from the charcoal, which, as will be readily understood, is in a condition to readily absorb and carry off valuable vapors and by-products which will be lost unless means is provided for preventing such action. The operation of this part of my invention will be fully explained hereinafter.

Each of the sections 1, 2, and 3 comprising my improved retort is divided into a plurality of horizontally - arranged passages through which the sawdust or similar material is conveyed and during its passage is being heated for accomplishing the distillation thereof.

The sawdust passing into the hopper 4 is agitated at the outlet end 6 of the hopper through the medium of a toothed cylinder 7, located therebelow, which toothed cylinder breaks up and prevents any caking of the sawdust and causes it to be deposited into the receiving end of the upper passage-way 8 of the upper section 1. For the purpose of regulating the feed of the material to the apparatus the feeding-screw 9 is longitudinally adjustable upon the shaft 10 through the medium of a screw-nut *d*. By moving the feed-screw 9 in respect to the outlet of the hopper 4 the rate of feed of the material through the apparatus will be governed. The end wall *e* of the passage-way 8 is provided with openings to permit the escape of any material that may get back of the cylinder. The sawdust is then moved forward in this passage-way through the medium of a suitable feed-screw 9, carried at the end of the cylinder 7, which causes the material to be moved

forward in the said passage-way. A shaft 10 passes centrally and longitudinally through the passage-way, and this shaft is provided with a suitable number of projecting arms 11, (see Figs. 5, 6, and 7,) and attached to the ends of these arms 11 are suitably-shaped shovels 12. These shovels extend throughout the length of the passage-way and as the shaft is revolved will gather the sawdust from the bottom of the passage-way and convey it upward and cause it to drop upon the inclined combined heating and conveying disks 14. The disks, as will be readily understood, become heated to some extent by radiation from the walls of the retort, but are directly heated to a considerable extent by a circulation of heated vapors directly into and through the passages (to be described hereinafter) in which the disks are located. By means of the shovels 12 the sawdust is deposited upon the inclined faces of the disks, and it passes thereover in thin strata, thus subjecting each particle of the dust to the repeated heating action of the disks. This effects a thorough drying of the dust in the drying-section of the still and a thorough distillation and carbonization in the succeeding sections of the still. These disks 14 are separated through the medium of suitable intervening collars or sleeves 15, having their ends inclined for the purpose of supporting the said disks in their proper positions, and for the purpose of preventing the revolution of the disks they are provided at their lower sides with suitable and adequate weights 16. It will be noticed that some of the disks 14 adjacent the arms 11 have short lower portions to prevent interference with said arms as the latter travel with the revolving shaft 10. The weights 16 serve to hold the disks in their proper position and prevent them from rotating with said shaft. From this description it will be understood that the sawdust being fed along in the passage 8 is gathered up by the said shovels, carried around to a point above the axis of revolution, and deposited upon the said disks, and these disks being arranged as here shown, together with the shovel effect, the conveying of the material in the passage-way and also the heating thereof are obtained for accomplishing distillation. The material passes from the outlet end of the passage 8 through an opening 18 into the inlet end of the passage 19 therebelow. The disks in the passage below are inclined in a direction opposite to the inclination of the disks in the passage-way above, and therefore effect a movement of the material in the said passage 19 in a direction opposite to its movement in the passage-way 8 above. In this manner the material is fed from one passage-way to another and in opposite directions until it finally reaches the lower and outlet passage-way 20. From this passage-way 20 the material passes into a receiving exit-chamber 21. When the material has passed through the several passage-ways of the upper sec-



tion 1 of the retort, which will require such time as will accomplish the removal of the watery vapors therefrom. Preferably the upper passage 8 is provided with a suitably positioned and arranged exit 22 for the passage of the watery vapors therefrom.

All of the watery vapors are extracted from the dust in its passage through the drying-section, and these pass out through the opening 22. Vapors which are evolved from the dust in its passage through the succeeding sections descend through the passage-ways of the apparatus because there is no other escape and on account of their specific gravity. Their removal at the lowest point of the section is preferable.

