

T. WIEDEMANN & J. H. TEMPLIN.

VACUUM CLEANING APPARATUS.

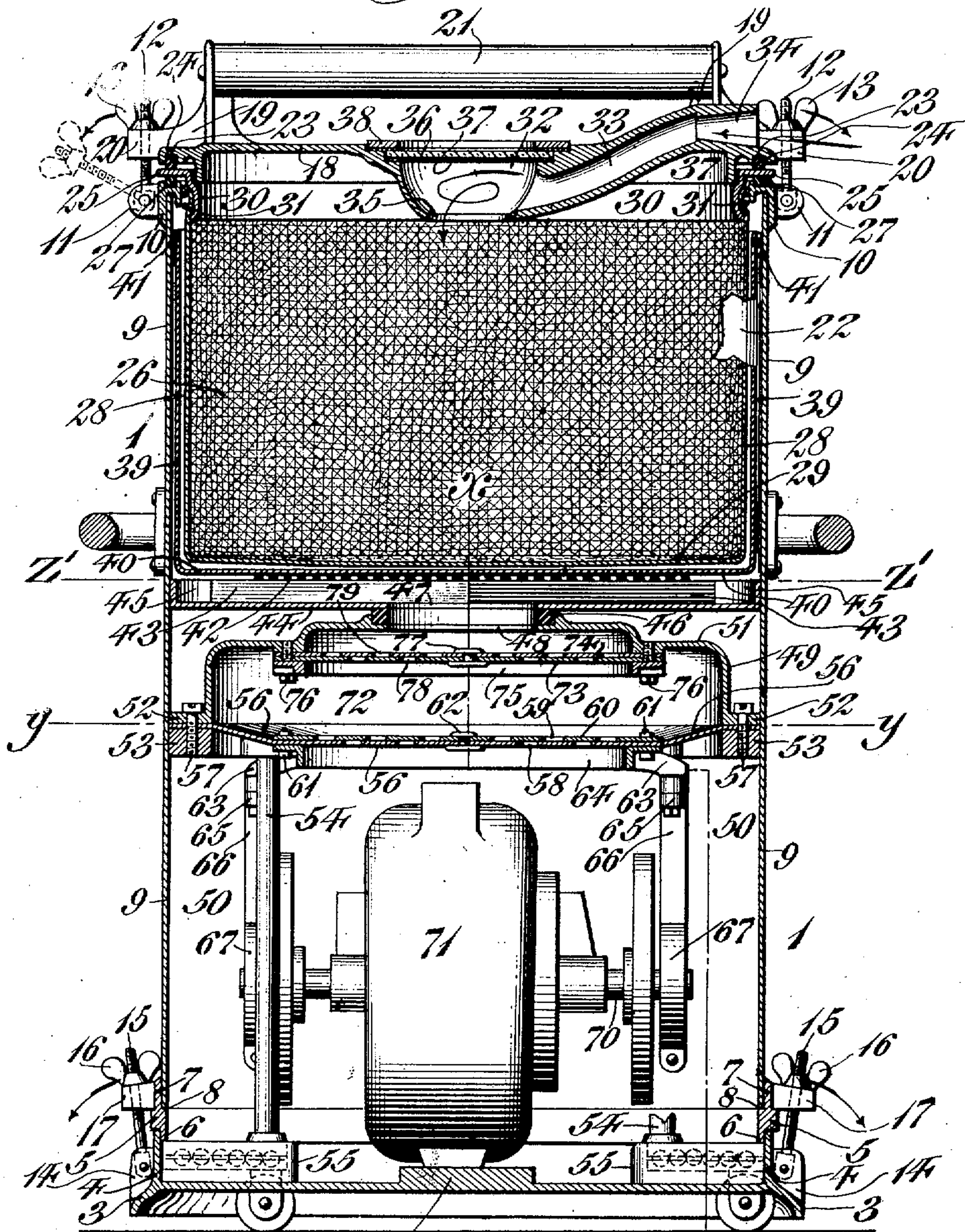
APPLICATION FILED JULY 31, 1909.

965,783.

Patented July 26, 1910.

