

June 7, 1955

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2,709,949

MACHINES FOR TREATING PAPER-MAKING MATERIAL

Filed Dec. 16, 1952

3 Sheets-Sheet 2

FIG. 3

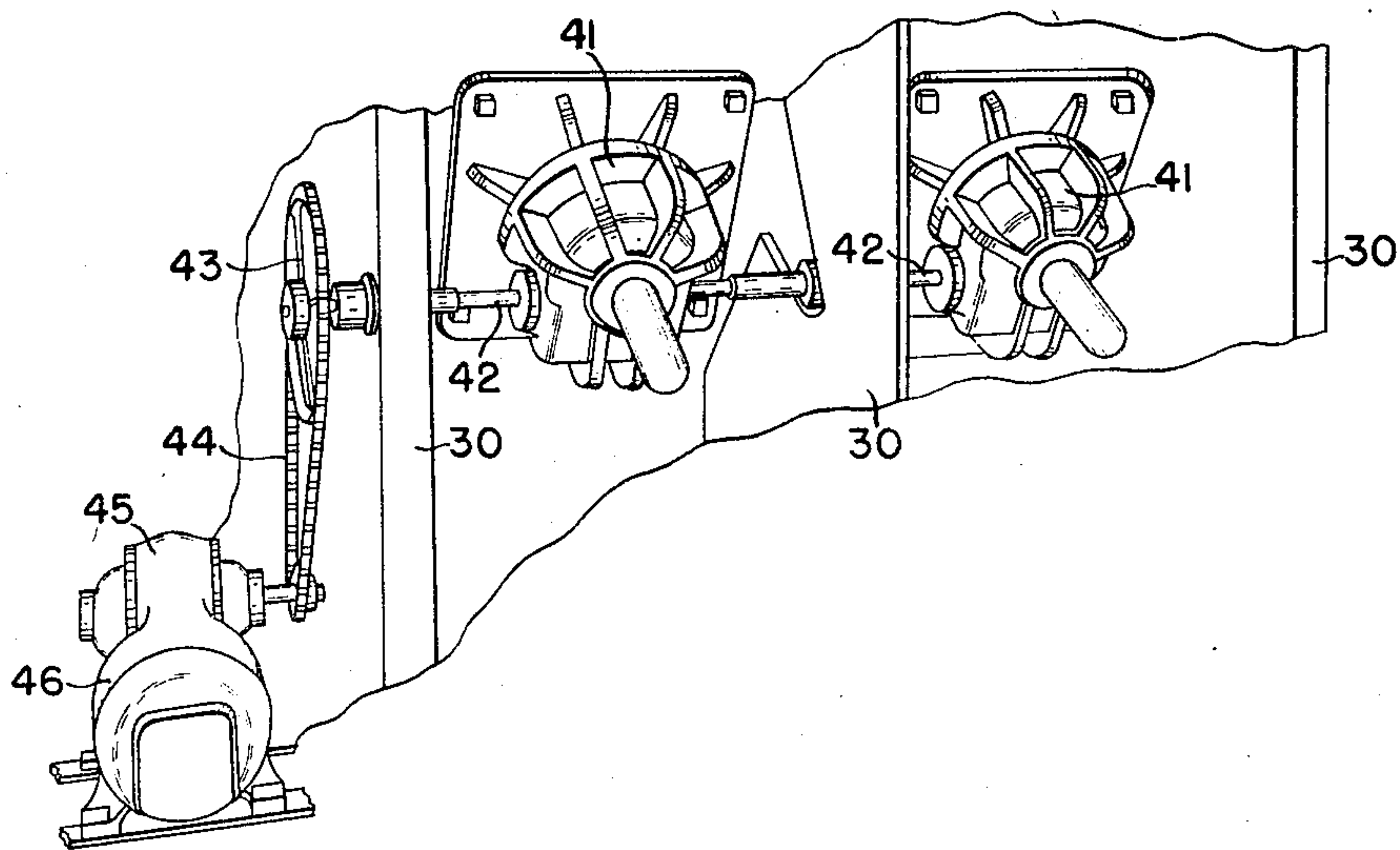
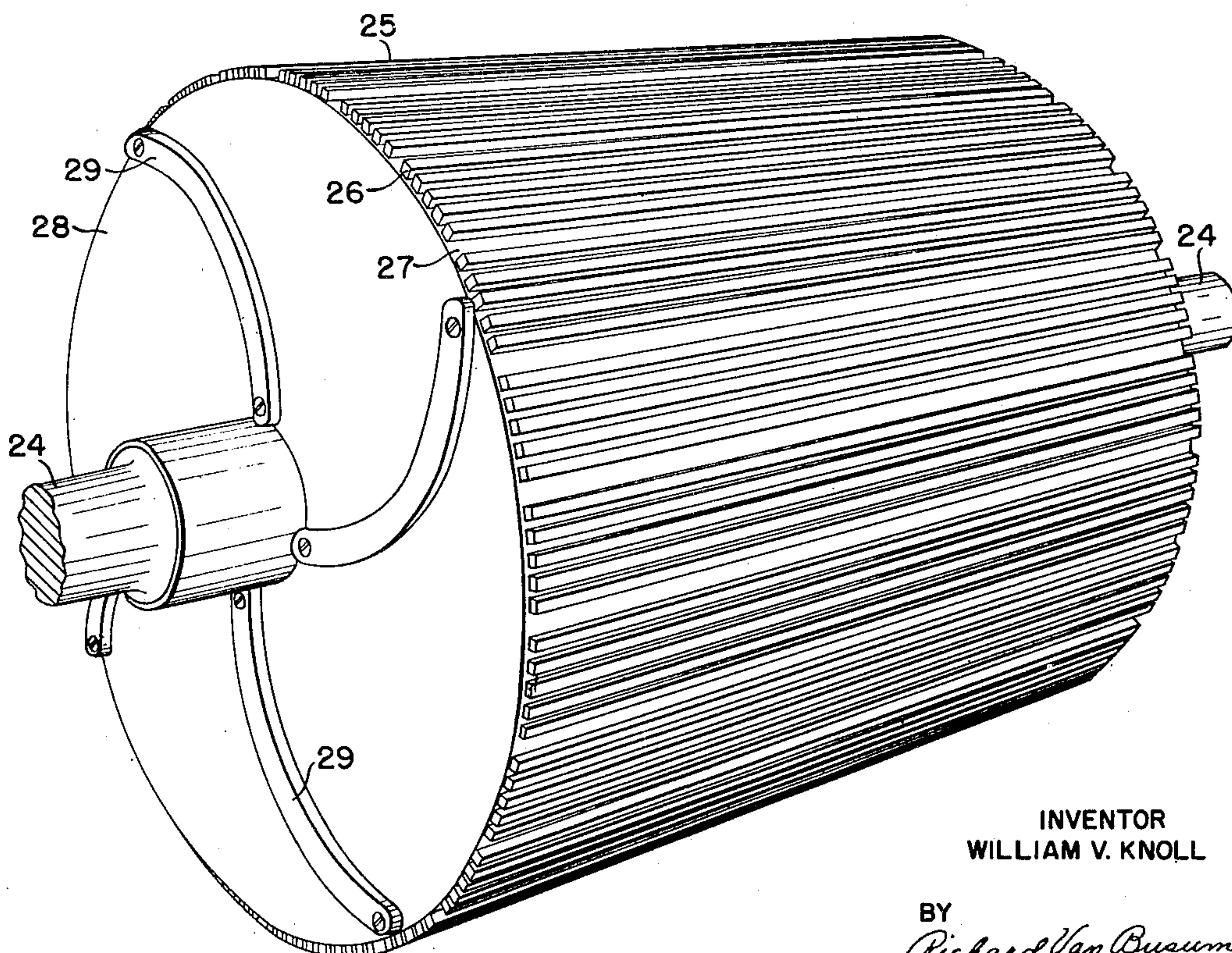