Each of the passage-ways of section 1 is provided with the combined heating and conveying disks described in respect to the passage-ways 8 and 19 and also with the shovels. Also the passage-ways of the sections 2 and 3 are provided with similar disks and shovels acting in the manner explained in respect to section 1, and need not therefore be more specifically explained. As here shown, the shafts 10 are journaled in openings formed in the end walls of the several passage-ways through which they pass; but it will be readily understood that should it be found desirable any suitable well-known form of journal may be provided therefor. The upper section will be maintained at a proper temperature to expel only the watery and valueless vapors from the material. The intermediate section 2 will be maintained at a proper temperature to remove the lighter but valuable by-products in the form of vapors, which are passed through suitable condensers, (to be more fully explained hereinafter,) and the lower or final section 3 is maintained at a sufficiently high temperature to remove the heavier by-products, which are also condensed and recovered. For the purpose of preventing, therefore, the high temperature of the lower section being immediately conveyed to the section 2 above an intervening space 25 is preferably arranged, and for the purpose of preventing the same result in respect to the intermediate section 2 and the section 1 thereabove an intervening space 26 is provided. In this way I am enabled to more perfectly maintain independent and proper temperatures in the several sections of the retort to accomplish their respective functions. The material passing into the receiving-chamber 21 at the exit end of section 1 is conveyed into the upper and receiving passage-way 27 of the intermediate section through the medium of a suitable conveyer 28, here shown in the form of a screw, situated in a passage-way 29, establishing communication between the exit end of the lower passage-way of section 1 and the inlet end of the upper passage-way of the intermediate section 2, located therebelow. An outlet-opening 30 is provided at the exit end of the passage-way 29, the walls of which preferably overlap, as

here shown, for the purpose of preventing to a certain degree the passage of any vapors from the section 1 above to the section 2 therebelow. The screw conveyer 28 at the exit end of the passage 29 is provided with a counter-screw 31, which serves to crowd the material into the inlet end of the passage-way 27. The continued movement of the material causes it to pass back and forth in opposite directions through the passage-ways of the intermediate section 2 until it reaches the exit end of the lower passage-way thereof, when it passes into a receiving exit-chamber 32, similar to the chamber 21, provided for the upper section 1, and the material is conveyed from this chamber 32 into the receiving end of the upper passage-way of the final section 3 in the same manner in which it is conveyed from section 1 to section 2, and this having been previously explained need not be further described.

In order to prevent an abnormal temperature in one part of either section of the retort, and thereby an overheating of one part of the section, which, as before stated, will cause the acid vapors to be decomposed and thereby lost, I provide means for circulating heat and producing a uniform heat in the several sections and preventing loss owing to decomposition so common in externally-heated retorts. One way of accomplishing this is shown in Fig. 4. In this instance a blower 35, which is situated in the receiving exit-chambers 21 32 of the several sections, gathers the hot vapors evolved from the dust in the drying and distilling operations and forces them through the shafts 10, which are here shown hollow. The hot vapors are forced through these hollow shafts and from one to the other through the medium of suitable passage-ways 36 in the direction indicated by arrow in Fig. 4. By radiation the heat is conveyed from the hollow shafts to the disks, (not shown in Fig. 4,) and the disks in turn contribute their heat directly to the material falling upon them, and by radiation the hollow shafts and the disks also heat the respective passages in which they are placed. The ends of the hollow shafts are journaled in the walls of the retort. In this way an even temperature is maintained throughout the section, which prevents any overheating of one part of the section and the consequent disadvantage thereof. In Figs. 2, 6, and 7 the disks are supported by solid shafts 10, while in the modification Fig. 4 the disks are supported by the hollow shafts 10', with the intervening collars, as shown in Figs. 2, 6, and 7. Passages 36 connect with the chambers or boxes 36' at the ends of the hollow shafts 10', and the receiving end 37' of the lower shaft connects with the chamber 50, in which blower 35 is placed. The hot gases evolved from the dust are drawn into the chamber 50 from the chamber 50' at the end of the lower passage 51' of its drying or distilling section.



