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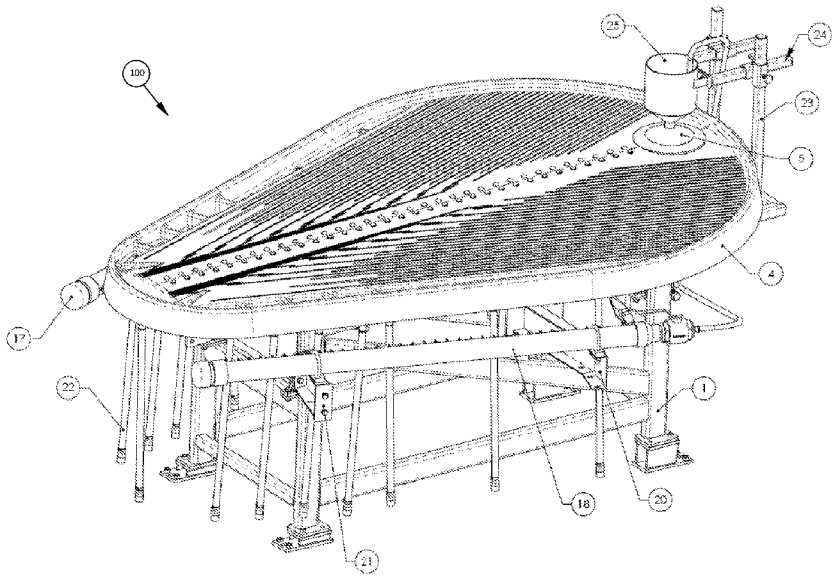


FIGURE 2

(57) Abstract: A shaker table apparatus is disclosed. The apparatus comprises a tabletop deck assembly (4) having a feed end and a discharge end; at least one dressing water nozzle (29) having a low-profile with respect to said tabletop deck assembly (4); and at least one outboard dressing water valve manifold (17,18) which is operably connected to the at least one dressing water nozzle (29). The at least one outboard dressing water valve manifold (17,18) is positioned and configured so as to not require an operator to reach over the tabletop deck assembly (4) to adjust a flow of dressing water to said at least dressing water nozzle (29). A method of operating a shaker table apparatus is also disclosed. The method comprises the steps of engaging a portion of the at least one outboard dressing water valve manifold (17,18); and, adjusting a flow of dressing water said at least one dressing water nozzle (29) without reaching over the tabletop deck assembly (4). A dressing water nozzle for a tabletop deck assembly of a shaker table apparatus is also disclosed.

WO 2015/048975 A2

SHAKER TABLE APPARATUS AND COMPONENTS AND METHODS THEREOF

CROSS-REFERENCE OF RELATED APPLICATIONS

This application is an international application which claims the benefit of U.S. Provisional Patent Application No. 61/886,014 filed on October 2, 2013 and U.S. Provisional Patent Application No. 61/901,527 filed on November 8, 2013.

BACKGROUND OF THE INVENTION

This invention relates to mineral separation devices, more particularly to improved shaker table apparatus, and even more particularly to improvements to dressing water manifolds and tabletop decks for better accommodating magnetic separators and improving recovery and separation grade.

Shaker tables have been in existence for several decades. FLSmidth-Knelson Solutions uses a Knelson- brand concentrator to concentrate dense particles which contain a value mineral. This concentrate then gets flushed to either a ConSep ACACIA Reactor Unit (if use of cyanide is permitted on site), or to a shaker table. The product of a shaker table is typically smeltable gold. For example, relevant prior systems may be found in any one of U.S. Patent Nos.: 2,325,340; 4,078,996; 4,150,749; 4,170,549; 4,251,357; 4,340,469; 4,758,334; 5,160,035; 5,205,414; 6,059,118; 6,155,707; 7,533,775; 4,758,334; 2,325,340; 4,326,951; 4,340,469; and 4,347,130.

