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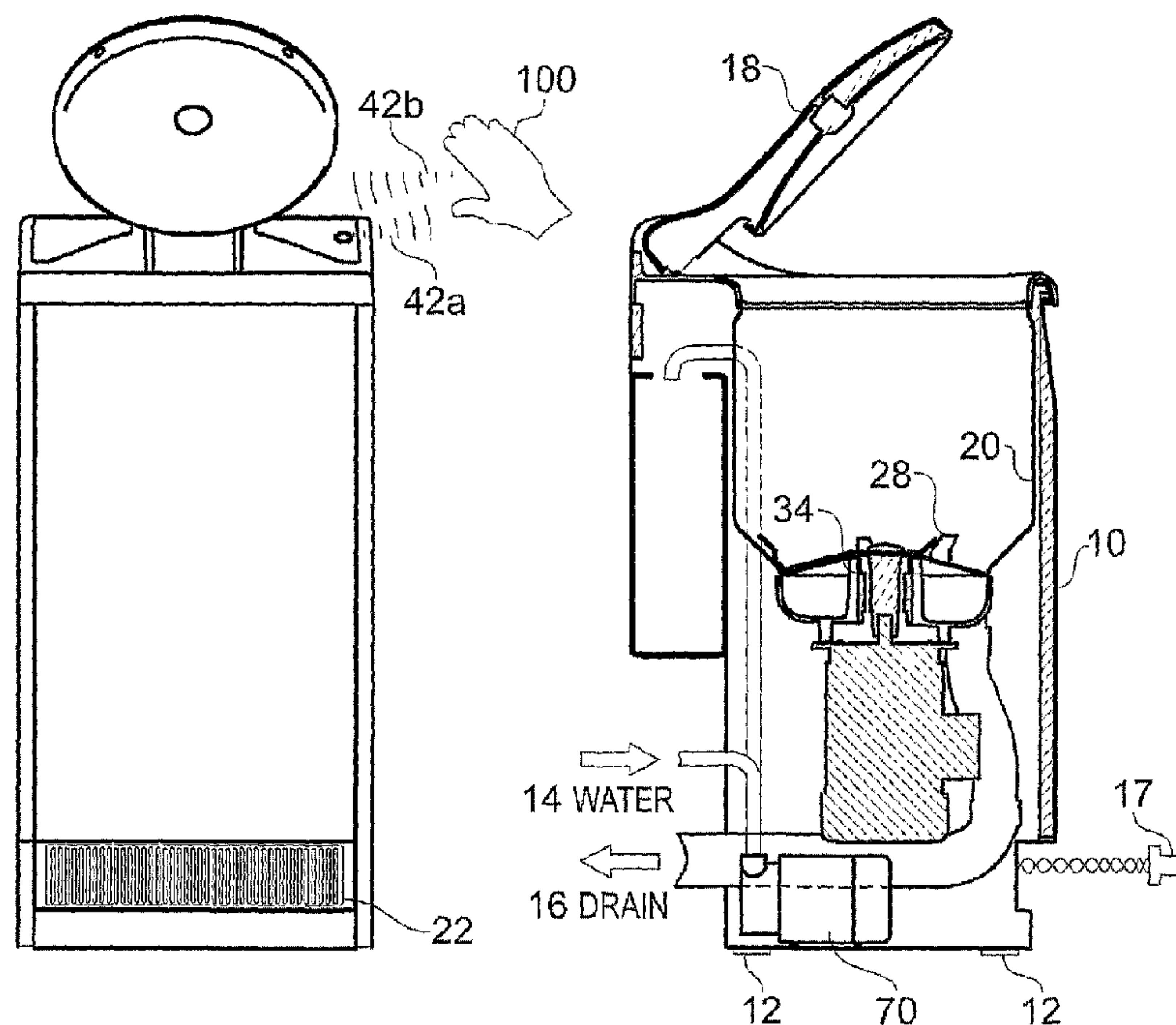
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(57) Abrégé/Abstract:

The invention relates to a macerator, of the type used for disposal of assorted or fibrous products and biological waste, typically as used in sluicerooms in hospitals or care homes. In one aspect the macerator (10) comprises a chamber (20) and lid (18), which together in use define a sealed volume for receiving items to be macerated. A chopper (28) is located in the chamber and an inlet (14) is provided for water; and a drain (16) for removal of macerated product. A means is provided for closing the lid to the chamber using a non-contact control system. Ideally the non-contact control system includes a proximity sensor, such as an infra red (IR) sensor for detecting a user or operators hand. The invention overcomes previous problems of having to close the lid by hand and thus reduces the risk of cross contamination. In another aspect an improved chopper and chopping cycle helps to reduce noise and water and energy requirements.

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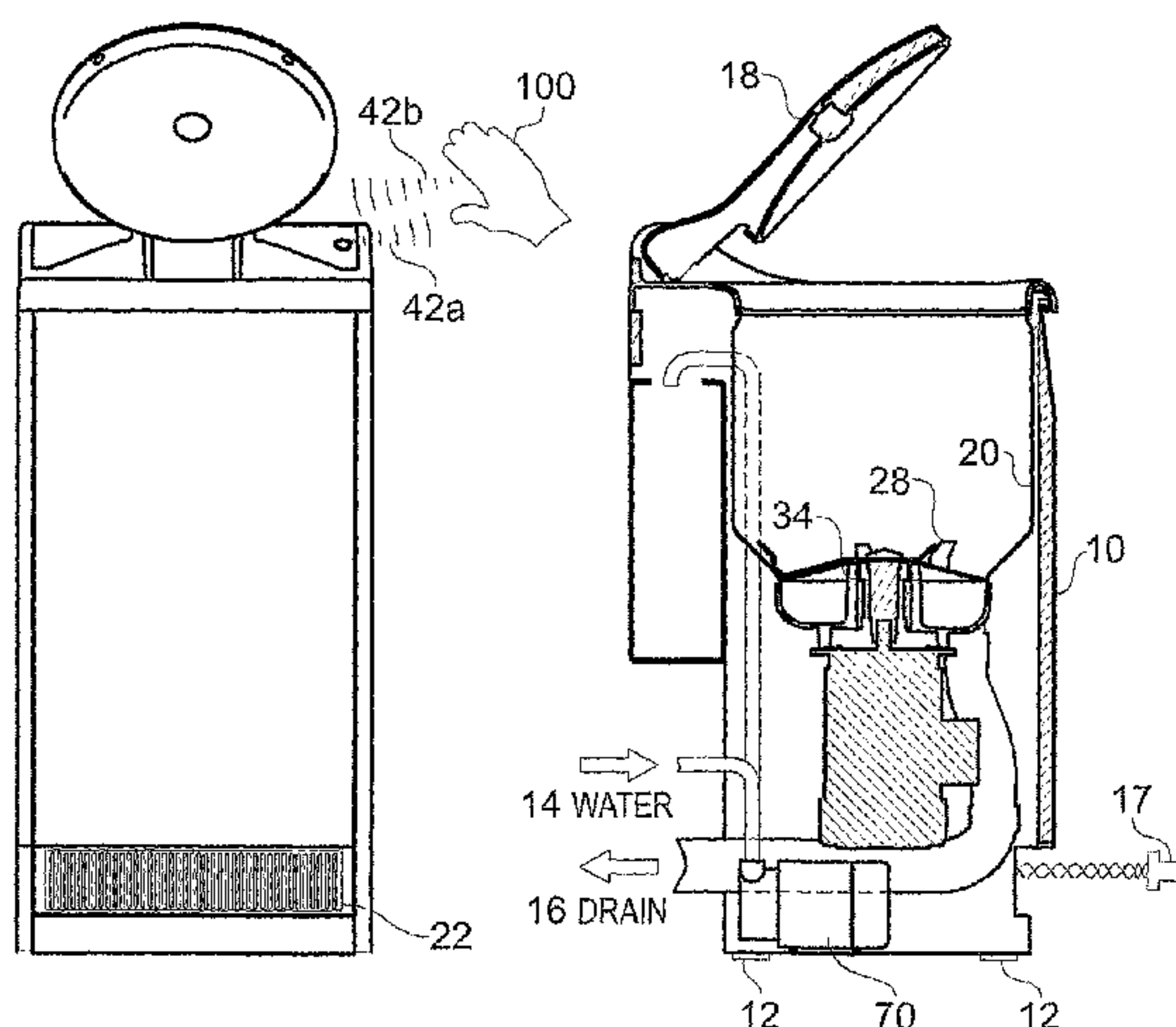


FIG. 1

(57) Abstract: The invention relates to a macerator, of the type used for disposal of assorted or fibrous products and biological waste, typically as used in sluicerooms in hospitals or care homes. In one aspect the macerator (10) comprises a chamber (20) and lid (18), which together in use define a sealed volume for receiving items to be macerated. A chopper (28) is located in the chamber and an inlet (14) is provided for water; and a drain (16) for removal of macerated product. A means is provided for closing the lid to the chamber using a non-contact control system. Ideally the non-contact control system includes a proximity sensor, such as an infra red (IR) sensor for detecting a user or operators hand. The invention overcomes previous problems of having to close the lid by hand and thus reduces the risk of cross contamination. In another aspect an improved chopper and chopping cycle helps to reduce noise and water and energy requirements.

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Title: A MaceratorField of the Invention

The present invention relates to a macerator, of the type used for disposal of assorted pulped products, such as paper, cardboard, pulped paper or similar fibrous or starch-based products and human waste. More particularly, but not exclusively, the invention relates to hygienically operated macerators for reducing human waste and paper pulp waste collectors or similar items.

Background of the Invention

In conventional flush toilets a relatively large volume of water is used to complete a flush cycle as it is required to start the siphoning and vortex action and to maintain the siphon until all waste material has been evacuated from the bowl. Although commonplace, such toilets are inefficient and ill-equipped to deal with frequent repeated use and/or large amounts of waste. In addition large bore sewage pipes are required for drainage of the waste.