FIG. 4



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FIG. 5

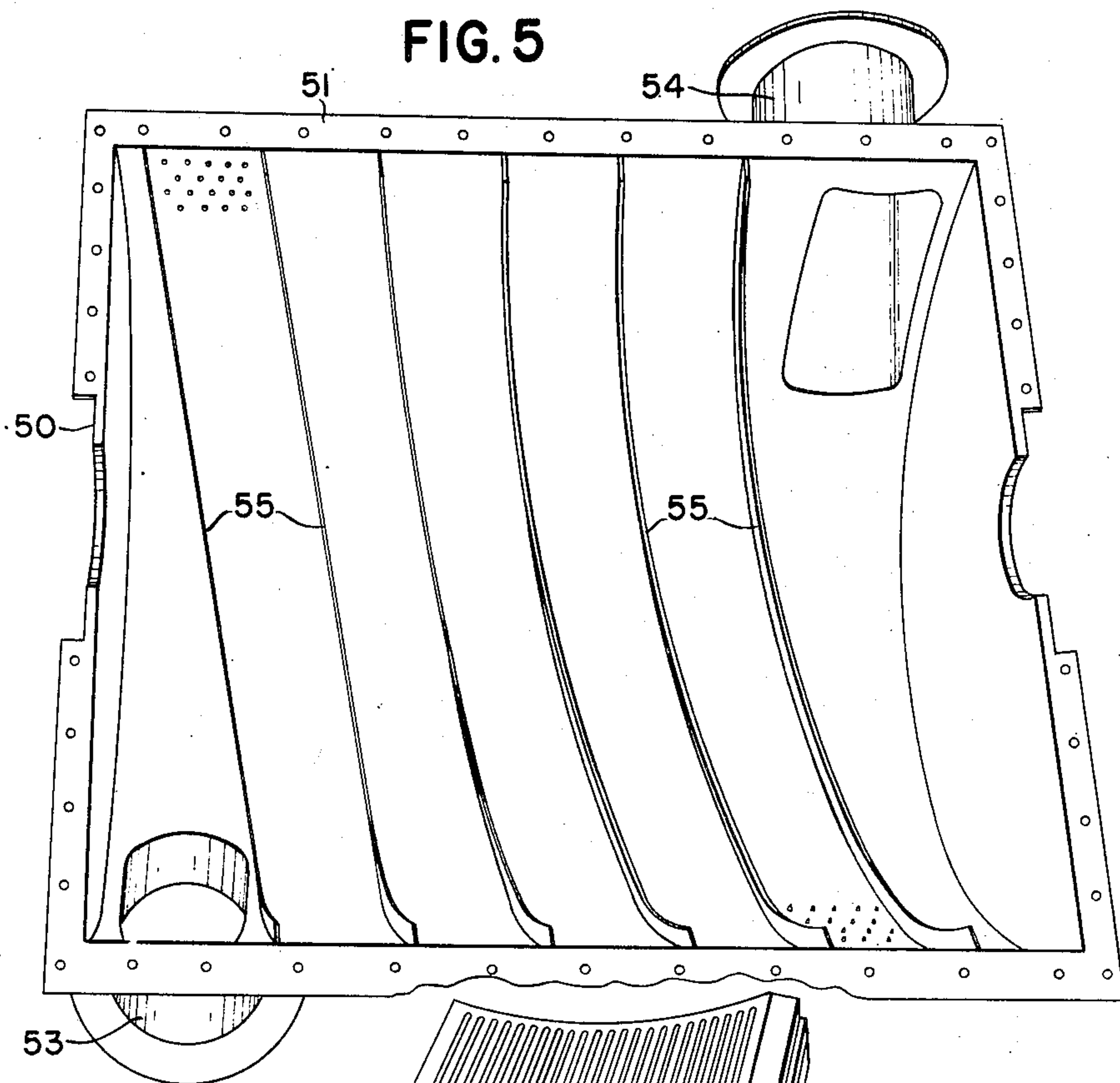


FIG. 6

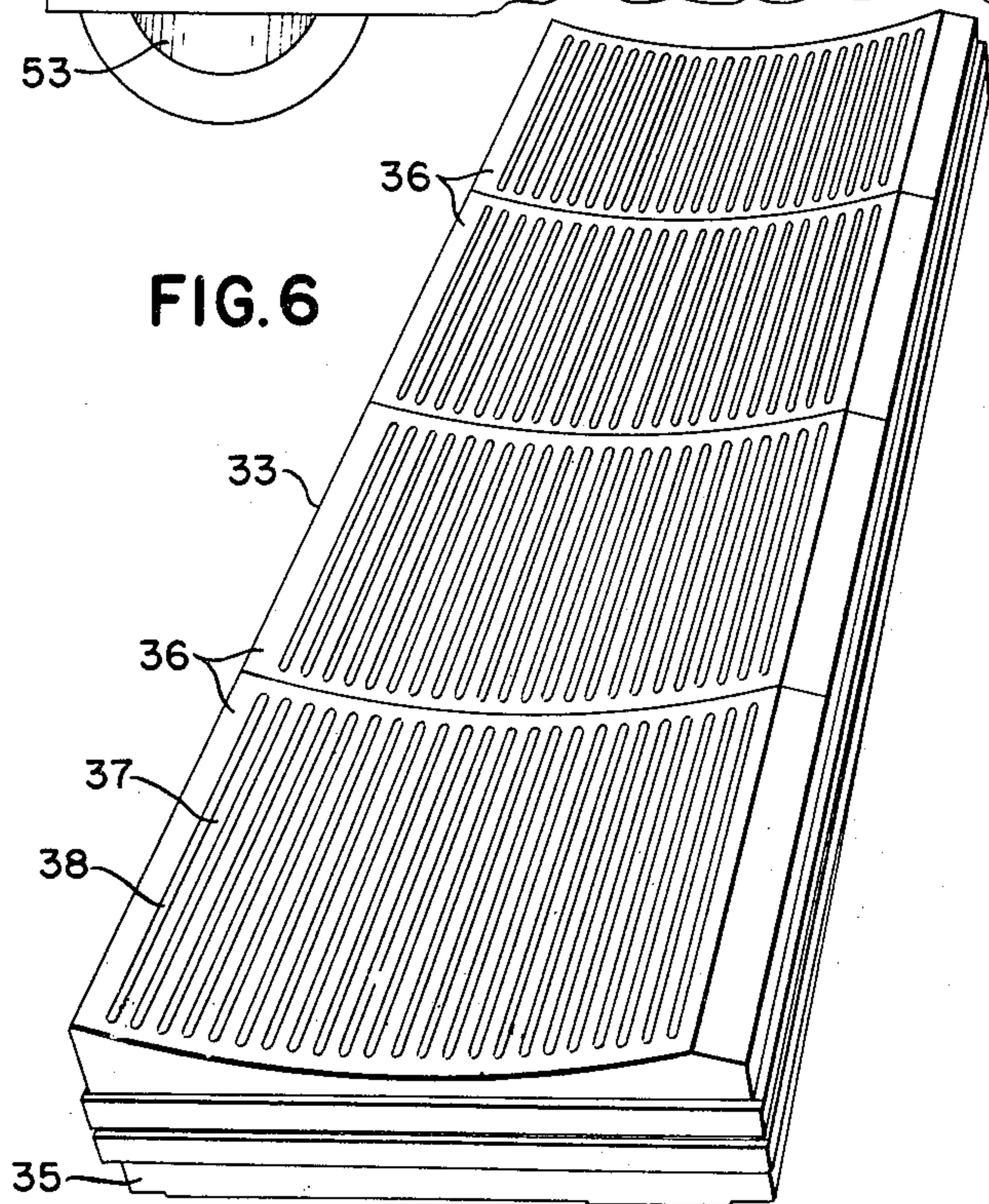
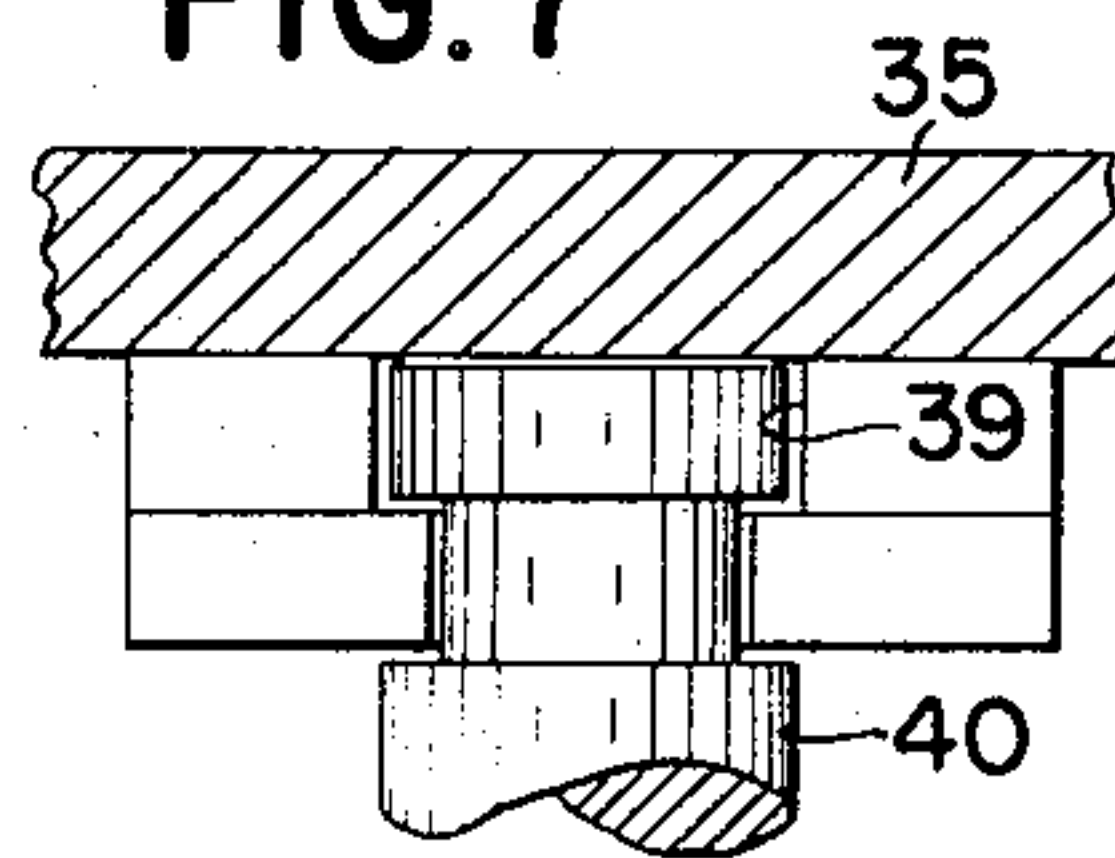


FIG. 7



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MACHINES FOR TREATING PAPER-MAKING MATERIAL

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4 Claims. (Cl. 92—22)

This invention relates to machines for pulping and/or refining paper-making material, and is particularly directed to improvements in continuously operating machines for use in treating paper-making material.