Another way of accomplishing this even temperature in the several sections is shown in Figs. 2, 5, 8, and 7. This manner of accomplishing the result consists in providing the  
 5 pipes or tubes 38, located in the respective passage-ways at a point beyond the path of travel of the shovels and provided throughout their length with a number of openings 39. These pipes or tubes 38 are connected  
 10 with the blowers 35 by pipes 38', and by means of which the heated vapors are conveyed to the several passages and the consequent heat evenly distributed throughout the several passage-ways of the respective sections and  
 15 an even temperature maintained therein. It is well understood by those skilled in the art of wood-distillation that in the heating thereof vapors are evolved from the heated wood, which vapors contain gases and by-products,  
 20 and that the condensation of these vapors in any suitable known condenser separates the gases from the by-products, which gases are then termed "non-condensable" or "fixed" gases. In this connection it should be noticed that the vapors which I convey by these  
 25 methods are taken directly from the respective sections and before any condensation thereof, and consequently before any fixed gases are separately evolved, and which prevents any consequent loss of valuable vapors  
 30 or by-products, which would be the result should fixed or non-condensable gases be fed or conveyed to the distilling passage-ways or sections. The material having been dried in  
 35 the upper section, when being treated in the sections 2 and 3 therebelow dust arises in the operation, and it is desirable to prevent the dust being conveyed to the condensers 40, Fig. 1, there being a condenser for each  
 40 of the sections 2 and 3. In order to prevent this, I provide dust-collecting chambers 41 and 42, respectively, for sections 2 and 3, and these dust-collecting chambers are connected through the medium of suitable pipes 43 with  
 45 the said condensers 40. The vapors evolved from the sawdust being heavy they descend to the outlet-chambers 21 and 32 rather than ascend, and by reason of their heavy nature pass through the condensers rather than up  
 50 through the still. The function of the blowers is to take a portion of these heavy hot vapors from the exit-chambers, which point is the hottest point of the retort, and deliver them directly into the still-passages to come in direct  
 55 contact with the dust and the heating and conveying plates, and by means of the circulation of the hot vapors through each section of the still an even temperature is maintained throughout the several passages of the respective sections and more effectively than can be  
 60 done by external heat alone. Where external heat only is used, that portion of dust that is in contact with the heated wall of the passage becomes heated; but as the dust is a very poor conductor of heat it acts in the nature of an  
 65 intervening non-conductor of heat. Where the hot vapors, however, are fed directly into

the passages and intermingle with the dust as it is being agitated and feed successively in thin layers or strata over the heated disks,  
 70 each particle thereof is heated and the whole mass in the passages practically uniformly heated. By reference to Fig. 8 the means which I here use for effecting the collection  
 75 of the dust consists in a plurality of depending plates 44, carried upon a suitable vibratory shaft 45, carrying at its outer end a pulley 46 or other means by which it can be suitably rotated. For the purpose of vibrating the shaft by the revolution thereof a suitable  
 80 cam 47 is provided. One member of the cam 47 is attached to the outer side of the chamber 41 and the other member of the cam attached to the revolving and vibrating shaft 45. The depending plates 44 are arranged  
 85 upon the shafts 45 through the medium of intervening sleeves 93 and a pin 94. The shaft 45 projects through the opposite side of the wall of the chamber 41 and carries thereon a spring 95, engaging the outer side of the  
 90 chamber and a pin or projection 96 upon the end of the shaft. This spring 95 serves to normally hold the cam members 47 together, whereby when the shaft 45 is revolved through the medium of the pulley 46 the plates 44 are  
 95 caused to vibrate, as will be readily understood. This shaft 45 will be periodically revolved for the purpose of periodically shaking the collected dust from the depending  
 100 plates.

By reference to Fig. 9 it will be noticed that the blower-chamber 50 has its inlet end provided with a perforated wall 51 for the purpose of intercepting the dust and other particles and preventing them from passing  
 105 into the blower-chamber, and hence being conveyed by the blower back into the section with which the blower is connected. In order to brush from the perforated wall 51 the collected dust, a suitable gear 52 is located  
 110 on the blower-shaft, and this gear is in mesh with a gear 53, located on the shaft therebelow. Connected to the inner face of the gear-wheel 51 is a suitable brush 54, which engages the outer face of the said perforated wall and  
 115 removes by a brushing action the deposited dust, and thus prevents the perforations from becoming clogged.

Since the sections are maintained at a considerable heat, it is necessary to provide a  
 120 cooling means for the journals of the blower-shaft, which is here shown in the form of a water-jacket 55.