Ball mill filings may be present in concentrate arriving at a shaker table. These filings pose a problem to tabling/separation at a shaker table, since large chunks of ferrous metal can behave similar to smaller, denser gold particles. Therefore, the presence of such metallic impurities can likely disrupt and pollute the collection of gold on a shaker table. If the use of an upstream magnetic drum separator is not desirable, then a suspended plate magnet separator may be used above the shaker table's active surface. However, the space available to accommodate suspended plate magnet separators is very limited with existing shaker table devices.

For example, conventional 'Gemini' shaker table designs use a large raised central water manifold which extends down the length of the shaker table to deliver dressing water to the tabling surface. The dressing water is necessary to wash away impurities and allow gold to be collected by the table. The existing Gemini-style central water manifold requires a user to reach over/across the active tabling surface to manually adjust each water nozzle at the

center of the table, which, itself, is shaking with the table and central water manifold. This is especially problematic for larger table profiles, which require non-ergonomic sizeable reaches over the table to its centerline and risks disruption of table separations. In addition, the existing nozzle/valves used on these large raised central water manifolds are easily snapped or twisted when manipulated - particularly during shaking. It is also quite difficult for an operator to grab and manipulate a shaking nozzle/valve and readily adjust flow in a finely-tuned manner to optimize separation in a particular location of the shaker table. Accordingly, a more robust system is required which gives an end user a higher degree of control over the dressing water flow delivered to or from each nozzle.

Moreover, since Gauss profiles generally decay rapidly as the magnetic device moves farther away from a particular location, a plate magnet separator should generally sit as close to the tabling surface as possible in order to optimize magnetic separator performance. The existing Gemini-style large raised central water manifolds, nozzles, and edge geometries all sit high. Consequently, they obstruct magnetic separation devices and prevent close positioning with a shaker table top, thus, impede the overall effectiveness of a shaker table separation circuit.

Additionally, with prior shaker table devices, a large amount of water may be present within the chute/waterslide regions during operation. The large amount of water may build up prior to groove tips, and accordingly, during operation, the devices may cause the formation of standing "waves" – which provide bypass routes (i.e., a "short-circuit" paths) that make it easy for incoming feed to mistakenly enter tails collection. This is highly undesirable, since precious solids which are present in the feed may be unknowingly discarded. Standing waves approximately 1/2 to 1.5 inches away from the walls (running parallel to wall) of prior Gemini devices have been observed, where solids 'dance' or float to the tails collection trough via the standing waves without being processed by table grooves.

As can be imagined, there are many variables which contribute to the ultimate performance of a shaker table. Features of the embodiments disclosed hereinafter have contributed to apparently high gold recovery performance.

OBJECTS OF THE INVENTION

It is, therefore, an object of the invention to provide a mechanically-robust, improved shaker table capable of efficiently and effectively providing smeltable table concentrate.

It is another object of the invention to improve existing dressing water manifolds and tabletop deck geometries so that they are better-suited to accommodate magnetic separators.

It is a further object of the invention to provide a new tabletop deck design which is optimized for use with a closely-positioned suspended overhead plate magnet separator.

It is yet an even further object of the invention to drastically improve the ergonomics and control offered to users who monitor and fine-tune dressing water to the tabletop - either during operation or outside of operation.

It is a further object of the invention to provide a fully automated shaker table system having improved table security by reducing unnecessary human contact with areas of the tabletop deck assembly which carry concentrated amounts of product.

Another object of the invention is to provide a shaker table system which enables recycling of tailings and middlings over the tabletop deck to minimize losses and improve recovery.

It is a further object of the invention to provide a batch separation process that can be modified to accept concentrate from one or more gravity concentrators or similar concentrating devices.

It is a further object of the invention to provide a competitive concentrate treatment option which does not involve intensive cyanidation, and therefore, may be utilized when cyanide destruction or permitting is not available.