The general object of the present invention is the provision of an improved machine for the continuous pulping or refining of paper-making material.

Another object is to provide means to cause the paper-making material to circulate in a comparatively narrow spiral or helical path through the machine to obtain a more thorough treatment of said material.

Still another object is the provision of a plurality of adjustable bed plates to facilitate the treatment of the paper-making material.

A further object is to supply an improved type of beater roll device for coacting with the adjustable bed plates to more thoroughly treat the fibers of the paper-making material.

Another object is the provision of improved means to automatically adjust and maintain the bed plates in proper working relationship to the periphery of the beater roll at all times, without actual surface contact of said plates and said beater roll.

A further object of the present invention is the provision of means adjacent to the bed plate to separate and spread the fibers of the paper-making material as it moves from one bed plate to the next, to obtain more thorough treatment of said fibers.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, a preferred form or embodiment of which is hereinafter described with reference to the drawings which accompany and form a part of this specification.

In the drawings:

Fig. 1 is a perspective view of the complete machine with a portion of the hood or cover broken away to show the beater roll.

Fig. 2 is a fragmentary view of the lower portion of the machine, showing in particular the arrangement of the adjustable bed plates.

Fig. 3 is a fragmentary perspective view of one end of the machine, showing the adjusting mechanism for the bed plates.

Fig. 4 is a perspective view of the beater roll used in the present machine.

Fig. 5 is a view of the inside of the hood or cover, showing the spiral or helical guide vanes for guiding the paper-making material in a comparatively narrow spiral path around the periphery of the beater roll.

Fig. 6 is a perspective view of one of the bed plates.

Fig. 7 is a detail view showing the manner in which the bed plates are connected to their adjusting mechanisms.

Description

The present invention is directed to an improved and versatile machine for treating paper-making material, to

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properly reduce and refine the fibers thereof for use in making paper of different grades and qualities.

In contradistinction to the usual batch type of machine, the present machine is arranged for the continuous treatment of paper-making material, and if desired, each machine may be used singly for this purpose, or in batteries of two, three, or more connected in series, in which arrangement the material passes through one machine to the next, and so on, to obtain the required refinement of the fibers of the paper-making material.

Where there is a demand for a continuous supply of a large quantity of paper-making material, the machines may be used in parallel batteries of two or more machines; or where an extended degree of treatment of the material is required, several batteries of machines, arranged in series, as explained above, may be employed for obtaining this result.

The unique construction of the machine and the operating characteristics thereof makes for a marked saving in power requirements to operate the machine, which in some cases may amount to between 30% and 50% when comparing this continuously operating machine with the conventional continuous and batch type pulp beaters. One of the reasons for the saving in power is that no power is required to circulate the paper-making material within and through the machine, and another, and perhaps more important reason, is that there is no actual contact of the metal treating surfaces, as is necessary in most conventional machines, and this results in a more uniform and thorough treatment of the fibers of the paper-making material without unnecessarily shortening and deforming said fibers, but instead gives them a true brushing, and thus produces material having all the necessary and desirable characteristics for making paper of most any grade or quality.

Speaking in general terms, the improved machine comprises a cylindrical beater roll of unique construction, rotatably supported on anti-friction bearings, the upper half of the beater roll being enclosed in a close-fitting hood or cover fabricated of suitable material, such as stainless steel, for example, and having a plurality of equally spaced spiral or helical vanes, which barely clear the accurately ground periphery of the beater roll and act to guide the paper-making material in a long, continuous and substantially narrow spiral path around the periphery of said beater roll from one end of the machine to the other.

The beater roll has a plurality of closely spaced horizontal ridges in its periphery, which coact with similar ridges formed on the arcuate working surface of the three separately adjustable bed plates mounted in the machine opposite the lower half of the beater roll. Each of the three bed plates is provided with automatically controlled means for adjusting the ridged working surfaces thereof in relation to the corresponding surface of the beater roll, and the desired spacing between said surfaces is constantly maintained at all times. As previously stated, there is never any actual contact of the metal treating surfaces and the bed plates may be arranged to maintain a progressively spaced relationship to the periphery of the beater roll to obtain a gradual reduction of the fibers of the paper-making material as it passes through the machine.