In certain circumstances waste disposal facilities are required in situations that do not permit the use of the traditional types of toilet. Often large sewage pipes are not practical. In other situations disposal of larger or denser items is required. This may be in location such as sluicerooms in hospitals or care homes, where there is predominance of bedridden or geriatric patients, or in temporary, or off-shore environments, such as ships.

In addition there are situations, for example where a nursing home or hospital ward has a large number of bed-ridden residents or patients utilising disposable bedpans and urine bottles or similar. The adoption of single-use waste collectors, such as pulped paper bedpans or urine bottles, allows for a fresh collector for each use. This is inherently more hygienic in environments, where cross-contamination is a major concern. However, this entails a waste disposal system which is capable of handling an assortment of waste products including denser or more fibrous matter as well as human waste.

Increasingly designers and manufactures of domestic, commercial and industrial equipment are preoccupied with the costs of resources, which such equipment requires. In particular designers and manufactures of macerators are keen to reduce the amount of water and electricity they use.

In addition such facilities necessitate ease of use and hygienic operation. In this way the facility would ideally allow complete and simple use without contact. The process should be as quick as possible, freeing up more time for patient care. Preferably the unit should not be noisy or disruptive of a local environment typically containing sensitive persons.

Prior Art

There have been a number of previous attempts at resolving the problem of disposal of waste products, some of the most successful of which have been macerators.

A previously known macerator had a drain valve located at the bottom of a chamber containing a waste grinder, which was offset so that ground waste product flowed towards the drain.

Previous devices mixed the waste product with water to produce an effluent that was drained through the sewage system. During the operating cycle, water was typically fed continuously into a macerating chamber as the macerator motor continuously operated. Typically such devices took the form of a cylindrical chamber having a chopping mechanism arranged at the bottom, typically on the perimeters of a disc or in a concentric or annular arrangement to allow progressive reduction until the small particles were of sufficient size to allow discharge. Such devices were sometimes resource inefficient – often requiring several litres of water in a cycle - and in addition may have permitted elongate particles to pass through to a waste pipe with the risk of blocking the pipe or drain.

European Patent EP 0 347 205 B1 (WARD *et al*) discloses a macerator for reducing fibrous products, comprising a housing and agitating means rotatably mounted within the housing for reducing the products.

In the preferred embodiment approximately 12 litres of water was pumped into the chamber before commencement of the maceration cycle. A chopping blade is adapted to follow the contour of the chamber wall. After disintegration of the waste into relatively large pieces, the subsequent reduction in size of the pieces was effected mainly by impact and turbulence.

The macerator worked by relying on high hydraulic shear forces between the agitating blade and the internal wall of the housing on liquid within the housing. The drain valve was then opened and additional water was used to rinse the chamber.

European Patent EP-B1-1 348 816 (SHEPHERD) describes a waste disposal apparatus which includes a macerating chamber, water inlet and waste outlet, and a first and second drive arranged to independently drive a water pump and macerator and to interrupt the water flow while the macerator drive is driving the macerator.

The apparatus described includes: a control system to restrain the flow of water into the chamber. In the embodiment described flow of water was interrupted after a predetermined interval to allow macerated waste to drain away, before reintroduction of water into the chamber and in preference to continuing to sluice the largely emptied chamber. The separate nature of the drives, and the interruption of continuous water flow, attempted to reduce water usage.

UK Patent Application_GB-A-2 445 036 (Vernacare Limited), which has an earlier filing date than the present Application and was published on 25 June 2008, describes and claims a macerator with a housing, an opening, a releasably securable closure and a contactless switch for controlling a function of the macerator. The preferred embodiment of the contactless

switch is a foot-controlled infra-red switch, which is described as reducing cross infection as this removes the need for the user to operate the contactless switch without the use of hands.

The prior art thus discloses devices that provide varying methods of macerating or disintegrating assorted waste with relative speed, but not necessarily great efficiency of energy or water usage per load. In addition because many of the aforementioned devices relied on the use of water to reduce the waste, they were frequently noisy due to the volume in movement of water and waste. Furthermore all the aforementioned prior art devices were reliant on contact from the user to activate, open or close the macerating chamber.

It is an object of the present invention to provide a speedy efficient and relatively quiet device that is fully capable of being used hygienically.

Summary of the Invention

According to a first aspect of the present invention there is provided a macerator comprising: a chamber and lid, which together in use define a sealed volume for receiving items to be macerated; a chopper which is located in the chamber; an inlet for water; and a drain for removal of macerated product characterised in that means is provided for closing the lid to the chamber using a non-contact control system.

An alternative embodiment, the opening means includes a foot switch which when activated by a users foot triggers the release mechanism on the macerator so as to open the lid.

Thus in accordance with another aspect of the present invention, there is provided a macerator comprising: a chamber and lid, which together in use define a sealed volume for receiving items to be macerated; a chopper which is located in the chamber; an inlet for water; and a drain for removal of

macerated product, characterised in that a foot operated non-contact control system is provided for closing the lid to the chamber.

Preferably the non-contact control system includes a proximity sensor, such as a capacitive sensor or an infra red (IR) sensor for detecting a user or operators hand or foot. The IR proximity sensor is ideally positioned so that it is at the rear of the macerator, typically on a control panel and facing towards the front of the macerator.

The IR sensor ideally has a relatively narrow operating range of between 0.05m and 0.2m so that lid closure is a deliberate action and is not inadvertently triggered by a casual bystander.

A logic circuit may be included and configured to close the lid on receipt of a specific pattern or sequence of signals, for example a user may have to wave their hand across the sensor a predetermined number of times and/or confirm a command signal and/or maintain their hand in a preferred vicinity for a given time interval. It will be appreciated that the specific pattern or sequence of signals for controlling closure of the lid may be varied.

Sensors are arranged to detect closure of the lid and to lock the lid into position. Ideally solenoid bolts, or alternatively reed switches, are triggered as soon as a lid closure signal is detected by the sensors.

Alternatively the non-contact control system may include a voice recognition system, which is capable of identifying a user's voice; or some other feature, such as an iris and/or an audible control signal, for example, 'close lid'.

In a yet further embodiment the non-contact control system may be adapted to read an optical badge, for example worn by a user or adapted to respond to a short range radio frequency (RF) identity (ID) tag.

What is important is that the non-contact control system is configured to operate on command of a control signal is that it enables a user to close the

lid of the macerator without contacting any switch or part of the machine with their hands, thereby reducing the risk of cross infection and maintaining the macerator in as clean as state as possible. An advantage with this is that the improved macerator reduces the risk of leaving any soiled substances or contaminants in contact with the closing switch, which would otherwise have been able to be touched by a subsequent user or users and which might have led to possible cross infection, for example to a different ward.

Preferably an opening mechanism is provided for enabling the lid of the chamber to be opened without contact by a user's hand. Such an opening mechanism is ideally a foot pedal and permits opening of the lid, for example whilst a user is carrying a stack of soiled items for maceration.

However, it is within the scope of the invention that the opening mechanisms are also operated by way of a similar remote switch such as, for example, an IR or other optical switch; it being appreciated that the lid will only be permitted to open once the macerator has concluded the cleaning cycle.

Advantageously at least one safety lock ensures lid opening is only possible when the machine has completed the cycle and stopped. A safety interval of between a few seconds and one or two minutes may be set, after which safety interval, the lid opens.

Optionally an override may be provide, which is typically located at the rear of the macerator, which permits an operator or maintenance engineer to open the lid in the event of a fault or lid jamming.

According to a third aspect of the present invention, there is provided a method of macerating a pulp paper product comprising the steps of: introducing the product into a chamber; sealing the chamber with a lid; chopping the product for a predetermined period of time using a rotating blade when at least part of the product is in substantially dry state; introducing a predetermined volume of water, whilst the chopper continues to chop the

product; and draining the chopped waste product from the chamber whilst the water supply continues to rinse the chamber.

Preferably the initial chopping interval is less than 30 seconds and ideally less than 20 seconds and preferably around 10 seconds in duration. This initial period of chopping – herein referred to as ‘dry chopping’ – typically takes places using a chopper speed of around 1000 to 1500 revolutions per minute (RPM).

The chamber volume is typically at least 0.25 m³ and is capable of receiving up to eight soiled waste pulp products.

Ideally less than 20 litres of water are introduced. Preferably between 18 to 20 litres of water is introduced and more preferably between 16 to 18 litres of water is introduced. Most preferably less than 16 litres of water is introduced.

Despite appearing to use a relatively large volume of water, compared with for example the above mentioned prior art systems, it is appreciated that the present invention in fact pulps more products and is therefore more efficient when comparing volume of water per product macerated, than many prior art systems. An advantage of this aspect of the invention therefore is that it not only speeds up the maceration process, but also requires less water and is more environmentally friendly than existing macerators having comparable loads.

It is believed that the improved maceration cycle is faster and requires less water because of the initial ‘dry’ chopping process, which disintegrates paper/pulped product into relatively small fragments, thereby greatly increasing the surface area available for absorbing water. This initial ‘dry’ chopping phase is therefore considered important for the rapid absorption of water. Once water has been absorbed by the chopped pieces of pulp product, the resultant mass is of a consistency suitable for draining, further water serves to rinse the chamber and assists with the removal of the water soaked material as well as the waste.

At or near to the end of the cycle the rotating chopper ideally is switched off and further introduction of water serves simply to rinse out the inner surface of the drum or chamber.

At this stage an optional disinfectant and/or air freshener may also be introduced.

This aspect of the invention leads to a faster chopping cycle, thereby requiring less energy for the operation of the electrical components, pumps and motor that drives the chopper, as well requiring less water. Therefore the macerator not only reduces the amount paid for electricity but also reduces water meter charges, as well as producing less waste. It is therefore apparent that the improvements to the chopping cycle not only save money but are more environmentally friendly.