3 SHEETS—SHEET 1.

*Fig. 1.*



WITNESSES

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INVENTORS

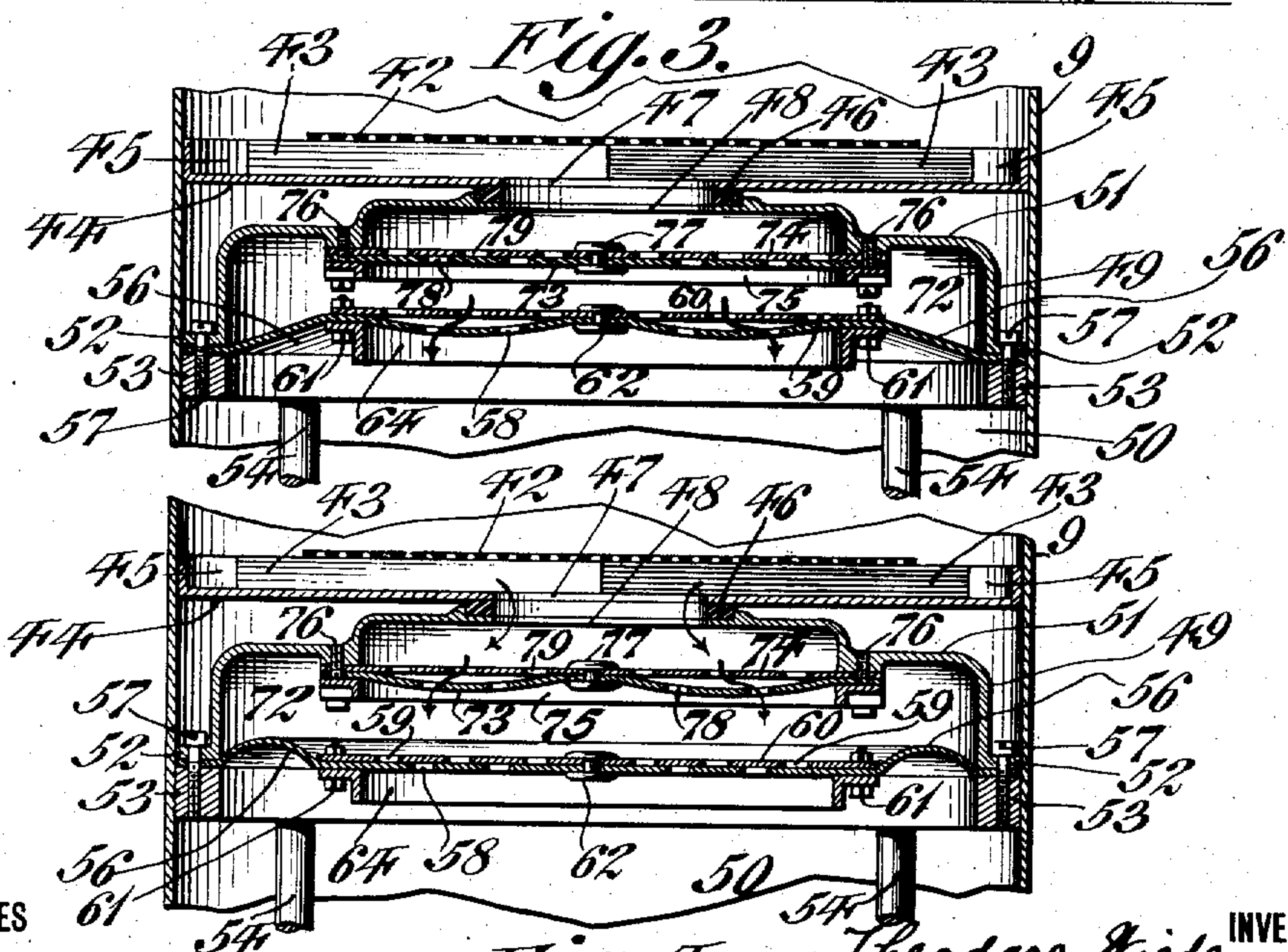
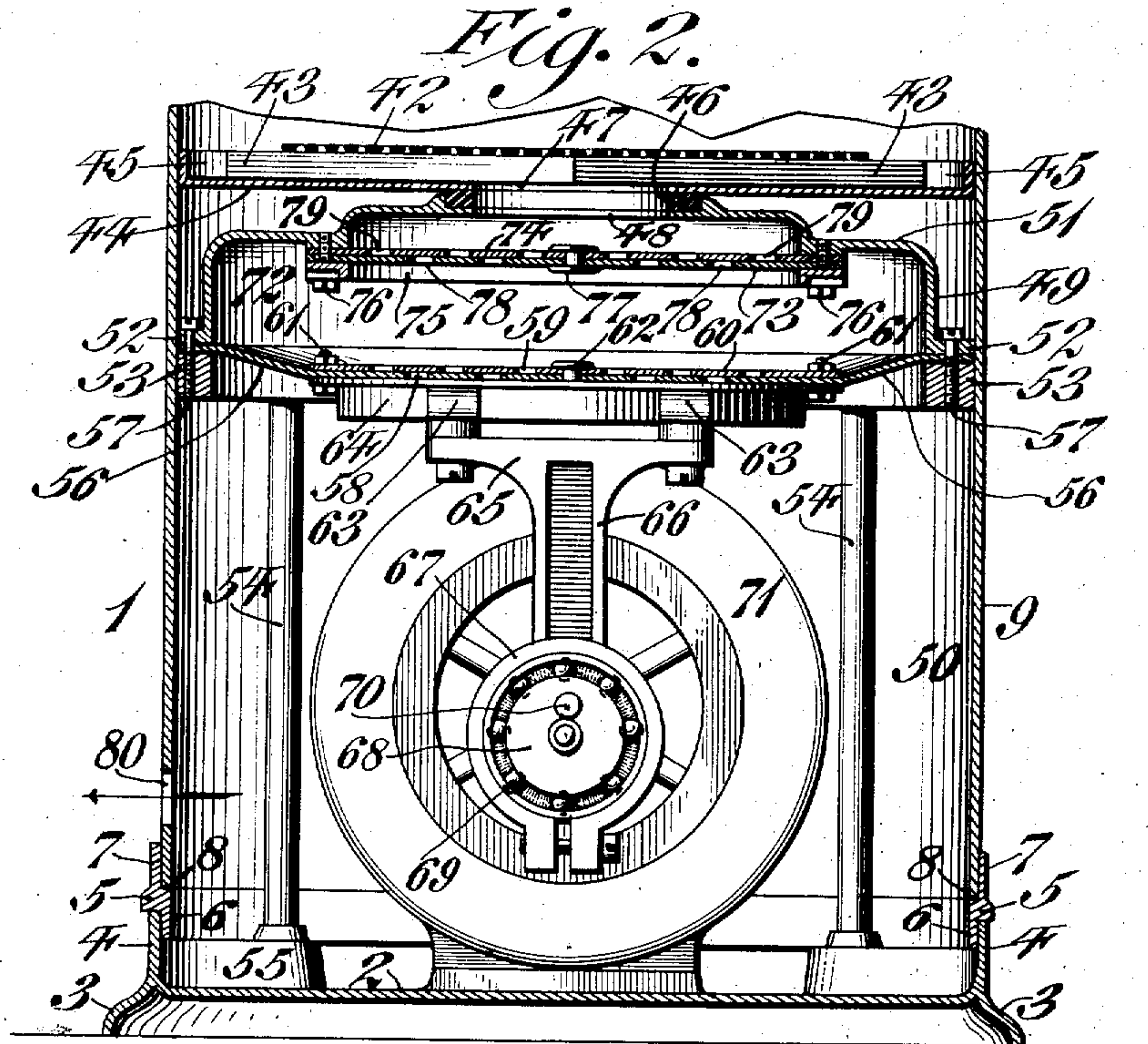
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3 SHEETS—SHEET 2.