As the paper-making material enters one end of the machine, it passes in a comparatively narrow path under the beater roll, is treated between the working surfaces of said roll and the bed plates. As the material moves upwardly it is guided in a narrow spiral path by the spaced spiral vanes, again between the working or treating surfaces of the beater roll and the bed plates, and this treatment is repeated over and over again as the material continues to move in a substantially narrow spiral path

from the inlet end of the machine to the outlet or discharge end of the machine.

It is to be noted that the close-fitting housing or hood around the beater roll, the horizontal ridges in said beater roll and the close fitting spiral guide vanes, combine to obtain a centrifugal pumping action which draws the material into and circulates it through the machine without the assistance of external means for applying pressure to said material. Moreover, the horizontal ridges in the beater roll and the bed plates coact in such a fashion as to continuously compress and release the paper-making material in a sort of squeezing action that materially assists in the production of fibers having all the desirable characteristics for use in paper-making.

The mechanism of the machine, described in general above, which forms a pertinent part of the present invention, will be described in detail in the ensuing pages.

Directing attention to Figs. 1, 2 and 3, the machine which is chosen to illustrate the present invention comprises a base 20, composed of suitable material and having secured thereto the lower ends of front and rearward pairs of uprights 21 and 22, only the front pair being here shown. Each pair of uprights supports an anti-friction bearing 23, arranged to receive and rotatably support opposite ends of a shaft 24 for a cylindrical beater roll 25 formed of four similar drum members, see also Fig. 4, secured to corresponding spider elements (not shown) in turn secured on the shaft 24. The drum members may be removed one at a time from their corresponding spiders, for replacement or repair, without the necessity of removing the spiders from the shaft, and the manner in which the drum members and spiders are arranged, two of said drum members may be disassembled from each end of the shaft. The drum members have alternate horizontal ridges 26 and grooves 27, formed on their peripheries, which match, as here shown, when said drum members are properly assembled into a beater roll unit.

End plates 28 (Fig. 4), only one shown, secured to the outer faces of the end drum members, close or seal the interior of the cylindrical beater roll against the entrance of the paper-making material. Each end plate has secured to the outer face thereof a series of curved agitators 29, which assist in circulating the paper-making material and thus preventing it from becoming static at the ends of the machine.

For a more detailed description of the beater roll mechanism, reference may be had to the co-pending application for Letters Patent of the United States, Serial No. 155,635 filed April 13, 1950, by William V. Knoll, now Patent No. 2,661,665, which provides a complete disclosure of the beater roll mechanism.

Referring to Figs. 1 and 2, secured to the base 20 at their lower ends are three righthand vertical supporting plates 30 and three similar lefthand plates 31, which support three similar bed plate castings 32, only two here shown, having recesses 34 arranged to receive three corresponding bed plates 33. The bed plates 33 fit snugly but freely in the corresponding recesses 34 and each of said bed plates comprises a solid bottom supporting portion 35 (Fig. 6) having secured thereto four similar sections 36 with similar curved working surfaces which coact with the periphery of the beater roll 25. The curved working surfaces of each of the sections 36 has formed thereon alternate horizontal ridges 37 and slots or depressions 38, which coact with the ridged periphery of the beater roll for reducing the fibers of the paper-making material.

The bed plates 33 (Figs. 6 and 7) are arranged for adjustment in relation to the beater roll by means of T slots 39 formed in the bottom portions 35 thereof, which are engaged by headed adjusting rods 40 (Fig. 2) there being two such rods for each bed plate, which extend through and fit freely in corresponding borings in the castings 32. The lower ends of the rods 40 enter into and are supported by corresponding housings 41 (Fig. 3), which are bolted to the bottom surface of the correspond-

ing castings 32. The rods 40 are arranged to be adjusted inwardly and outwardly by means of a gearing contained in the corresponding housing 41, said gearings for the pair of rods 40 for one bed plate 33 being connected to a common shaft 42, which extends through the corresponding housings and is further supported by the corresponding vertical plates 30 or 31 (Figs. 1 and 3).

Inasmuch as the adjusting mechanism used for each pair of rods 40 is similar in every respect, it is believed that the description of one such adjusting mechanism should be sufficient.

It will be noted by referring to Fig. 3, that the shaft 42 drives the gearing for both of the rods for adjusting one bed plate in relation to the periphery of the beater roll. The lefthand or outer end of the shaft 42 has secured thereon a gear 43, connected by a chain or link belt 44 to a pinion mounted on a shaft connected to a reduction gearing mounted in a gear box 45, integral with an electric motor 46 which drives the reduction gearing.