It is appreciated that the first and second aspects of the invention may be combined into a single macerator in which both aspects are present.

According to a fourth aspect of the invention there is provided an improved chopping blade for use in a macerator comprising: three primary blades and three secondary blades, the axis of each blade lying in a plane and being disposed at substantially 60° one to another, whereby primary and secondary blades are arranged in alternating fashion one to another.

Ideally the length of the primary blade is between 5 - 25cm and the secondary blade is between 1 - 7cm. While preferably the length of the primary blade is between 10 - 15 cm and the length of the secondary blade is between 3 - 6 cm.

Typically the widths of the blades are in the range of 2 - 4 cm and more preferably between the range of 1.5 - 2.5cm. The thickness of blades is typically in the range of 0.3 - 0.6cm.

Ideally the material for the blades is hardened steel or stainless steel with relatively blunt faces and curved tipped regions. The chopper is ideally located centrally within the chamber or drum and supported on a shaft, which is connected directly to a motor exterior to the drum. In use the motor is arranged to operate the blade to a maximum rotational speed of typically 1000-1500 RPM and ideally around 1200 RPM, typically 1425 RPM. This not only achieves energy efficient chopping, but has also been found to achieve faster and quieter results.

End or distal portions of the primary blades are advantageously shaped and arranged so as to conform to the interior shape of the drum so as to define a narrow gap, of substantially constant width between the surface of the blade and the surface of the chamber.

In one embodiment the blades are arranged with two bends - so as to form an S-shape - whereby a major surface of the blade is substantially parallel with the flat surface of part of the interior of the chamber.

In a preferred embodiment the flat surface of part of the interior of the chamber is a portion of a frusto-conical surface angled so as to direct pulped waste and slurry into a drain.

Ideally the gap between the blade and the chamber is less than 0.5 cm and ideally less than 0.3 cm. The gap has been found to be ideal as if it is too large, pulp product sticks to the underside of the blade and tends to "ball"; and if the gap is too small, there is insufficient shear force generated between the product to be pulped and the wall of the chamber.

The chopper is the fact that it has two sets of blades: a first set of relatively short blades and a second set of longer blades. Short and long blades alternate and are disposed in a symmetric manner.

An advantage of the preferred arrangement of blades is that they promote very efficient, 'dry' chopping – that is chopping prior to introduction of water. The chopping cycle is not only highly efficient but relatively quiet.

As a result of the improved blade, typically the noise levels are below 60 dB and ideally less than 50 dB.

The chamber or drum has a sump region whose volume is typically 3 - 5 litres and in which the blade is located at a distance of approximately 9.0 cm from the base of the sump. This distance ensures there is clearance between the blade and the drum so as to prevent any build up of debris which may otherwise jam or inhibit rotation of the chopper.

Suitable sensors are located on the rotator shaft to determine the amount of rotor torque that is required and to isolate power to the motor in the event of a stall. In the event of a stall such sensors may be arranged to reverse the sense of rotation of the motor so as to remove debris and free rotation of the motor.

It is appreciated that the fourth aspect of the invention may be used in conjunction with the first and/or second and/or third aspects of the invention and combined into a single macerator in which two or more aspects are present.

According to a fifth aspect of the invention there is provided a macerator control system for determining a particular duty cycle, wherein a menu of alternative cycles is provided for varying: chopping speed and/or chopping duration prior to introduction of water and/or amount of water to be introduced and/or instant when drain is opened, characterised in that the menu is in the form of a look-up table and operates under control of software.

This feature of the invention permits a single type of macerator to be configured for use in a wide variety of applications, for example in conditions

where there is a large volume of heavily soiled pulp products to ones where there is a smaller amount of lightly soiled products.

Further this feature provides the flexibility to an operator of selecting different pulping times and to vary the amount of water that is used in a cycle. Certain minimum limits may be imposed so as to ensure that products have been pulped to a sufficiently small size and that a minimum volumes of water are introduced into the chamber so as to enable it to be flushed properly.

A preferred embodiment of the invention will now be described, by way of example and with reference to the Figures in which:

Brief Description of Figures

Figure 1 there is shown an overall view of one embodiment of the macerator 10 of the type found in hospitals or care homes;

Figure 2 is a flow diagram showing key decisions in control and logic of the operation of the macerator;

Figure 3 shows various views of a macerator lid;

Figure 3a is an overall view;

Figure 3b is an underplan view;

Figure 3c is a plan view;

Figure 3d is a side elevational view;

Figure 3e shows a part-sectioned detailed view of the hinge portion that connects the lid to the macerator;

Figure 3f shows an end elevation of the macerator lid;

Figure 4 is an overall view of solenoid housing;

Figure 5a is a plan view of six-bladed chopper;

Figure 5b is side elevation of the six-bladed chopper; and

Figure 6 is a block diagram of an automatic control system for closing a lid of the macerator.

Detailed Description of Figures

Referring to the Figures generally and in particular Figure 1, there is shown an overall view of one embodiment of the macerator 10 of the type found typically in hospitals or care homes. Macerator 10 is in the form of a generally parallel piped shaped cabinet whose dimensions are approximately 0.5 - 0.7m (width), 0.5-0.8m (depth) and 0.8-1.1m (height).

The cabinet 10 is typically floor mounted on four rubber feet or supports 12. Macerator 10 requires a water supply 14 (usually only cold), a sewage drain 16, and an electrical supply 17 (single phase or 3-phase). A hinged lid 18 closes to seal an inner drum 20. In use the lid 18 is opened by a foot switch, pedal or kick plate 22. This enables a user, who is typically carrying one or more soiled bedpans or pads for maceration, to open the lid without the need to place the aforementioned soiled items on a work surface, or any part of the macerator 10, thus ensuring a hygienic disposal.

In use the lid 18, shown in detail in Figures 3a to 3f, is closed and locked by two lock or throw bolts 24a and 24b, which operate under control of solenoids 26a and 26b (shown in detail in Figure 4) respectively in a failsafe manner. The failsafe mechanism ensures that in the event of a power failure, interruption in electricity 17 or water 14 supply the throw bolts maintain lid 18 in a locked state.

Referring to Figures 5a and 5b chopper 28 is supported in a substantially central location at the lower region of drum 18 and supported by sealed bearing 34. Chopper 28 comprises a multisided blade device, which ideally has three relatively long blade portions 36a, 36b and 36c, and three relatively short of stubby blade portions 38a, 38b and 38c. Long blade portions are disposed intermediate short blade portions in a star configuration at substantially 60° one to another.

An advantage with this configuration of blade portions is that it has been found to produce low noise levels, which are of particular benefit in wards, hospitals or care homes where macerators often need to be operated at night when patients are asleep.

Brief reference will now be made to Figure 2 in which a logic diagram illustrates a series of questions/decisions and states which control the operation and safety features of macerator 10.

Figure 2, which is a flow diagram showing key decisions, initially the macerator 10 is operated with a foot switch to open lid. An LED indicates 'power on' status. The macerator 10 may then be loaded with typically up to 8 pulp products. To close the lid 18 a user moves a hand over a proximity sensor which includes IR detector 44. Once the lid 18 is closed the motor is activated. The machine checks the load on the motor and if there is a problem indicator F3 will flash on the display. This fault code signifies a prompt to remove an obstruction, for example a trapped item in the lid. Provided there are no obstructions two shoot bolts 24 are fired to lock the lid 18 and an LED indicates that the maceration cycle commences.

The motor 32 for dry chopping is then started. Subsequently after an interval of approximately 10 seconds water pump 70 is switched on. This fills the chamber 20 with water for 70 seconds. Dosing fluid, such as detergent or disinfectant, may then be added and the peristaltic pump is started. The time period defined for this is 3 - 30 seconds.

The cycle is then complete and motor 32 is switched off. Pump 70 continues to pump water for cleaning the chamber for 10 seconds. If the motor 32 is still rotating fault code F8 flashes on a display and the cycle is halted. A counter is incremented by 1 on the basis that another cycle has been carried out and a check of a predetermined limit is made. If the limit has been reached then an alarm triggers and a service is required. If not however, the cycle is complete and returns to start. The LED indicates the ready state.

There are two counters: a first is embedded in software and may be reset, for example by a service engineer to alert the time for the next service; and the second keeps a tally of the absolute number of cycles. The system counter in software requires re-setting at servicing to the next service interval; the absolute cycle counter cannot be altered.

The unit runs a continuous fault check loop whereby for example if a pressure sensor is activated fault code F1 flashes on display, the drains are cleared and the unit is restarted. If the water tank is not filling during the cycle the fault code F5 flashes. If the power is interrupted during the cycle the fault code F6 flashes. If the lid is opened during cycle or the motor is turned off, F7 flashes on the display.

There is also a continuous fault check loop regarding eventualities wherein the motor 32 can be halted mid cycle. Where there is too much product in the chamber 20 fault code F2 flashes on a display. In the event that the motor fails fault code F4 flashes.

Referring again to Figures 1 and 3 an operator/user (not shown) approaches the macerator 10, typically carrying a stack of soiled disposable pad pans (not shown) for hygienic disposal. If lid 18 of macerator 10 is already open the user places the stack, typically up to 8 pulped paper products, into the inner drum 20, having a tapered or part conical lower regions which promotes drainage of pulped matter. Hinged lid 18 is then closed by an automatic closing system 40 described in detailed below with reference to Figures 2 and 6.

In a particularly preferred embodiment an automatic closing system (ACS) 40 comprises a source of infra red (IR) radiation 42a, an infra red (IR) detector 44, a threshold detection circuit 46, control logic 48 and a relay 50.