WITNESSES

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*Fig. 4.*

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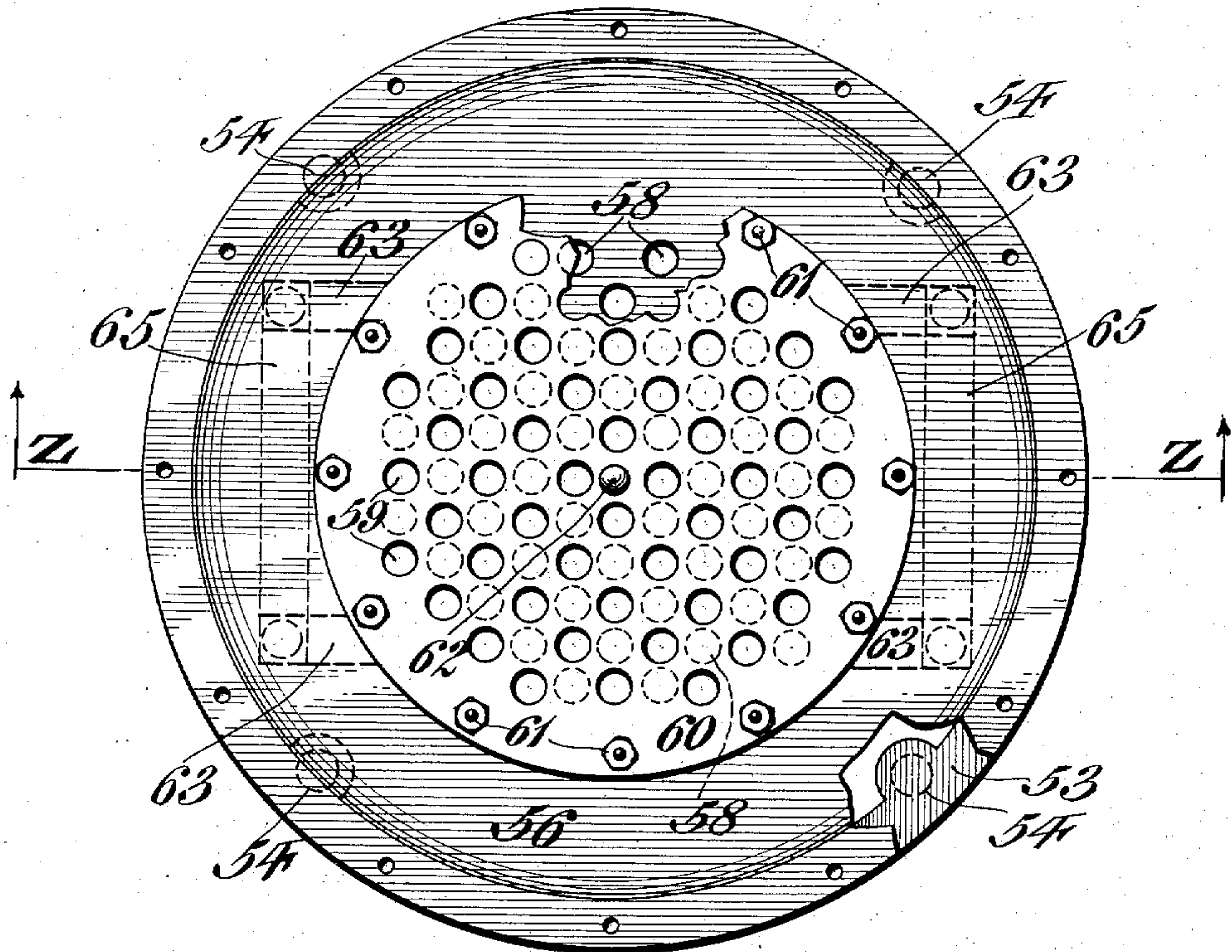
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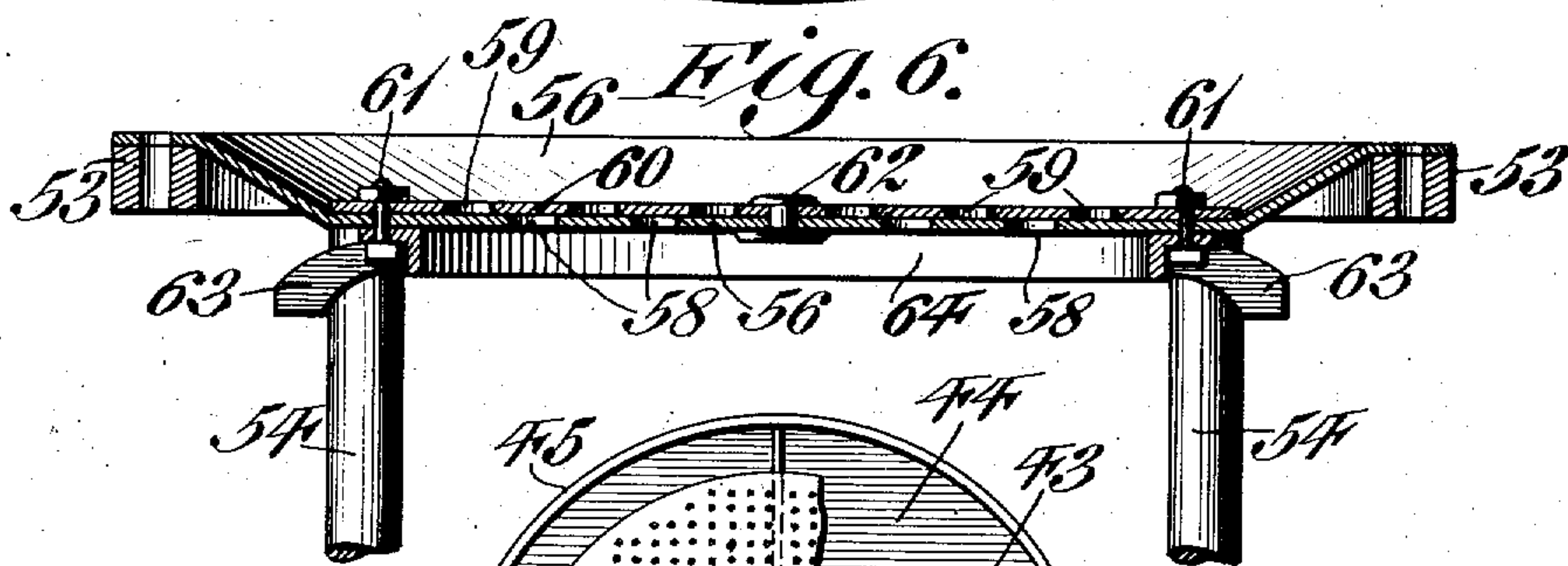
Patented July 26, 1910.