When the material has been passed through the retort and therefore distilled, there remains still the problem of removing the resultant charcoal therefrom without a loss of the valuable by-products and vapors which are naturally taken up and absorbed by the charcoal. These vapors, as is well known,  
 125 are considerably heavier than the atmosphere and have a tendency to descend. I have provided means whereby the charcoal can be removed and continuously from the still with-



out the loss of any material amount of these valuable by-products or vapors. The means by which I accomplish this consist of an exit-chamber 5, which is connected through the medium of a suitable passage-way 60 with the exit end of the lower passage-way 61 of the final section 3 of the retort. The charcoal is forced upward through this passage-way 60 through the medium of counter-screws 62, carried by the shaft 63 of the said lower passage-way, into the inlet end of the lower passage-way of the exit-chamber 5. This exit-chamber 5 consists of a plurality of horizontally-arranged parallel passages similar to the passage-ways of the several sections 1, 2, and 3 of the retort. The charcoal is therefore conveyed through the medium of suitable conveyers (here shown in the form of screws 64) back and forth through the several passage-ways of the exit-chamber 5, being forced from the exit end of one passage-way through the inlet end of the other passage-way through the medium of counter-screws 65, located at opposite ends of the shaft, which are situated within the passage-ways of said exit-chamber. At each point where this reverse action occurs there will be a pack of material nearly closing the passage for vapors. The charcoal is finally passed from the machine through the final exit 68 and then received or conveyed in any suitable manner at any desired point. The principle involved in taking the charcoal from the machine without the loss of the valuable by-products and vapors consists in elevating the sawdust to a point above the condenser 40 of the said final section 3. The result is accomplished because the heavy vapors having evolved from the charcoal will pass downward to the lower condenser, for they cannot pass out the exit-opening 68 against the atmospheric pressure. Thus by taking the final product (the charcoal) from the machine by an upward movement thereof a considerable saving of the valuable by-products is accomplished.

For the purpose of assisting in the regulation of a uniform temperature throughout the sections 2 and 3, where such uniform temperature is most necessary, I provide any suitable number of valves 70, which will be so located as to enable me to regulate the passage of the heated vapors into the several passage-ways of the respective sections of the retort, and thus to exactly regulate the temperature thereof uniformly throughout the entire length of each section. For the purpose of enabling the operator to determine the temperature of the several sections any suitable thermometer (indicated at 72 in Fig. 3) will be provided, and, if desired, these thermometers may be connected or so situated as to indicate the temperature at different points in the several sections of the retorts, thus enabling the operator by the means of the valves 70 to keep a uniform temperature in the several parts or passage-ways of the re-

tort-sections. Preferably, a portion of the fixed or permanent gases passing from the condensers 40 through the pipes 82 will be used to furnish heat for the continuous distillation of the product after the still has been sufficiently heated through the medium of the furnaces 88, (to be more fully referred to hereinafter,) and the heavier by-products pass from the condensers through the pipes 81 into suitable receptacles 80.

By reference to Fig. 3 it will be noticed that the retort is inclosed within a suitable wall or covering, here shown as composed of brickwork. In this figure I have shown three retorts, which, preferably, I term a "battery." These retorts are in communication with a suitable furnace 88, which is in communication through the medium of passage-ways 89 with the spaces 90, located at opposite sides of the retort. Transversely-arranged passage-ways 100 serve to connect the vertically-arranged passage-ways at suitable points for the purpose of regulating the passage of the products of combustion from the furnace to the several sections, and thus causing more or less heat to be conveyed to the respective sections. In this way it will be readily understood the upper section can be kept at a temperature comparatively low as compared with the temperature of the intermediate section 2, and the intermediate section 2 can be kept at a temperature low as compared with the temperature of the lower or final section. Naturally this would be the result, owing to the fact that the sections 2 and 1, respectively, are located farther from the fire; but through the medium of the dampers 101, located at the intersection of the vertically and transversely arranged passage-ways, the temperature of the several sections can be accurately controlled. When the still has been started by heat from a fire in the furnace 88 and sufficient gas has been generated, then the fire within the furnace 88 may be permitted to die down and the gas be used to run the still. In this event suitable burners 102 will be located in the spaces 25 and 26 between the sections 1, 2, and 3 and also in the furnace immediately below the lower section. These burners are supplied with gas from the pipes 82, and should there be a surplus of gas generated it may be permitted to escape or be stored in any suitable form of receiving-chamber. (Not here shown or described, since it forms no part of my present invention.) Through the medium of suitable valves the heat supplied to the respective sections will be under the control of the operator, as will be readily understood. As this use of the fixed gases for supplying the heat to continue the distilling process is broadly old, it need not be more specifically herein shown.