It is a further object of the invention to provide larger available surface areas than conventional center feed tables.

Another object of the invention is to provide a shaker table apparatus having superior abrasion resistant surfaces for enhanced particle mobility and minimal routine maintenance.

These and other objects of the invention will be apparent from the drawings and description herein. Although every object of the invention is believed to be attained by at least one embodiment of the invention, there is not necessarily any one embodiment of the invention that achieves all of the objects of the invention.

SUMMARY OF THE INVENTION

A shaker table apparatus is disclosed. The shaker table apparatus may comprise a tabletop deck assembly having a feed end and a discharge end, at least one dressing water nozzle having a low-profile with respect to said tabletop deck assembly, and at least one outboard dressing water valve manifold which is operably connected to the at least one

dressing water nozzle. The at least one outboard dressing water valve manifold may be positioned and configured so as to not require an operator to reach over the tabletop deck assembly. The at least one outboard dressing water valve manifold may also be positioned and configured so as to readily allow an operator to adjust a flow of dressing water to said at least dressing water nozzle. The apparatus may comprise one or more dressing water tube which extends between at least one dressing water nozzle and at least one outboard dressing water valve manifold. The feed end of the tabletop deck assembly may be rounded to create a deliberate dead zone which forces material over processing grooves and eliminates short-circuiting found with conventional devices. In some embodiments, the feed end of the tabletop deck assembly may be located vertically above the discharge end of the table, thereby creating a tabletop deck assembly angle of inclination between approximately 1 and 3 degrees. One or more fang-shaped diverter features may be provided at a discharge end of the apparatus, which is configured to improve concentrations at the discharge end. The shaker table apparatus may have at least one water dressing nozzle which is separately provided to the tabletop deck assembly. The shaker table apparatus may also comprise a quick connect feature between at least one water dressing nozzle and at least one outboard dressing water valve manifold. An overhead magnetic separator may be provided overtop of the tabletop deck assembly, and may be spaced from the tabletop deck assembly by an overhead clearance gap less than 3.5 inches, which is less than possible with conventional devices. In some embodiments, the shaker table apparatus may comprise a spin filter upstream of said at least one dressing water nozzle to minimize potention clogging of the nozzle. In some embodiments, one or more outboard dressing water valve manifolds may be provided at an easily-accessible peripheral location which is not centrally located on an upper portion of the tabletop deck assembly. The at least one outboard dressing water valve manifolds may comprise a single manifold or two outboard dressing water valve manifolds. In some embodiments, each of the two outboard dressing water valve manifolds may be positioned on opposing sides of the tabletop deck assembly of a shaker table apparatus. In other embodiments, each of the outboard dressing water valve manifolds may positioned on the same side of the tabletop deck assembly.

A method of operating a shaker table apparatus is also disclosed. The method comprises engaging a portion of the at least one outboard dressing water valve manifold; and, adjusting a flow of dressing water said at least one dressing water nozzle without reaching over the tabletop deck assembly.

A dressing water nozzle subassembly for a tabletop deck assembly of a shaker table apparatus is further disclosed. The dressing water nozzle subassembly may comprise a cavity for receiving an o-ring and a body, a collet adapted to accept the outer diameter of a tube, a central opening, and one or more nozzle openings intersecting the central opening. The dressing water nozzle may further comprise a mushroom shape. In some instances, the nozzle may incorporate a flat rounded head configured to establish a low-profile with respect to said tabletop deck assembly. One or more torque-engaging surfaces may be provided to the nozzle for alignment and/or purposes of fastening or tightening. The one or more torque-engaging surfaces may be provided as one or more flats or slots in some embodiments. The nozzle openings may be provided on the same side of the dressing water nozzle, thereby providing a one-sided dressing water nozzle, or the nozzle openings may be provided on opposing sides of the dressing water nozzle, thereby providing a double-sided dressing water nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

To complement the description which is being made, and for the purpose of aiding to better understand the features of the invention, a set of drawings illustrating preferred separation devices methods of operating said devices is attached to the present specification as an integral part thereof, in which the following has been depicted with an illustrative and non-limiting character. It should be understood that like reference numbers used in the drawings may identify like components.