3 SHEETS—SHEET 3.

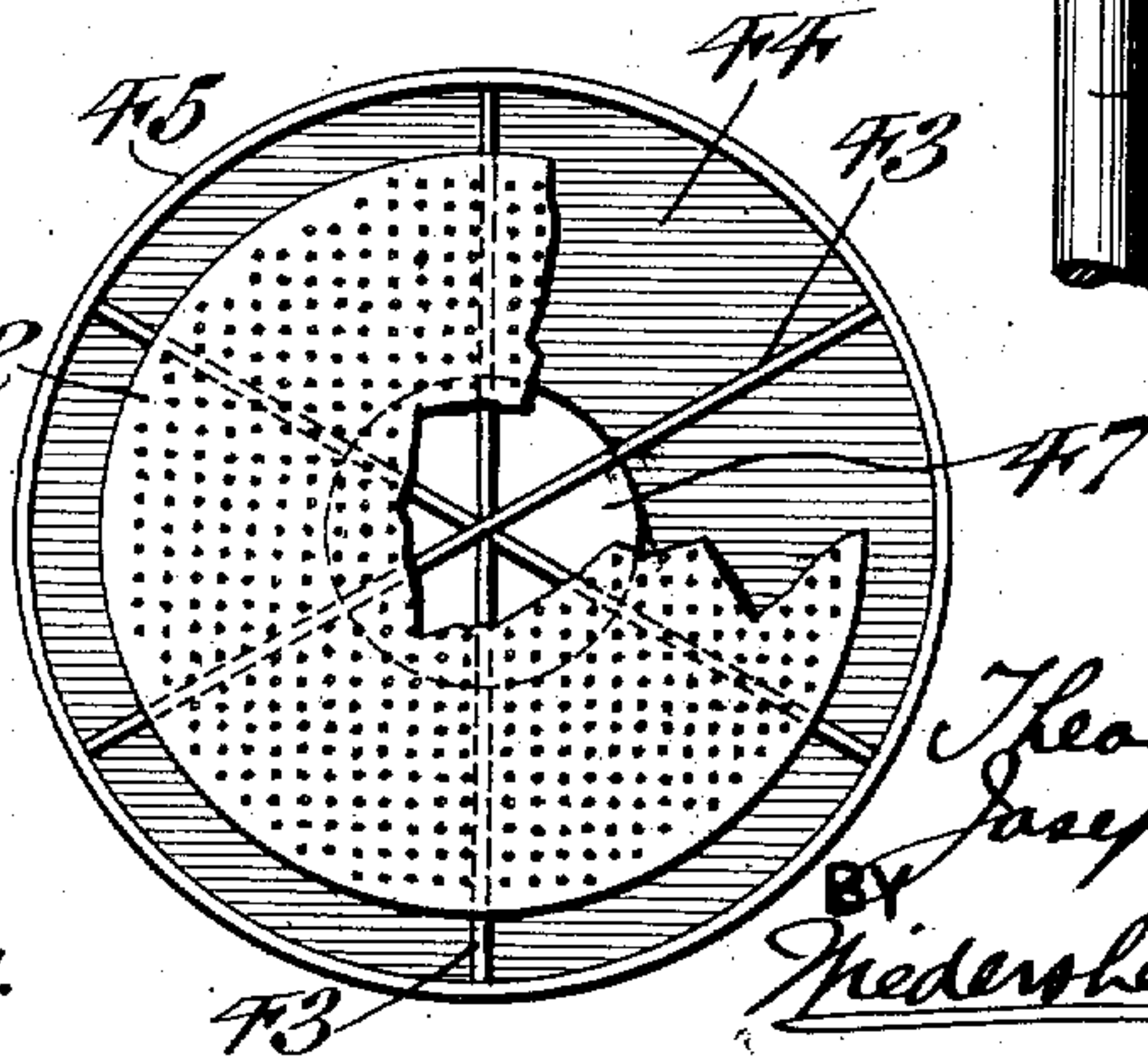
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



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# UNITED STATES PATENT OFFICE.