A known type of control mechanism is employed to automatically control the operation of the motor 46 to maintain constant adjustment of the corresponding bed plate 33 in relation to the periphery of the beater roll 25. Likewise, each bed plate assembly is provided with limit control devices, to prevent movement of the bed plates under the control of the adjusting mechanism beyond the limits desired for safe operation. These limit control devices are settable to compensate for wear of the working surfaces of the bed plates and beater roll.

In operation, the bed plates 33 are adjusted for any predetermined degree of fiber treatment, the bed plate nearest the inlet side of the machine being preferably adjusted with wider spacing between its working surface and that of the beater roll, to permit the paper-making material to enter more easily. The in and out movement of each bed plate assembly is controlled through automatically operating reversible control switches, which in turn control the operation and direction of rotation of the associated motor 46 and the gearing connecting said motor to the pair of adjusting rods 40 for the corresponding bed plate assembly.

Under normal conditions of operation, once the proper manual adjustment of the bed plates 33 has been made for any predetermined extent of fiber treatment, the automatic control mechanism will maintain this adjustment until there is a change in the density of the paper-making material or a change in the quantity of such material entering the machine. When these changes occur, they are compensated for by the automatic control mechanism which alters the adjustment of the bed plates accordingly, to maintain a uniform fiber treatment. The machine is provided with a conveniently located control panel (not shown) containing the control instruments, including the necessary manual control devices, and if desired, a recording meter.

Each bed plate assembly is provided with stainless steel wearing plates and guide members to permit free adjusting movement of said bed plates without leakage of the paper-making material therearound. Between each of the bed plates 33 (Fig. 2) there is a slightly depressed flat portion 47, having a plurality of comparatively sharp inwardly extending projections which act to separate the fibers and to prevent them from accumulating in bundles as they move from one bed plate to the next. The three bed plate assemblies are enclosed by corresponding end plates 48 (Figs. 1 and 2), said end plates being secured to the outer edges of said bed plate assemblies. The end plates 48 are provided with removable covers 49, which cover inspection openings opposite the corresponding bed plates 33 and through which access may be had to said bed plates for removal or adjustment, if required.

As previously explained, the curved working surfaces of the three bed plates 33 (Fig. 2) are concentric with the periphery of the beater roll 25 (Fig. 4) and occupy a space corresponding substantially to one-half the cir-

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circumference of said beater roll. The other half of the circumference of the beater roll 25 is covered by a closely fitting hood 50 (Figs. 1 and 5) fabricated of any suitable material, such as stainless steel, for example, and having a flange 51, which is bolted securely to a flat surface 60 formed by the upper edges of the castings 32 and the end cover plates 48. A suitable gasket 52 (Fig. 1) is provided between the flange 51 of the hood 50 and the flat surface 60 to prevent leakage. Likewise proper sealing means is provided for preventing leakage around the shaft 24 (Fig. 4) of the beater roll, where it extends through the hood 50 and the end plates 48.

The hood 50 is provided with a vertical inlet nozzle 53 (Figs. 1 and 5) located near the righthand end thereof, and with a substantially horizontal outlet nozzle 54, located at the opposite or lefthand end thereof, to provide entrance and exit of the paper-making material into and out of the machine. It will be noted that the inlet nozzle 53 is provided with a suitable flanged portion for connecting said inlet nozzle to a pipe which leads to any suitable supply source, such as a vat or tank, or to a preliminary reducing or beating machine, and that the outlet nozzle is provided with a similar flange for connecting it to a pipe leading to a source of demand, such as a paper-making machine or a storage vat or tank.

Secured by welding or other suitable means to the interior of the hood 50 (Fig. 5) is a series of spiral or helical vanes 55, said vanes being equally spaced in relationship to each other and arranged helically in relationship to the axis of the beater roll 25. The arcuate inner edges of the vanes 55 fit closely to the periphery of the beater roll 25 (Fig. 1), said arcuate surfaces and the periphery of said beater roll being accurately finished by grinding, lapping, or some other suitable means, to permit accurate and close fitting of these parts without any danger of actual metal-to-metal contact.

The closely fitting hood 50 and vanes 55 coacting with the ridges 26, upon rotation of the beater roll 25, create an impelling or pumping action, which draws the paper-making material through the inlet nozzle 53 and forces said material to circulate between the periphery of said beater roll and the bed plates 33 in a substantially narrow spiral or helical path and to be finally forced out the outlet nozzle 54. This results in the fibers of said paper-making material being treated and re-treated many times, as they are compelled by the vanes 55 to pursue a helical path between the beater roll and the bed plates. The impelling and circulating action described above makes it unnecessary to apply pressure from an external source to the material to force it into and through the machine. Therefore the material may enter the inlet nozzle 53 under the influence of gravity, if desired, thus reducing to a marked degree the amount of power required for the overall treatment of the paper-making material, and combining in one efficient machine all the features needed for the proper treatment and circulation of material for making paper of various grades and qualities.