Referring to Figure 5, which shows in use ACS 40 detecting a users hand when waved close to the IR detector 44 as an increase in reflected IR radiation 42b. The threshold detector 46 removes any ambient or incident background IR radiation from a received signal (S) and - in the event that the duplicate of received signal exceeds a pre-defined threshold level (T) - a trigger signal is sent to logic circuit 48. The logical sequence of decisions and actions which are taken and controlled by logic circuit 48 are outlined in detail in Figure 2.

Threshold detection may be varied so as to change the varying angle/viewing cone of detected IR radiation and/or the distance between target (hand 100) and detector and/or the particular frequency of the IR radiation 42a. Variation of these criteria enables a high degree of selectivity to be achieved, thereby ensuring the macerator 10 can be used in a wide range of environments, for example in banks or rows or for example opposite one another, without risk of a false reading or input signal being received.

A particular advantage with this aspect of the invention is that it ensures that a user no longer has to contact any part of the macerator 10 in order to switch it on or commence a maceration cycle. This is of special importance with the increased prevalence of cross contamination between patients and wards in hospitals of the bacteria leading to Methicillin Resistant Staphylococcus Aureus (MRSA) and Clostridium difficile (c-difficile), as the person carrying soiled items (nurse auxiliary or cleaner) is typically moving between a number of different places in the hospital or care home.

Referring again to Figures 1 and 4, the closing operation of lid 18 is now described in greater detail and with referring to specific safety features housed in solenoids 26a and 26b. Upon detection of a proximal hand 100 or other

trigger, lid 18 closes under supervision of a lid safety system 52. Lid safety system 60 included a driver or activator 54 arranged to close the lid 18 on receipt of a signal from auto close system 40. Pressure sensor 56, which is located so as to sense strain in the driver activator 54, where the level of strain detected exceeds a particular value, sends a fault signal to the activator 54, which automatically arrests its motion. This feature ensures that a user does not inadvertently trap a hand or finger, or any other item unintentionally positioned so that it prevents lid 18 from closing.

In situations where the lid safety system 52 is triggered an alarm may sound and/or the driver activator 54 may be controlled to relax or to attempt to close, thereby giving the user a chance to remove the item.

In addition to the aforementioned alarm, a range of fault codes and alternative alarms are provided for the safe and efficient operation of the macerator.

These are described in detail below. The fault codes and error signals have been designed in order to ensure the macerator is relatively straightforward to maintain and repair.

- If the mains drains or the chamber is blocked, pressure sensor. detects a change in pressure and stops the unit, displaying F1.
- If too much pulp product is loaded into the unit then the macerator stops and displays F2.
- If chopper is jammed during cycle unit stops and displays F3.
- If motor 32 stops rotating during cycle F4 is displayed.
- If chamber 20 is not filling after a desired time lapse F5 is displayed.
- If power is interrupted during the cycle the unit displays F6. When power is re-connected the unit automatically finishes the cycle.
- If lid 18 is opened during cycle the macerator stops and displays F7.
- If motor 32 is still rotating after a cycle is complete the macerator unit displays F8.

- When cycle counter reaches the setting set the unit will display F9, implying that a service is required.

It will be appreciated that variation may be made to the aforementioned embodiments, without departing from the scope of the invention.

It is further understood that the terms: paper, cardboard, pulped paper or similar fibrous or starch-based products are intended to include: biodegradable products, disposable hygiene products, female hygiene products, nappies (diapers), incontinence pads, and other sanitary articles for use by incontinent people, incontinence equipment, bedpans and the like, that may formed from vegetable matter or any synthetic, organic or other material that is temporarily liquid impervious, (for example by way of a coating), but capable of being macerated.

It is also understood that the above description is not intended to be limiting in that the optimum dimensional relationships for the parts of the invention, may include variations in size, materials, shape, form, function and manner of operation, assembly and use; and all are deemed readily apparent to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

Claims

1. A macerator comprising:

a chamber and lid, which together in use define a sealed volume for receiving items to be macerated;

a chopper which is located in the chamber;

an inlet which is provided for introducing water into the chamber;

a drain for removal of macerated product from the chamber;

a means which is provided for opening the lid;

a lid closure system which is provided for closing the lid, wherein the lid closure system includes a non-contact control system arranged to detect a user's presence and activate an actuator that closes the lid upon receipt of a command signal; and

a lid locking means which ensures that the lid is locked when closed, before the control system begins a macerating cycle.

2. The macerator according to claim 1, wherein at least one sensor is arranged to detect closure of the lid and to initialize the lid locking means.

3. The macerator according to claim 1 or 2, wherein at least one sensor is provided for detecting an obstruction to closure of the lid, and wherein the sensor automatically arrests the actuator upon detection of said obstruction.

4. The macerator according to claim 1, wherein the non-contact control system includes a proximity sensor, and the proximity sensor is an infra red (IR) sensor.

5. The macerator according to claim 4, wherein the infra red (IR) sensor has an operating range of between 0.05m and 0.2m so that lid closure is not inadvertently triggered by a casual bystander.
6. The macerator according to any one of claims 1 to 5, wherein the non-contact control system includes a proximity sensor, and the proximity sensor includes a recognition system, which is capable of identifying an audible control signal.
7. The macerator according to any one of claims 1 to 6, wherein the non-contact control system includes a proximity sensor, and the proximity sensor includes an optical recognition system.
8. The macerator according to any one of claims 1 to 7, wherein the non-contact control system includes a proximity sensor, and the proximity sensor includes a short range radio frequency (RF) receiver for receiving a signal from RF identity (ID) tag.
9. The macerator according to any one of claims 1 to 8, wherein an opening mechanism is provided for enabling the lid of the chamber to be opened by the user's foot.
10. The macerator according to any one of claims 1 to 9, wherein a safety release mechanism permits opening of the lid after a predetermined interval following end of a cycle.
11. The macerator according to any one of claims 1 to 10, wherein the chopper comprises: three primary blades and three secondary blades, the axis of each blade lying in a plane and being disposed at substantially 60° one to another, whereby primary and secondary blades are arranged in alternating fashion one to another.
12. The macerator according to any one of claims 1 to 11, wherein a control system determines a particular duty cycle, characterised in that a menu of alternative cycles is provided for varying: chopping speed and/or chopping duration prior to

introduction of water and/or amount of water to be introduced and/or instant when a drain is opened whereby the menu is in the form of a look-up table and in use operates under control of software.

13. A method of macerating a pulp paper product, using the macerator according to any one of claims 1 to 12, comprising the steps of:

introducing the paper product into chamber;

sealing the chamber with lid;

chopping the paper product for a predetermined period of time using a rotating chopper, when at least part of the paper product is in substantially dry state; and

introducing a predetermined volume of water, whilst the chopper continues to chop the paper product; and

draining the chopped waste product from the chamber whilst the water supply continues to rinse the chamber.

14. The method of macerating a pulp product according to claim 13, wherein that an initial chopping interval is less than 30 seconds.

15. The method of macerating a pulp product according to claim 13 or 14, wherein a volume of less than 20 litres of water is used in a cycle.

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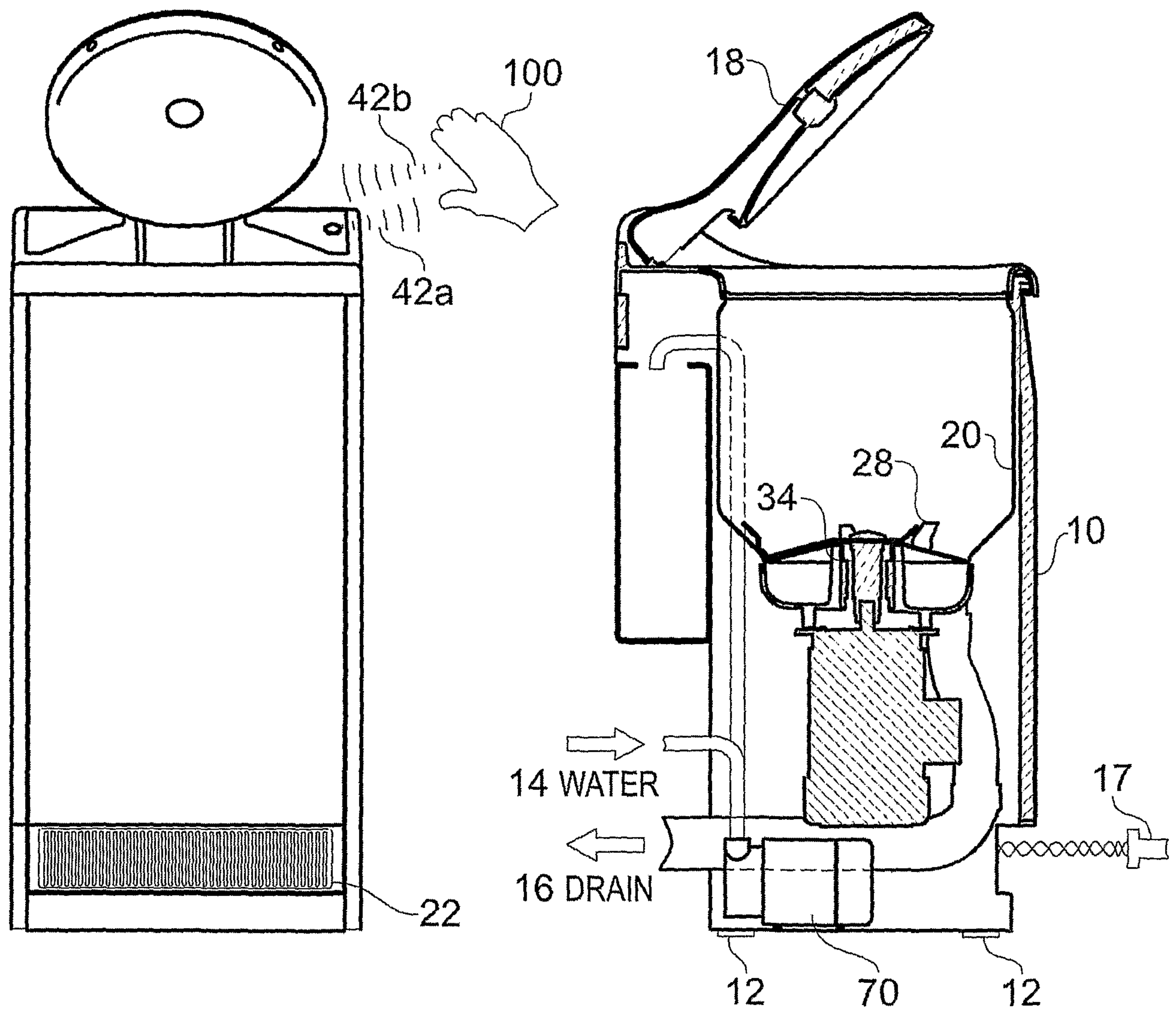