THEODORE WIEDEMANN AND JOSEPH H. TEMPLIN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO KELLER MANUFACTURING COMPANY, A CORPORATION OF DELAWARE.

## VACUUM CLEANING APPARATUS.

965,783.

Specification of Letters Patent. Patented July 26, 1910.

Application filed July 31, 1909. Serial No. 510,559.

*To all whom it may concern:*

Be it known that we, THEODORE WIEDEMANN and JOSEPH H. TEMPLIN, citizens of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Vacuum Cleaning Apparatus, of which the following is a specification.

This invention relates to vacuum cleaning apparatus adapted to modern requirements for removing dust, dirt and foreign matter generally from carpets, upholstery fabrics and the like by currents of air and relates more particularly to the valve mechanisms controlling the delivery of air to the apparatus. It is well known in apparatus of this character that suitable pumping or suction and discharge apparatus is used in connection with a motor for carrying a dust-laden current of air into a suitable dust receptacle or separating apparatus which is located adjacent thereto and which is conveniently accessible for the purposes of removal, inspection or repairs, and in order to effectually control the motor and the operating parts of the mechanism the pumping chamber and its valves serve a most important function in the operation thereof.

In use the apparatus is frequently actuated and some times for a considerable period without the suction devices in contact with upholstery or the like for the removal of dust, dirt, etc. at which time if no means are provided for regulating the motor it is liable to raise or develop an excessive high speed tending to overheat the parts and damage the operating mechanism. To this end we have devised a novel valve structure and pumping chamber wherein the speed of the motor is accurately governed whether the device is carrying a load of dust-laden air into the separating chamber or not, and wherein the pulsations are uniform, accurate and dependable. Furthermore it is a desideratum in an apparatus of this character that the pumping apparatus and its adjuncts be located intermediate of the motor and the dust separating devices whereby the power is applied directly to the suction creating device without loss of energy and provision is further made for enabling any part of the suction or discharge apparatus valves or equivalent devices to be readily accessible at all times for

the purpose of inspection, repairs and renewal.

To the above ends our invention consists of a novel construction of dust separating device, pumping and actuating mechanism valve mechanism operating in conjunction therewith, vacuum pumping and pressure chambers all arranged as will be more fully set forth.

For the purpose of illustrating our invention we have shown in the accompanying drawings one form thereof which is at present preferred by us, since the same has been found in practice to give satisfactory and reliable results although it is to be understood that the various instrumentalities of which our invention consists can be variously arranged and organized and that our invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Referring to the drawings:—Figure 1 represents a vertical section of a vacuum cleaning apparatus embodying our invention. Fig. 2 represents a section substantially on line  $x-x$ , Fig. 1, showing the pumping mechanism and one side of the actuating mechanism therefor. Fig. 3 represents a section through the pumping mechanism, showing the position that the lower or discharge valvular elements assume during the upward movement of the lower diaphragm and its adjuncts. Fig. 4 represents a section of the pumping mechanism showing the position that the upper suction or inlet valvular elements assume during the downward movement of the lower diaphragm and its adjuncts. Fig. 5 represents a section on line  $y-y$ , Fig. 1. Fig. 6 represents a section on line  $z-z$ , Fig. 5. Fig. 7 represents, on a reduced scale, partly broken away, a section on line  $z'-z'$ , Fig. 1.

Similar numerals of reference indicate corresponding parts in the figures.

1 designates our novel construction of vacuum cleaning apparatus, the same comprising the base portion 2, the latter having the outwardly projecting or flaring flange 3 and the upwardly extending flange 4, upon the top of which latter rests the ring 5, the latter having the downwardly projecting portion 6, and the upwardly projecting

member 7, which latter is provided with the shoulder 8 upon which rests the outer wall or casing 9, which latter in the present instance is preferably round or cylindrical, although it will be apparent that the exterior shape or contour of the apparatus may be changed or varied according to requirements.

10 10 designates a ring secured to the upper portion of the casing 9, said ring being provided with the slotted lugs 11, having the bolts 12 pivoted therein, the upper ends of said bolts being threaded and provided with the thumb nuts 13, it being understood that 15 the rings 5 and 10 are in practice secured fast to the shell or casing 9 so as to be removed in unison therewith.

14 designates slotted lugs or ears secured in the present instance to the lower portion 20 of the base or bed member 2, said lugs or ears being arranged preferably diametrically opposite to each other and having pivoted therein the bolts 15, whose upper ends are threaded with thumb nuts 16, said 25 bolts being adapted to pass through the slotted ears 17, which are preferably located on the ring 5 so that by manipulating the thumb nuts 16 the bolts 15 can be readily engaged with or disengaged from the lugs 30 17, it being apparent that by the employment of the fastening devices referred to at the upper and lower portions of the apparatus, the lower portion of the casing can be readily disconnected from its base, 35 according to requirements, while the upper portion of the casing can be readily disconnected from the top or cover 18, as is evident, the latter being provided with the angular brackets 19 which terminate in the 40 slotted ears 20, which are adapted for the reception of the bolts 12, as will be understood from Fig. 1.