FIG. 1 is a plan view of a shaker table apparatus according to some embodiments which schematically indicates various grades of recovery at different locations.

FIG. 2 is an isometric view of a shaker table apparatus according to some embodiments.

FIG. 3 is a side view of a shaker table apparatus according to some embodiments.

FIG. 4 is a discharge end view of a shaker table apparatus according to some embodiments.

FIG. 5 is a feed end view of a shaker table apparatus according to some embodiments.

FIG. 6 is a detailed view of drive elements of a shaker table apparatus according to some embodiments.

FIG. 7 is a bottom view of a shaker table apparatus according to some embodiments.

FIG. 8 is a photograph of a shaker table apparatus according to some embodiments.

FIG. 9 is a close-up photograph of a central portion of the shaker table apparatus shown in FIG. 8.

FIGS. 10 and 11 are respective isometric and side view photographs of the shaker table apparatus shown in FIG. 8.

FIG. 12 shows results comparing shaker table apparatus performance according to some embodiments of the invention (left) to prior art devices (right).

FIG. 13 shows that to reach the tails trough, the feed must pass over approximately 20 processing grooves and cannot bypass the grooves as it does on prior devices.

FIG. 14 shows the 'fall line' of feed on a shaker table apparatus according to some embodiments.

FIG. 15 shows sulfides diverting means according to some embodiments.

FIG. 16 is a photograph showing a successful table test for a shaker table apparatus according to some embodiments.

FIGS. 17-19 show various views of a dressing water nozzle according to some embodiments.

FIG. 20 shows an entire separation system utilizing a shaker table apparatus according to certain embodiments of the invention.

In the following, the invention will be described in more detail with reference to drawings in conjunction with exemplary embodiments.

DETAILED DESCRIPTION OF THE INVENTION

A shaker table apparatus 100 and separation system 60 as substantially shown in the figures is disclosed. As can be seen in FIGS. 1-11 and 13-19, profiles of a tabletop deck assembly 4 have been designed so as to be much flatter than conventional shaker table devices. This has been accomplished by lowering the table's edge drain trough reliefs 50, 51, 52, 53, as well as by redesigning the dressing water distribution system to use low profile mushroom-style dressing water nozzles 29 which are provided adjacent the centerline of the table 4 and which extend either in series or parallel generally linearly from a feed end 56 to a discharge end 57. As shown, the nozzles 29 may be provided in an array 54 and may each comprise a head 30 and a body portion 31. This design replaces the previous Gemini-style water manifold tube (which incorporates a rather proud-sitting central manifold and nozzle/valves). The decreased profile of the shaker table apparatus 100 improves magnetic separation efficiency when used with an overhead magnetic separator, because the overhead magnetic separator can be placed in very

close proximity with the tabletop deck 4. Outboard dressing water valve manifolds 17, 18, 66 may be placed along the table sides (one on each side of the table as shown in FIGS 1-19 or both on a single side as shown in FIG. 20). Alternatively, a single outboard dressing water valve manifold 17, 18, 66 may be employed, which services both left and right portions of the tabletop deck 4. In such an embodiment, dressing water nozzles 29 may be purposed with nozzle openings 32 which are located on both sides of the nozzle 29, or the array 54 may alternate between left and right-facing nozzle openings 32. A series of dressing water tubes 19 extending between the dressing water valve manifolds 17, 18, 66 and the dressing water nozzles 29 which form array 54 serve to deliver dressing water to portions of the tabletop deck 4. Each central dressing water nozzle 29 may be connected to a respective outboard dressing water valve manifold 17, 18, 66 via a single dressing water tube 19. Dressing water tubes 19 may comprise plastic or rubber water hose lines terminating at a manual mini-valve threaded into the respective outboard dressing water valve manifold 17, 18, 66. A user may adjust dressing water to the tabletop deck 4 from either side or both sides of the shaker table apparatus 100, and therefore, it is no longer required to reach across the top of a shaker table to the shaker table centerline or manipulate a shaking nozzle/valve. The flat upper profile of the tabletop deck 4 allows the use of an optional overhead magnetic separator 69 such as a belt magnet, positioned in close proximity with the tabletop deck 4.