FIG. 1

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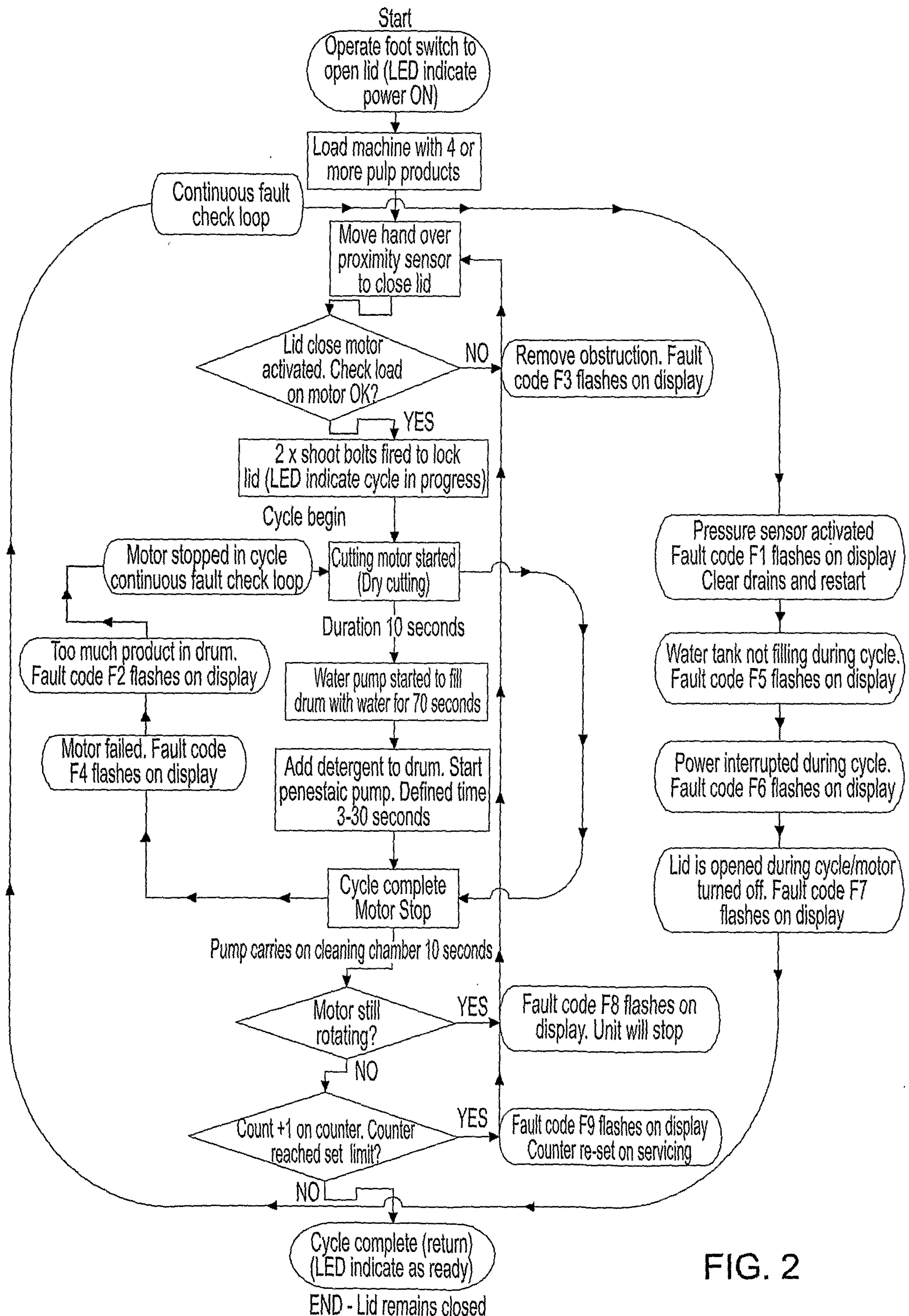


FIG. 2

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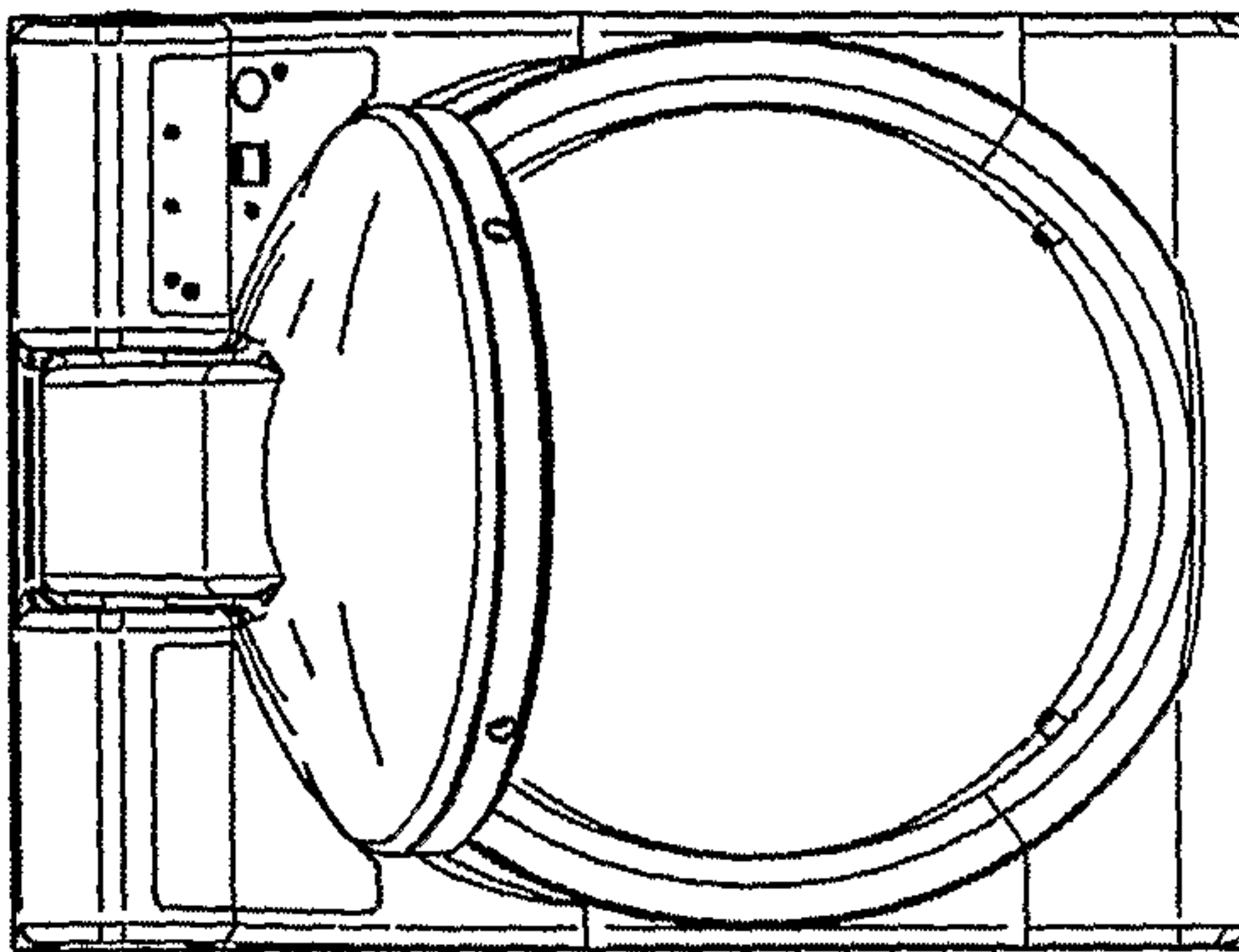