21 designates a handle which has its extremities preferably secured to the upwardly 45 extending members of the brackets 19, as will be understood from Fig. 1, said handle being preferably of sufficient length so that when it is desired to transport the apparatus from one apartment or room to another, the 50 handle can be readily grasped by two people if necessary.

In order that the upper compartment which we term the vacuum chamber or reservoir 22 may be made air and dust tight, we 55 place in the under side of the cover 18 a groove 23, in which is located an annular ring, packing or gasket 24, the latter being adapted to rest upon the top of the flange 25 of the inner dust bag 26, the under side 60 of said flange resting upon the annular ring, packing or gasket 27, which is mounted in a recess in the upper portion of the ring 10, whereupon it will be seen that when the thumb nuts 13 are tightened, the flange 25 65 will be tightly held between said packing

rings 24 and 27, the manner of assembling the top 18 on the flange 25 of the inner dust bag and the top of the casing 9 being apparent from Fig. 1. In the preferred form of constructing and assembling the inner dust 70 bag, the lower portion or body 26 thereof is constructed of some suitable fabric having the sides 28, as indicated and the bottom portion 29, the upper extremity of said sides 28 being secured to the annular portion 30 by 75 means of the wires or other fastening devices 31.

32 designates a bowl or depression formed in the cover 18 and with which a passage 33, leading from the inlet 34, communicates 80 and thereby conducts the dust laden current of air from a suitable hose connected to the opening 34, to the inner bag or separating device 26, it being understood that a suitable opening 35 is formed in the bottom of the 85 bowl to permit the passage of the dust and the like.

36 designates a plate of transparent material, which is seated in the recess 37 of the 90 depression 32 and is held in position by the ring or fastening device 38, as will be apparent from Fig. 1. The current of dust laden air after passing through the outlet 35 into the bag 26, whose construction and 95 manner of removal has already been described, passes thence through the outer bag 39, which is composed of sides and the bottom portion 40, the upper sides of said outer bag 39 being connected to or reinforced by the ring 41, as will be understood. 100

43 designates a perforated plate, preferably of somewhat less diameter than the casing 9, said plate being mounted above or 105 supported on the wings 43, the latter being contained within or resting upon the pan formed by the plate 44 and the upwardly extending flange 45, said plate 44 resting upon the ring or packing 46.

47 designates an opening in the plate 44 which discharges into the ring 46 and thence 110 through the opening 48 into what we term the pumping apparatus proper 49, it being noted that the latter is located between the vacuum reservoir 22 and what we term the pressure chamber 50, in the lower portion 115 of the casing 9. The pumping apparatus 49 comprises a top plate 51 which terminates in the flanges 52, which rest upon the frame 53, which is supported upon the upper extremities of the four posts 54, the lower ex- 120 tremities of the latter being supported upon the bosses 55 or their equivalent, which may be located in proximity to the base of the apparatus.

56 designates a diaphragm which has its 125 outer periphery secured between the flanges 52 and 53, it being apparent that the same bolts or fastening devices 57, which serve to hold the flanges 52 and 53 in juxtaposition, also hold the outer periphery of the dia- 130

phragm 56 in proper position. As will be understood from Figs. 3 to 6 inclusive the diaphragm 56 is provided with a series of ports or openings 58 therethrough, which are arranged in staggered order with respect to the ports or openings 59 of the plate or diaphragm 60, which is located above said diaphragm 56, as will be understood from Figs. 3 to 6 and is held in position with respect thereto by means of the bolts or fastening devices 61 and the inner or central fastening device 62, as will be best understood from Figs. 3 and 4.

63 designates arms which are secured to the ring or frame 64, the latter being secured to the diaphragm 60 and 56 by means of the fastening devices 61, before described, said arms 63 being secured to the head 65 of the connecting rods 66, which latter terminate in the eccentric strap 67, it being noted that said eccentric strap and connecting rod and head are preferably jointless or made integral or in one piece.

68 designates an eccentric, by means of which the eccentric strap and connecting rod are actuated, suitable ball bearings 69 being located between said strap and eccentric, the latter being rotated by the shaft 70, which is actuated by the motor 71. In the present instance we preferably employ an electric motor, since the same is capable of being readily coupled to electric light fixtures of usual construction. It will be understood that we employ two eccentric straps, connecting rods and their adjuncts, as will be apparent from Fig. 1, although it is evident that a single eccentric strap and connecting rod might be employed if desired. It will also be seen that we have a direct connection from each eccentric to the diaphragm 56.

Turning now to Figs. 1 to 4 inclusive, it will be seen that between the plate or member 51 and the diaphragm 56, a somewhat enlarged pumping chamber 72 is formed, such chamber extending nearly across the casing of the apparatus, the lower portion of said chamber being bounded by the upper diaphragms 73 and 74, whose outer peripheries are held in position by means of the ring or frame 75 having the fastening devices 76 passing therethrough, the center portion of said diaphragms being held in position by means of the fastening device 77, the lower diaphragm 73 being provided with the ports or perforations 78, which are arranged in staggered order with respect to the ports or perforations 79 of the upper diaphragm, as will be clearly apparent. It will be understood that areas of the passages 47 and 48 and the staggered ports 79 and 78, the chamber 72 and the staggered ports 59 and 58 and the area of the pressure chamber 50 are so proportioned and correlated with respect to each other and particularly the area of the chamber 72

must be of such proper relative dimensions and proportions that there will always be a substantially uniform quantity of air forced into the pressure chamber 50 and discharged from the outlet port 80, seen in Fig. 2, as will be hereinafter explained, so that the speed of the motor will be at all times substantially uniform, no matter whether the suction hose or the like is placed against the carpet, upholstery or other fabric to be cleaned, or whether it is withdrawn therefrom and the motor is simply running free, so that the pumping apparatus is simply sucking in air at atmospheric pressure.