The several shafts passing through the passage-ways 1, 2, and 3 of the retort are revolved through the medium of a suitable pulley-shaft 103, connected to one of said



shafts, and this pulley-shaft and the other shafts are provided with the meshing gears 104, (clearly shown in Figs. 2 and 3,) by means of which rotary motion is conveyed to the respective shafts. In the same way rotary motion is conveyed to the shafts in the exit-chamber 5 through the medium of the gear-wheels 105.

At points just above the blowers I provide suitable observation-openings 106, through which that part of the apparatus may be inspected at any time and which also serves as escape-openings in the event of the accidental admission of air to the interior of the apparatus.

In operation the sawdust is fed through the hopper 4 to the receiving end of the upper passage-way 8. The shovels 12 serve to lift the dust and feed it to the upper portion of the inclined disks, over which it passes in thin layers or stratas and is by the inclination of the disks fed along to the opposite end of the passage-way, from which it passes into the succeeding passage, and so on through each passage-way, traveling alternately in opposite directions until it is deposited into the exit-chamber 21. All of the watery vapors are evolved from the dust in its passage through the drying-section, which vapors pass out the opening 22. The vapors evolved from the dust in the succeeding portion of the apparatus are of a heavy nature and descend through the sections of the still into the exit-chambers thereof. The dust in its passage through the apparatus is packed at the points 30, preventing the passage of vapors between the sections. By means of the blowers all the hot vapors passing into the exit-chamber of the drying-chamber and a portion of the hot vapors entering the exit-chambers of the two lower sections are carried directly into the passage-ways and in direct contact with the dust and combined heating and conveying disks, according to the plan shown in Figs. 2, 5, 6, and 7. In the modification shown in Fig. 4 the hot vapors are carried by the blowers through the hollow shafts, and by radiation and conduction serve to heat the disks and the interior of the passage-ways. Since the vapors evolved in the upper or drying section do not contain any practical amount of gases or by-products, said vapors are not further treated. The dust in the sections 2 and 3 is subjected to a higher degree of heat, and the vapors evolved therefrom are heavily laden with both gases and by-products. Therefore these vapors are ultimately passed through suitable condensers, which serve to separate the gases from the by-products. The by-products are collected in suitable receptacles 80 and part of the gases used, as before stated, to supply the burners 102 to furnish heat for the distillation of the dust after the furnace has been sufficiently heated and a sufficient amount of gases generated, as before explained. Any surplusage of gases may be

permitted to either escape to the air or be collected in any desired way in a suitable storage-chamber.

Having thus explained the nature of my invention and described a way of constructing and using the same, though without attempting to set forth all of the modified forms in which it may be made, what I claim, and desire to secure by Letters Patent, is—

1. A distilling apparatus including a retort composed of independently-acting sections having a material communication with each other, means for feeding the material successively through said sections, independent heating means for said sections, and means adapted to control the heat and to keep said sections at different degrees of temperature.

2. A distilling apparatus including a drying-section, an initial distilling-section and a final distilling-section, means for feeding the distilled material successively through said sections beginning with the drying-section, and means adapted to heat said sections at successively higher temperatures, the temperature of the drying-section being the lowest.

3. A distilling apparatus including a retort provided with a plurality of separately-acting drying, initial and final distilling-sections, having material communications with each other, feeding means in said sections and feeding the material successively through said drying, initial and final distilling-sections, a heating means, and controllers for said heat adapted to provide a drying temperature for the drying-section and relatively higher temperatures for the respective distilling-sections.

4. An apparatus of the character described including a retort provided with a passage-way, inclined disks and lifting members located in said passage-way, and means for heating the disks independently of the wall of the passage-way.

5. An apparatus of the character described including a retort provided with a passage-way, inclined disks and a lifting member located in said passage-way, means for heating the passage-way and evolving hot vapors from the material therein, and a vapor-conveyer in communication with the opposite ends of the passage-way and adapted to circulate the hot vapors through the passage-way and in direct contact with the said disks.

6. An apparatus of the character described including a retort provided with a plurality of essentially parallel horizontal passage-ways having communication at their ends, disks inclined in opposite directions respectively in said passage-ways, lifting members in said passage-ways, means for heating the passage-ways and evolving therefrom hot vapors, and a vapor-conveyer having communication with the passage-ways and adapted to circulate said hot vapors therethrough and in direct contact with said disks.

7. An apparatus of the character described including a retort having inlet and outlet por-



tions, a condenser in communication with said outlet portion, and a hot-vapor-distributing communication having an inlet located at a point between said condenser and outlet portion, and its opposite portion communicating with the retort at various points.