While the form of mechanism herein shown and described is admirably adapted to fulfil the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form or embodiment herein disclosed, for it is susceptible of embodiment in various forms, all coming within the scope and spirit of this invention.

What is claimed is:

1. In a machine of the character described for performing the combined functions of treating and circulating paper-making material, the combination of a cylindrical beater roll mounted for rotation on a horizontal axis in the machine, the lower portion of said beater roll being enclosed by said machine; means including a rounded hook for enclosing the upper portion of the beater roll, said hood having inlet and outlet openings therein for the paper-making material; a plurality of vanes secured to the inner surface of the hood in uniformly spaced rela-

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tionship to each other and in spiral or helical relationship to the axis of the beater roll, the inner edges of said vanes being in close proximity to the periphery of the beater roll, but not actually touching same, said hood and said vanes coacting with the beater roll upon rotation thereof to create an impelling or pumping action, which draws the paper-making material through the inlet opening and causes said material to circulate through said machine in a substantially narrow helical path, and finally through the outlet opening; and means located beneath the beater roll and coacting with the periphery thereof to treat the paper-making material as it circulates through the machine.

2. A machine for performing the combined functions of treating and circulating paper-making material, comprising in combination means for treating the fibers of the paper-making material, said means including a cylindrical beater roll mounted for rotation on a horizontal axis in the machine and having a plurality of narrow horizontal ridges on the periphery thereof, the lower half of said beater roll being enclosed by the machine proper; a rounded hood for enclosing the upper half of the beater roll, said hood having inlet and outlet openings therein for the paper-making material; and a plurality of vanes secured to the inner surface of the hood, said vanes being arranged in parallel, spaced relationship to each other and in spiral or helical relationship to the axis of the beater roll, the inner edges of said vanes being arranged in close proximity to the periphery of said beater roll, but not touching same, said hood and said vanes coacting with the ridged beater roll upon rotation thereof to create a circulating or pumping action which draws the paper-making material through the inlet opening and causes said material to circulate through said machine in a substantially narrow spiral or helical path, during which said material is treated and re-treated many times to properly reduce the fibers thereof and to discharge said paper-making material through the outlet opening after treatment of the fibers thereof is completed.

3. In a machine of the character described, for treating the fibers of paper-making material, the combination of a cylindrical beater roll mounted for rotation in the machine and having a plurality of closely spaced ridges or fins to assist in the treating and circulating of the paper-making material; means coacting with the periphery of the beater roll to treat the fibers of the paper-making material; a rounded hood closely enclosing substantially the upper half of the beater roll, said hood having inlet and outlet openings therein for the paper-making material; and a plurality of vanes secured in spaced spiral or helical relationship to each other on the inside surface of the hood, the inner edges of said vanes arranged to barely clear the periphery of the beater roll, said hood and said vanes coacting with said beater roll upon rotation thereof to create a circulating or pumping action which draws the paper-making material through the inlet opening and causes it to circulate through the machine in a substantially narrow spiral or helical path, during which circulating said material is treated and retreated many times to properly prepare the fibers thereof and to discharge said paper-making material through the outlet opening, after it is properly treated.

4. In a machine of the class described, constructed and arranged to perform the dual functions of treating and circulating paper-making material, the combination of a closed cylindrical beater roll mounted for rotation on a horizontal axis in the machine, said beater roll having a plurality of horizontal ridges on the periphery thereof; three adjustable bed plates mounted in the machine beneath the beater roll, and each having a plurality of horizontal ridges coacting with the ridges on the beater roll to treat the fibers of the paper-making material; means to maintain accurate, spaced adjustment between the bed plates and the beater roll to insure proper treatment of the fibers of the paper-making material; a hood enclosing the upper portion of the beater roll, said hood

having inlet and outlet openings therein for the paper-making material; and a plurality of helical vanes secured in evenly spaced relationship to each other on the inside surface of the hood, the inner edges of said vanes constructed and arranged to barely clear the periphery of the beater roll, whereby rotation of said beater roll creates a pumping or circulating action which draws the paper-making material through the inlet opening and causes said material to circulate through the machine in a comparatively narrow helical path or channel, and to be treated over and over again by coaction of the ridged periphery of the beater roll and the ridged bed plates and to be finally discharged through the outlet opening, after treatment is completed.

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