Our novel construction of pumping chamber with the arrangement of superimposed diaphragms having staggered and unaligned valve ports is particularly well adapted for the above functions and in operation the movement of one diaphragm relative to another is accurately timed and furnishes a properly proportioned flow of air to or from the pumping chamber, the parts may be accurately assembled, the adjustments are simple, and the movements have a fixed relation to each other, while displacement of any of the valve structures and their adjuncts is practically a remote occurrence.

The operation is as follows:—The parts are first placed in operative condition appearing assembled as seen in Fig. 1, and the current can then be admitted to the motor. In Figs. 1 and 2 the diaphragm 56 and its adjuncts are seen in the lowest positions they may assume and upon the rotation of the eccentrics 68 it will be evident that the parts will rapidly in succession assume the appearance seen in Figs. 3 and 4, it being apparent that as the connecting rods 66 move upwardly they will raise the diaphragm 56 into the position seen in Fig. 3, whereupon the air in the chamber 72 will be compressed and will cause the diaphragms 73 and 74 and 56 to assume the positions seen in Fig. 3, whereupon the air will pass in the direction of the arrows seen in said Fig. 3 downwardly into the pressure chamber 50 and thence through the opening 80, seen in Fig. 2, to the atmosphere. It will be apparent that in our novel construction, the chamber 72 is designed so that there is a considerable clearance area whereby the maximum vacuum will be automatically limited in a similar manner to that already described and claimed in our application filed May 3, 1909, Serial No. 493,724. A further rotation of the eccentric 68 will cause the descent of the connecting rods 66, whereupon the diaphragms 56 and 60 will assume the positions seen in Fig. 4 and diaphragm 73 will also assume the position seen in said Fig. 4, whereupon the air will be drawn in through the staggered ports 79 and 78 from the space above them into the pumping chamber 72, it being understood

that as the diaphragm 56 moves from the position seen in Fig. 3 to the position seen in Fig. 4, the parts assume the position seen in said Fig. 4 by reason of the accumulation  
5 of pressure in the pressure chamber 50, as will be apparent to those skilled in the art.

In practice, motors of the character employed in our construction run at a very rapid rate or approximately fifteen hundred  
10 to two thousand revolutions per minute, so that it can be seen that the rapid reciprocations of the diaphragm 56 will, when the chambers 72 and 50 are properly proportioned with respect to each other, cause a  
15 sufficient body of air to be at all times contained or compressed in said chambers, so that the motor will not race, but will run at all times at substantially a uniform speed irrespective of whether the suction nozzle 32  
20 is in or out of contact with the carpet, upholstery or other fabric to be cleaned. We have found in practice that the most satisfactory results are obtained from the employment of a motor actuating two cranks  
25 or eccentrics, each having a connecting rod connected at one end to or actuated by one eccentric, while the opposite end of each of said connecting rods is rigidly secured to an arm or head, as 65, attached to the diaphragm 56, the latter being secured in its  
30 outer periphery to a suitable fixed point and said diaphragm serving to actuate or co-act in conjunction with suitable vacuum creating devices.

35 To obtain access to the interior for the purpose of removing, cleaning or changing the inner dust bag 26, it is only necessary to loosen the nuts 13, after which the bolts 12 can be turned downwardly and the top 18  
40 removed, whereupon the inner bag 26 can be removed and cleaned, and then replaced, all in a few moments' time. The object in employing two dust bags is to insure a thorough filtering of the air before it reaches the  
45 pumping chamber, the outer dust bag 39 not requiring to be removed as frequently as the inner one, as is evident. When it is desired to have access to the lower portion of the apparatus, it is only necessary to loosen  
50 the nuts 16, whereupon the casing 9 and its adjuncts can be readily and quickly removed from the base 2, and the motor 71, diaphragm 56 and its adjuncts are readily accessible.

55 In a contemporaneously pending application, Serial No. 501,098, we have shown and described a vacuum cleaning apparatus wherein we have claimed a machine similar  
60 to that shown in this case, considered with reference to the general features of the combination of elements having especial reference to the relative arrangement of vacuum chamber, pressure chamber, motor and  
65 pumping mechanism, while in the present case the claims are directed particularly to

our novel feature of valve mechanism, embodying among other things, diaphragms having ports therein, and said pumping mechanism being provided with a flexible diaphragm, forming part of the wall of said  
70 pressure and pumping chambers. We have also claimed herein a device wherein the motor and pump are preferably secured to each other and detachable from the inclosing casing, whereby said motor and pump may  
75 be bodily removed from the outer casing as a unit. So far as we are aware, we are the first to employ the above mentioned devices and to the structural features claimed in our co-pending application aforesaid, we  
80 herein make no claim.

In practice we prefer to provide the casing 9 with side handles and rollers or casters so as to enable the apparatus to be readily removed from one room or apart-  
85 ment to another.

The principal function of the apertured plate 43 is to form a support for the outer dust bag, said plate, the wings 45 and the plate 44 being readily removed from the  
90 ring 46.