FIG. 3c

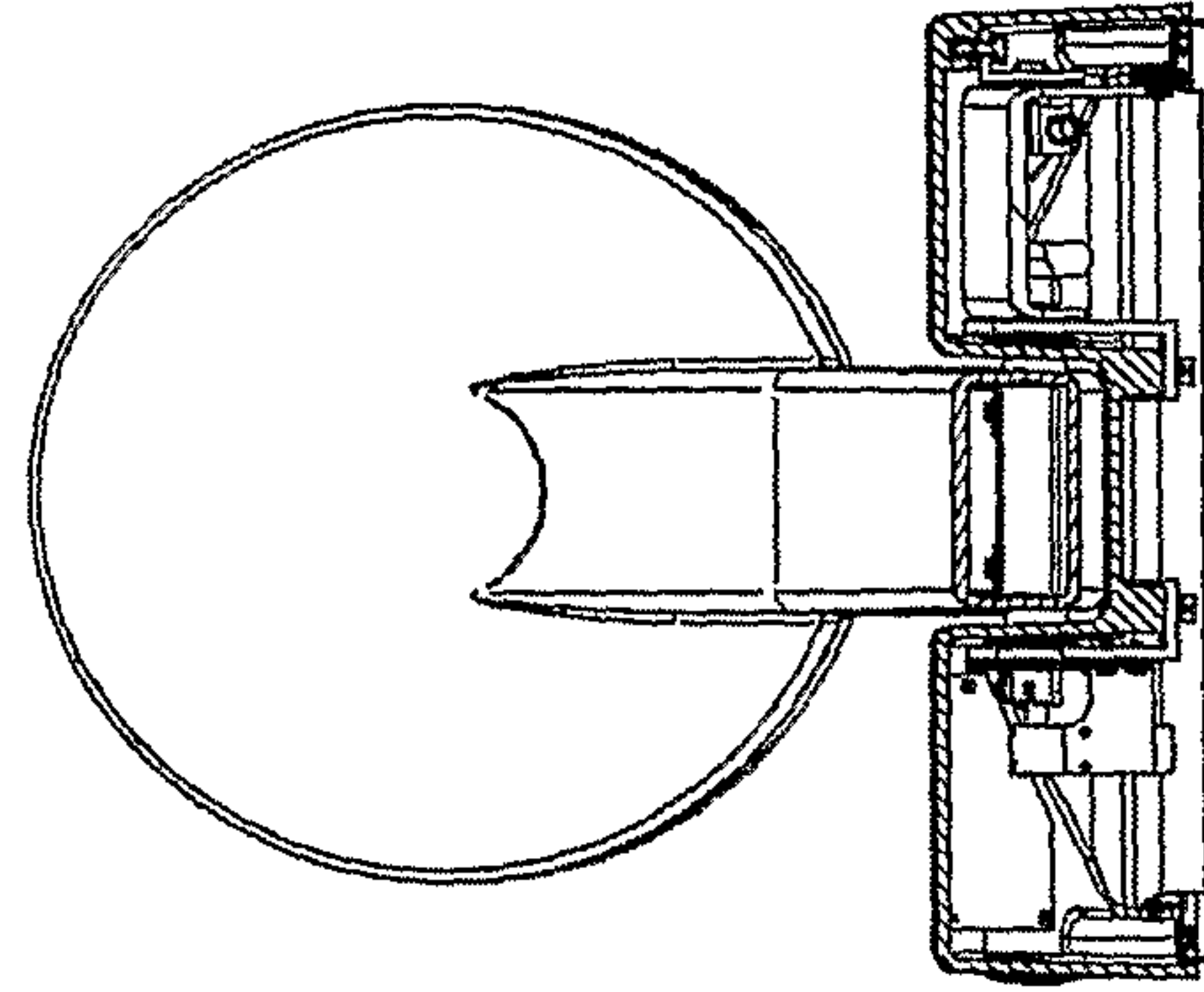
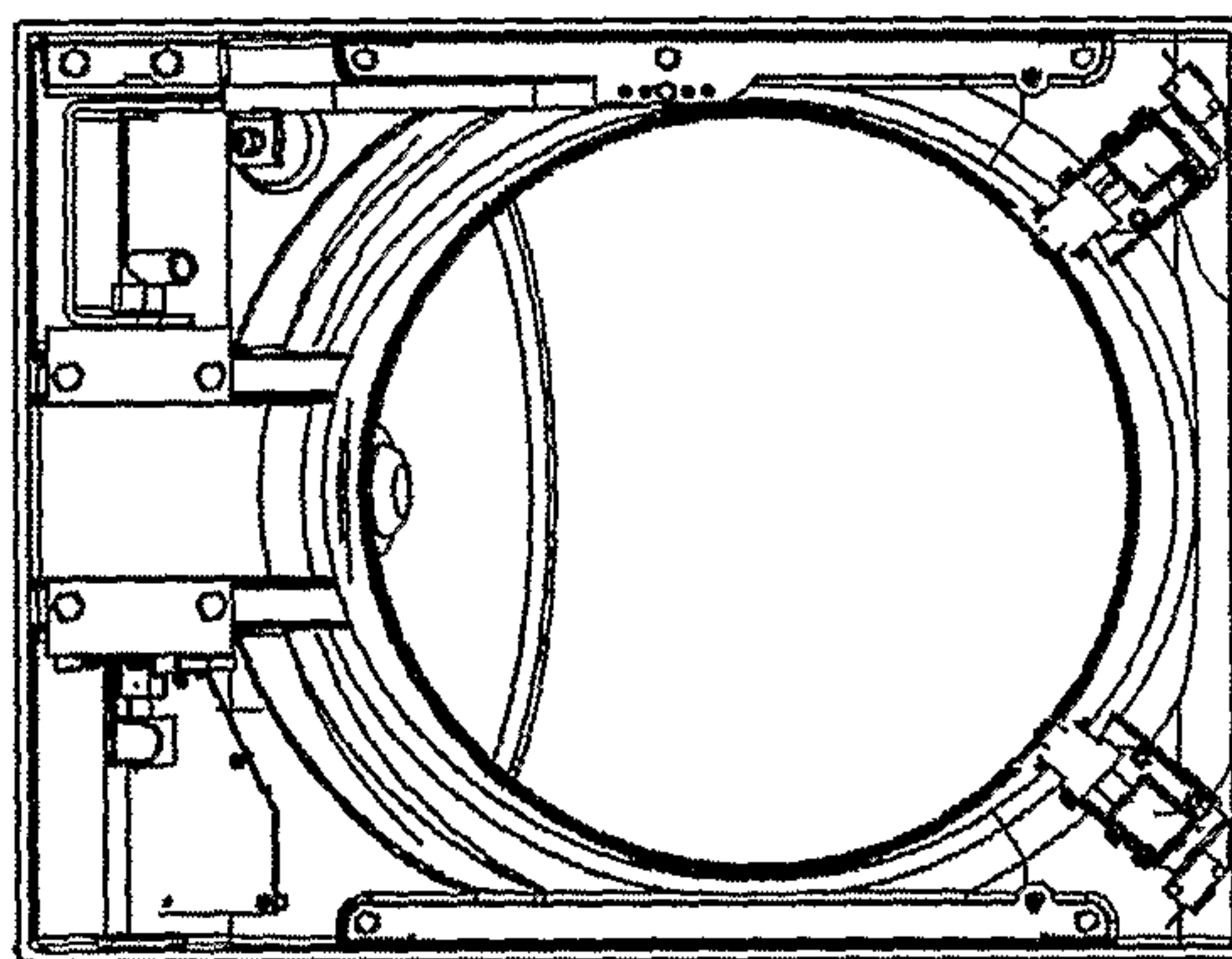