8. An apparatus of the character described including a retort divided into separate sections, each section having a separate outlet portion and separate hot-vapor-distributing communications between said outlet portions and various points of said sections.

9. An apparatus of the character described including a retort having an inlet and an outlet portion, a hot-vapor-distributing communication between said outlet portion and various portions of said retort, and a blower located in said communication.

10. An apparatus of the character described including a retort having an inlet and an outlet portion, a blower-chamber, a communication between said chamber and various portions of said retort, the blower-chamber having an inlet provided with a dust-interrupting portion.

11. An apparatus of the character described including a retort having inlet and outlet portions, a blower-chamber in communication with the outlet portion, said chamber having an inlet provided with a dust-interrupting member, and a clearing member for said interrupting member.

12. An apparatus of the character described including a retort having an inlet and an outlet portion, a condenser in communication with the outlet portion, and a dust-collector located between the condenser and said outlet portion.

13. An apparatus of the character described including a retort provided with inlet and outlet portions, a condenser in communication with the outlet portion, a dust-collector located between the condenser and the outlet portion, said collector comprising vibrating dust-collecting members.

14. A distilling apparatus including a retort having an inlet and an outlet portion, said outlet portion having a material-elevating means, and a vapor-outlet in communication with the retort and with the material-outlet.

15. A distilling apparatus including a retort having an inlet and an outlet portion, a vertically-arranged material-outlet chamber, and a vapor-outlet in communication with the said outlet-chamber.

16. An apparatus of the character described including a retort having inlet and outlet portions, a condenser in communication with said outlet portion, and an exit-chamber for the distilled material having an outlet at a point above the inlet of the condenser.

17. An apparatus of the character described including a retort having an outlet portion, and a vertically-arranged material-exit chamber having its lower portion in communication with said outlet portion and an exit at its upper portion, said chamber provided with

communicating horizontal passage-ways, and conveying and elevating members in said passage-ways.

18. An apparatus of the character described including a retort divided into a plurality of sections, a furnace, two parallel combustion-flues at each side of said retort and provided with laterally-extending connecting-passages, and dampers located in said flues to regulate the passage of said combustion through the flues and passages.

19. An apparatus of the character described including a plurality of parallel vertically-arranged retorts, two parallel combustion-flues at each side of said retorts, a furnace in communication with said flues, lateral passages communicating with said flues, and dampers in said flues for controlling the passage of combustion therethrough.

20. An apparatus of the character described including a vertically-arranged retort divided into a plurality of sections one above the other, two parallel flues at each side of the retort, lateral passages connecting said flues and located at the ends of said retort-sections, a furnace in communication with the flues, and dampers located at said passages for controlling the passage of the products of combustion through the flues and passages.

21. A wood-dust-distilling apparatus, including a retort having a distilling passage-way, dust-lifting member and spreading-surfaces in said passage-way.

22. A wood-dust-distilling apparatus including a retort having a distilling passage-way, dust-lifting members in said passage-way, and combined dust conveying and spreading members also in said passage-way.

23. A wood-dust-distilling apparatus including a distilling passage-way, and members located in said passage-way constructed and adapted to repeatedly lift and spread the dust into separate thin layers in said passage-way.

24. A wood-dust-distilling apparatus, including a retort having a distilling passage-way, and means located in said passage-way constructed and adapted to successively spread and move the dust in separate thin layers along within said passage-way, and heating means in said passage-way.

25. A distilling apparatus, comprising a distilling-section, a material passage-way in communication therewith, and a feeding member within the passage-way having a reverse action at the exit end of the passage-way, adapted to pack and feed the material for the purpose described.

26. A distilling apparatus, comprising a distilling-section, an exit material passage-way in communication therewith, and a feeding member within this passage-way having a reverse action at the exit end of the passage-way adapted to pack and feed the material from the passage-way, for the purpose described.

27. A distilling apparatus comprising separate sections, a passage-way connecting said



sections, a feeding member in said passage-way having a reversely-acting member at the exit end of the passage-way adapted to pack and feed the material for the purpose described.  
5 scribed.

28. A distilling apparatus comprising separate sections, a passage-way connecting said sections, a screw-feeding member in said passage-way having a reversely-arranged screw

at its exit end to pack and feed the material, 10 for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ELIAS S. HUTCHINSON.

Witnesses:

GEORGE E. FRECH,  
CHAS. R. WRIGHT, Jr.