It will be apparent that various changes may be made by those skilled in the art in the manner of assembling the casing, the dust separating devices, the valvular devices  
95 and their adjuncts without departing from the spirit of our invention and we do not therefore desire to be limited in every instance to the exact construction herein shown and described.  
100

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a vacuum pump, the combination with a casing containing a vacuum reservoir  
105 provided with an inlet port, a pressure reservoir provided with an outlet port, a pumping chamber between the said reservoirs and provided with an inlet opening, a flexible diaphragm forming one side of said pump-  
110 ing chamber and provided with a plurality of openings, a diaphragm having a plurality of openings therein mounted in said inlet opening, means to control the opening and closing of both said openings, of pumping  
115 mechanism cooperating with said pumping chamber, a motor located within said casing, and driving connections between said motor and said pumping mechanism.

2. In a vacuum pump, the combination  
120 with a casing containing a vacuum reservoir provided with an inlet port, a pressure reservoir provided with an outlet port, a pumping chamber between the said reservoirs and provided with an inlet opening, a flexible  
125 diaphragm forming one side of said pumping chamber and provided with a plurality of openings, a second diaphragm secured thereto and having openings therein in staggered relation to said flexible diaphragm  
130

openings, a diaphragm located in said inlet opening and provided with a plurality of openings, means to control the opening and closing of said inlet diaphragm openings, of pumping mechanism cooperating with said pumping chamber, a motor located within said casing, and driving connections between said motor and said pumping mechanism.

10 3. In a vacuum pump, the combination with a casing containing a vacuum reservoir provided with an inlet port, a pressure reservoir provided with an outlet port, a pump-  
15 ing chamber between the said reservoirs and provided with an inlet opening, a flexible diaphragm forming one side of said pump- ing chamber and provided with a plurality of openings, a perforated diaphragm se-  
20 cured to said flexible diaphragm, the perforations and openings of said diaphragms being arranged in staggered relation, a plu-  
25 rality of diaphragms in said inlet opening and having openings therein in relative staggered relation, of pumping mechanism cooperating with said pumping chamber, a  
motor located within said casing, and driv- ing connections between said motor and said pumping mechanism.

4. In a vacuum pump, the combination  
30 with a casing containing a vacuum reser-  
voir provided with an inlet port, a pressure reservoir provided with an outlet port, a  
pumping chamber between the said reser-  
35 voirs and provided with an inlet opening, a plurality of superimposed diaphragms lo-  
cated in said inlet opening, each provided with a plurality of openings relatively stag-  
40 gered, a ring securing said diaphragms to said pumping chamber, a fastening device  
securing said diaphragms together, a sec-  
ond set of diaphragms controlling the out-  
let from said pumping chamber, each of  
said diaphragms having a plurality of open-  
45 ings therein arranged in relatively stag-  
gered relation, of pumping mechanism co-  
operating with said pumping chamber, a  
motor located within said casing, and driv-  
ing connections between said motor and said  
pumping mechanism.

50 5. In a vacuum pump, a pulsation cham-  
ber comprising a casing, a flexible member  
secured at its outer edges within said cas-  
ing and provided with a plurality of open-  
55 ings, a substantially rigid diaphragm se-  
cured to said flexible member and having a  
plurality of openings therein in staggered  
relation to said first mentioned openings,  
and means to reciprocate said flexible mem-  
ber.

60 6. In a vacuum pump, a pulsation cham-  
ber comprising a casing, a flexible member  
secured at its outer periphery within said

casing and provided with a plurality of  
openings, a diaphragm secured to said flexi- 65  
ble member and having a plurality of open-  
ings therein in staggered relation to said  
first mentioned openings, means for pre-  
venting the relative movement of the central  
portion of said flexible member and said  
diaphragm, means to reciprocate said flexi- 70  
ble member, the opposite portion of said  
pulsation chamber having an inlet therein,  
and valve mechanism controlling said inlet.

7. In a vacuum pump, a pulsation cham-  
ber comprising a casing, a flexible member 75  
carried by said casing and closing one side  
thereof and provided with a plurality of  
openings, a substantially rigid diaphragm  
secured to said flexible member and having  
a plurality of openings therein in stag- 80  
gered relation to said first mentioned open-  
ings, means for preventing the relative  
movement of the central portion of said  
flexible member and diaphragm, means to  
reciprocate said flexible member, the oppo- 85  
site side of said casing being provided with  
an inlet opening, a substantially rigid aper-  
tured diaphragm covering said opening, an  
apertured flexible member having its outer  
periphery fixedly supported in proximity 90  
to the last named diaphragm, the apertures  
in said last named diaphragm and last  
named flexible member being arranged in  
relatively staggered relation, and devices for  
preventing the relative movement of the 95  
central portion of said last named apertured  
flexible member and said last named dia-  
phragm.

8. In a vacuum pump, the combination  
of an inclosing casing containing a vacuum 100  
reservoir provided with an inlet port, a  
pressure reservoir provided with an outlet  
port, a pump casing between the said res-  
ervoirs and provided with a pumping cham-  
ber having an inlet opening, a flexible dia- 105  
phragm forming one side of said pumping  
chamber and provided with a discharge  
opening, means for controlling the opening  
and closing of the pumping chamber inlet  
and the outlet carried by the flexible dia- 110  
phragm, a pumping mechanism cooperating  
with said pumping chamber, a motor  
located within said casing, driving connec-  
tions between said motor and said pumping  
mechanism, and said motor and pump cas- 115  
ing being secured to each other and detach-  
able from the inclosing casing, whereby the  
motor and pump casing may be bodily re-  
moved from the inclosing casing as a unit.

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