FIG. 3f



24a 24b

FIG. 3b

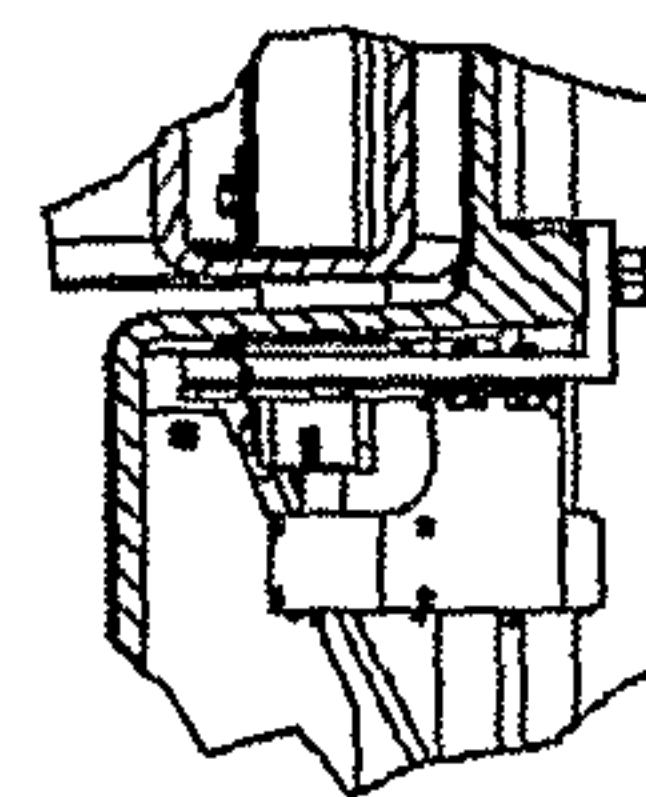


FIG. 3e

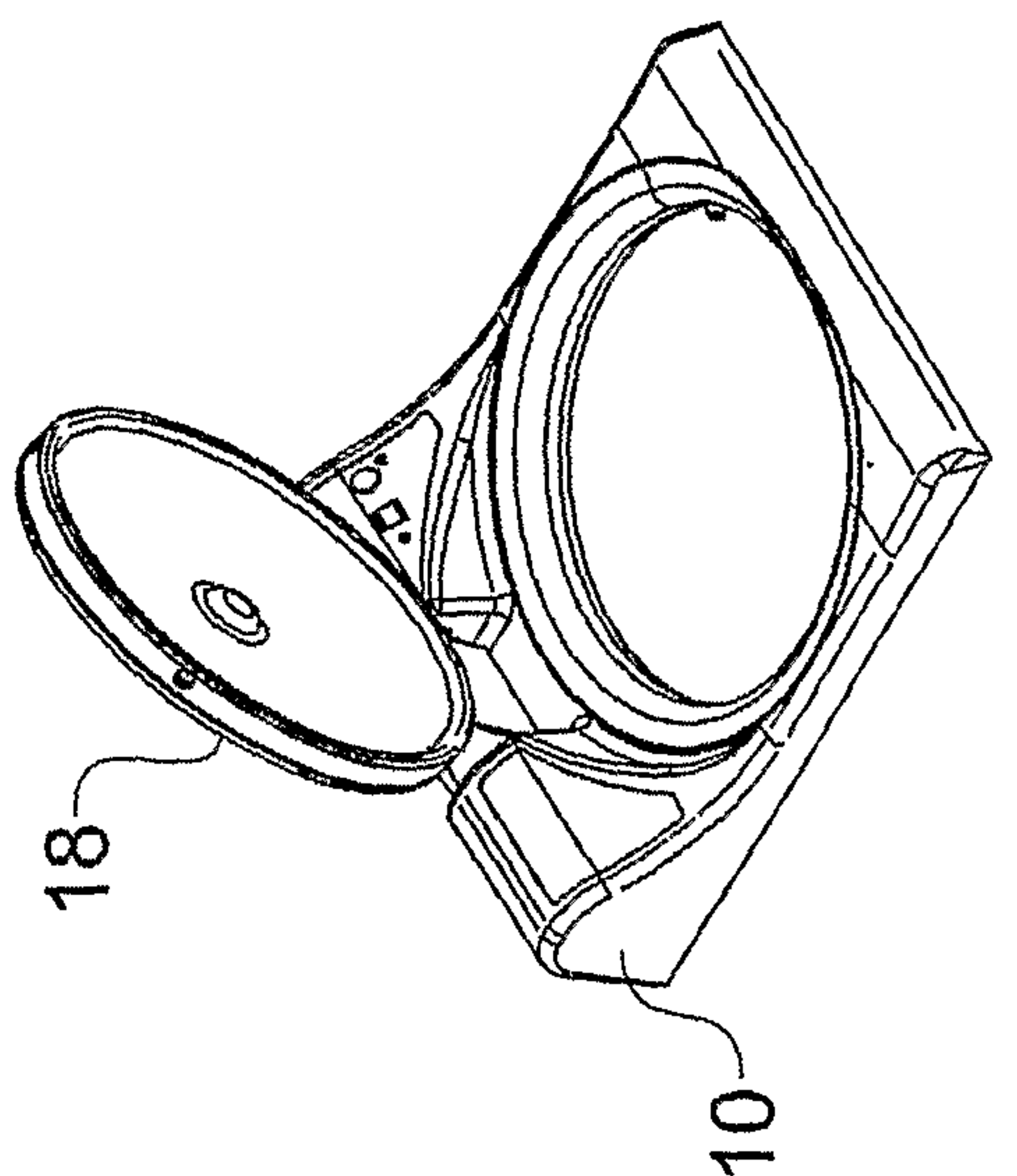


FIG. 3a

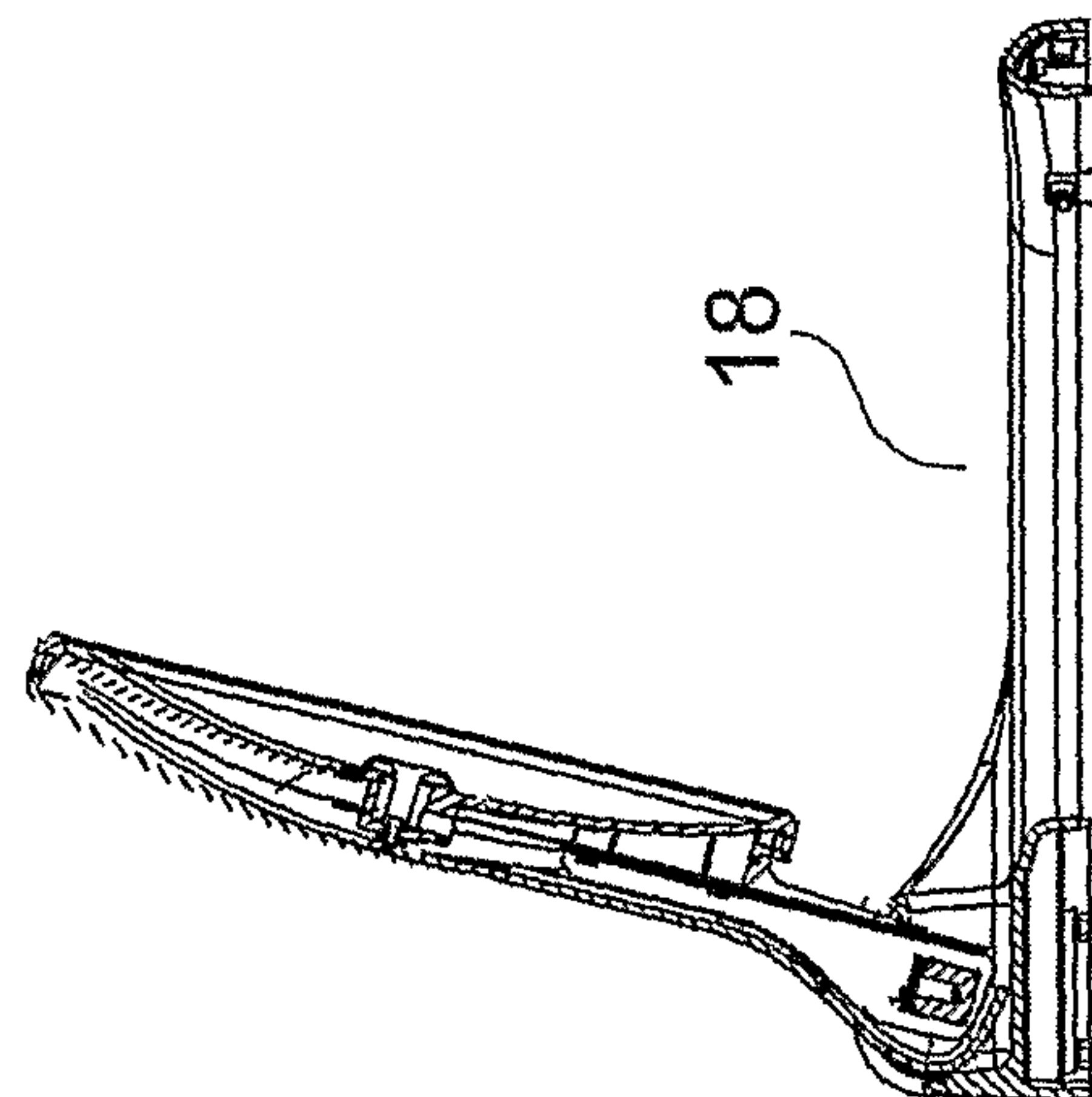


FIG. 3d

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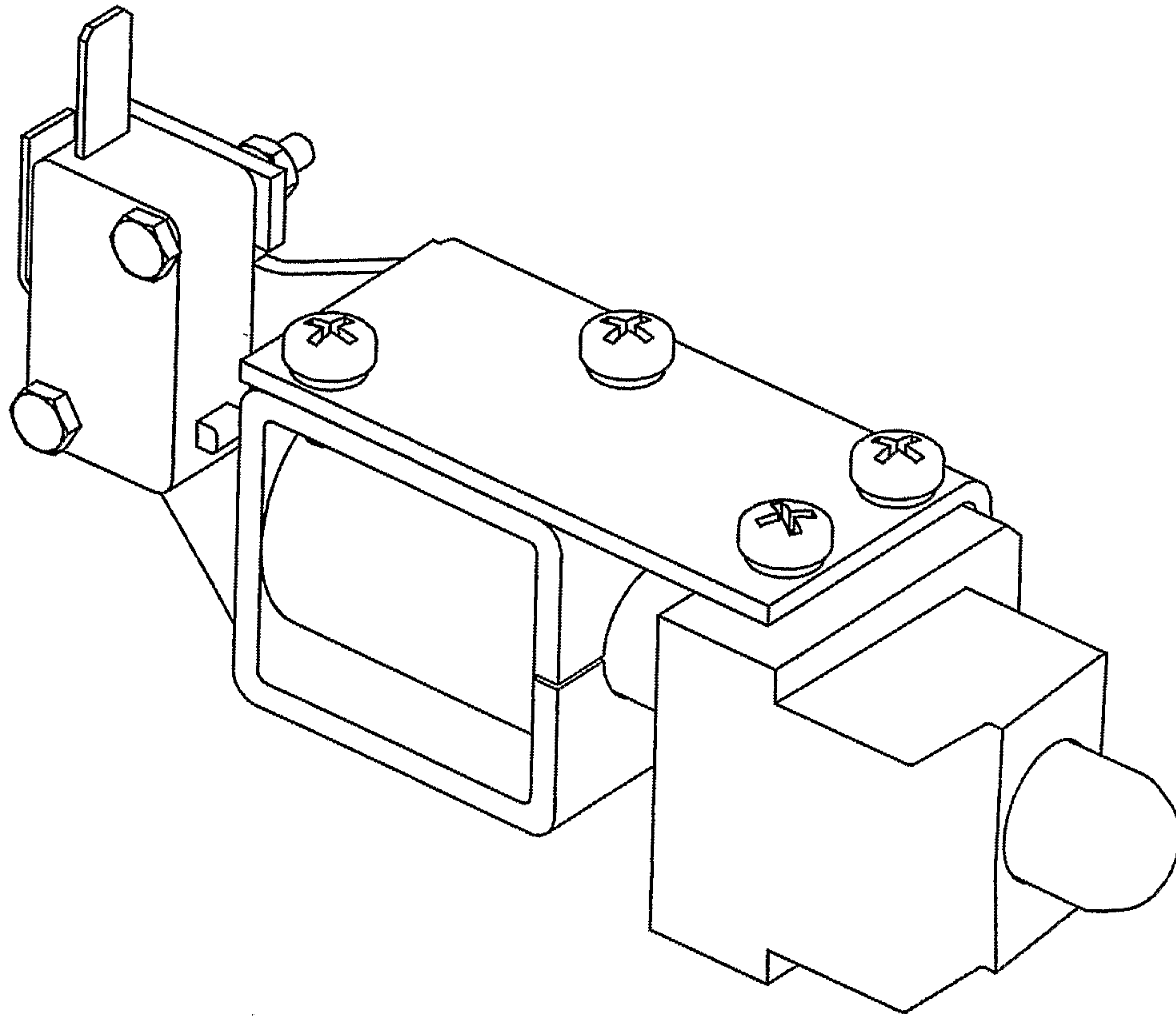


FIG. 4

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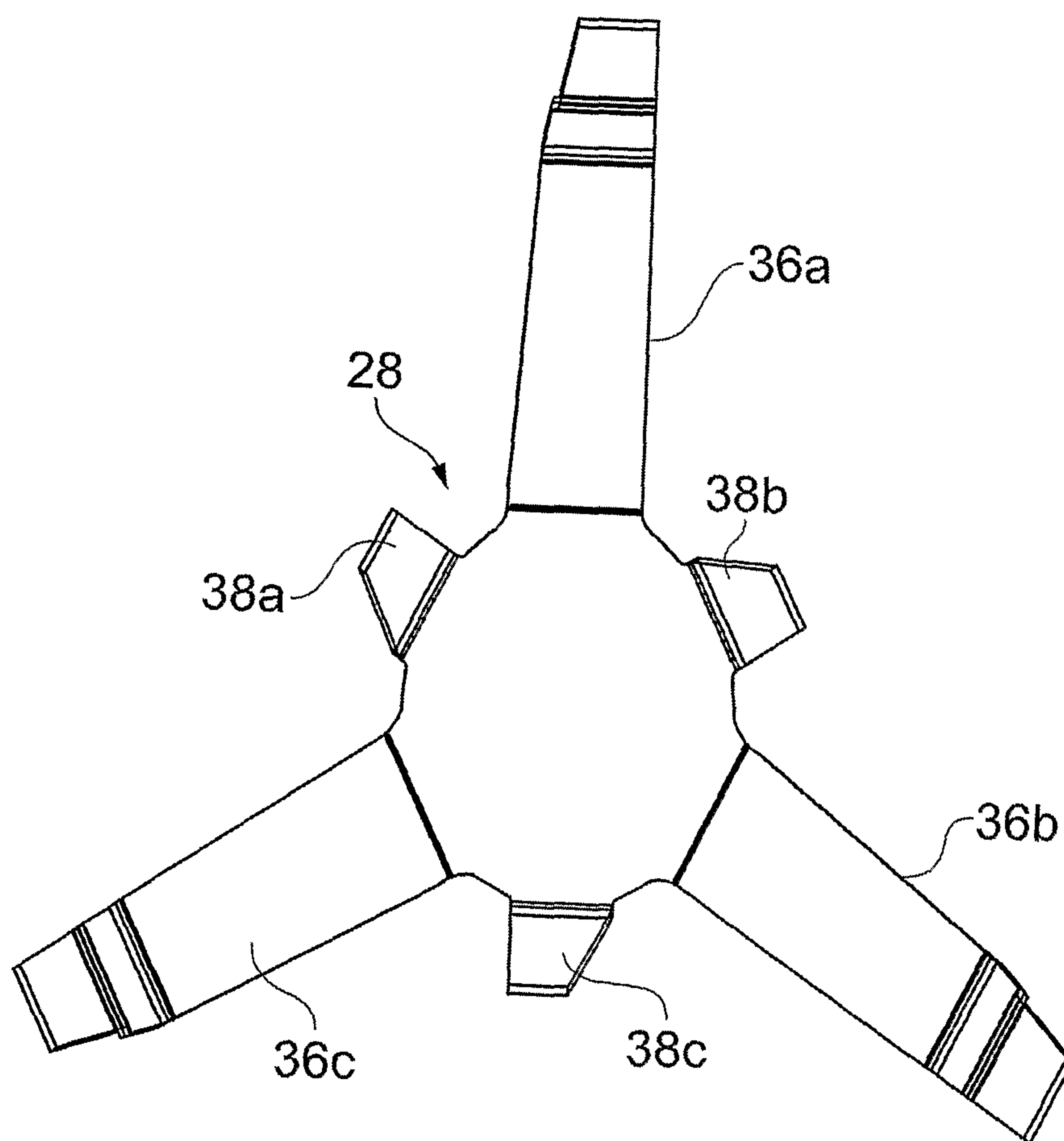


FIG. 5a

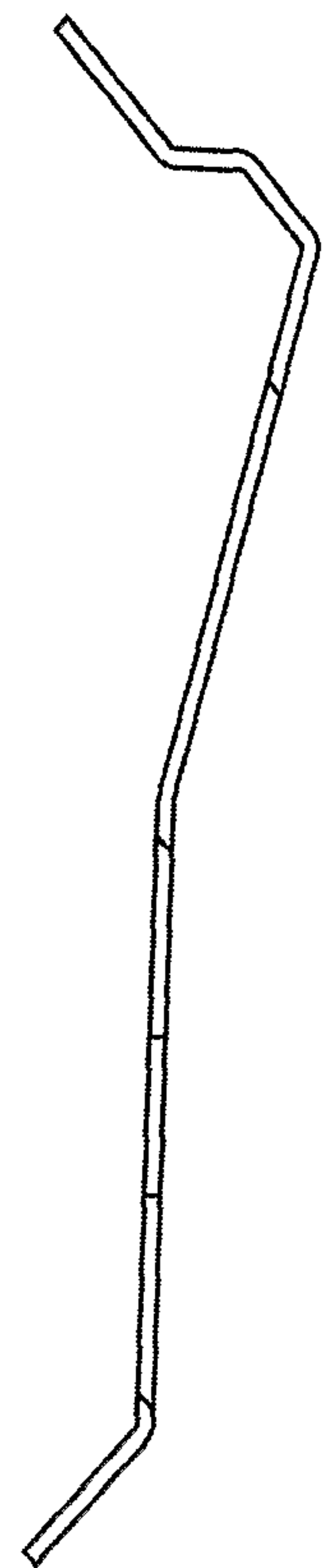


FIG. 5b

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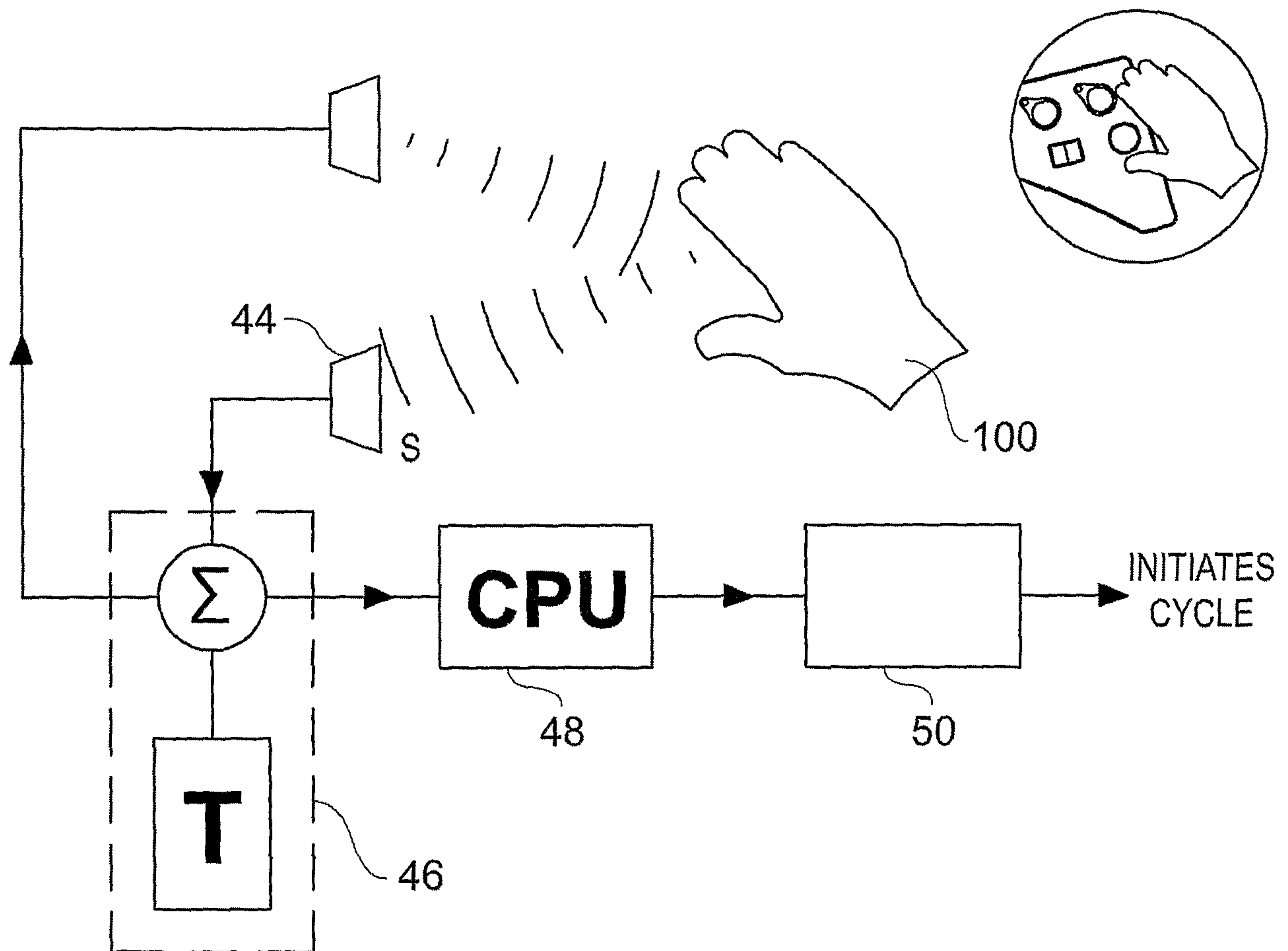


FIG. 6