The shaker table apparatus 100 may include a support frame weldment 1, a rocker plate bearing 2; a rocker plate weldment 3, a tabletop deck assembly 4 having a number of grooves 59, a molded infeed pad 5 which may be separable from the tabletop deck assembly 4 (and replaceable or interchangeable depending on type of feed), a variable frequency drive (VFD) 6 for delivering a shaking motion to the tabletop deck assembly 4, a drive gear motor 7 which is operably coupled to the VFD 6, an eccentric bushing 8, a drive bearing 9, a drive adapter 10, a drive rod weldment 11, an inner spring seat 12, an outer spring seat 13, a drive spring 14, a drain and nut 15, and a cast bumper 16. The VFD 6 may be computer controlled for fine tuning stroke frequency of the tabletop deck 4 and therefore greatly improve recovery efficiencies. The infeed pad 5 may be shaped to diffuse energy of the feed and spread the feed over a large area, thereby discouraging standing wave formation and short-circuiting to tails.

In certain embodiments, a first dressing water valve manifold 17 may be provided on a left-hand side of the tabletop deck assembly 4, and a second dressing water valve manifold 18 may be provided on a right-hand side of the tabletop deck assembly 4. The shaker table apparatus 100 may further include a first manifold support weldment 20, a second manifold

support weldment 21, a number of drain hoses 22 provided to a number of recovery basins 50, 51, 52, 53, a feed hopper support weldment 23, a hopper bracket weldment 24, a feed hopper weldment 25, and a water filter manifold assembly 26. A hold down pattern 27 may be applied to the apparatus 100 for bolting or securing the apparatus within a circuit.

The shaker table apparatus 100 may be connected to a water source via a water supply hose connection barb 28. The water supplied may be pre-filtered and sent to each nozzle 29 in the central array 54. The dressing water enters a central opening 33 within each nozzle 29 that also communicates with one or more nozzle openings 32. The one or more nozzle openings 32 are preferably strategically positioned to deliver dressing water to select portions of the tabletop deck 4. Torque engaging surfaces 38 such as flats, slits, or slots may be used to orientate the nozzle openings 32 and "tune" the delivery of dressing water to particular locations on the table 4.

Dressing water tubes 19 may be connected to each nozzle via a cavity 39 provided in each nozzle 29. In the particular embodiment shown, an o-ring 34 is positioned in the cavity 39 and the cavity 39 is fitted with a barrel-shaped body 36. The body 36 accepts a flexible/snapping collet 37 which has an inside diameter that is configured to accept an outside diameter of a respective dressing water tube 19. Similar quick release connections may be used between dressing water tubes 19 and manifolds 17, 18, 66. In other instances (not shown), each nozzle 29 may comprise a barbed nipple or NPT thread or other equivalent tube-connection means.

As shown, each dressing water nozzle 29 may comprise an optional outer thread 35 which may be accepted through an aperture 55 in the unfinished tabletop deck assembly 4. The nozzles 29 may be secured to the tabletop deck assembly 4 by a backside nut. Alternatively, the dressing water nozzles 29 may be glued or sealed into the tabletop deck assembly apertures 55 or snap-fitted into the apertures 55. Even more alternatively, nozzle openings, including central openings 33 and nozzle openings 32 may be machined directly into bosses which are molded into the tabletop deck assembly 4 at locations where apertures 55 would otherwise be provided. In such an embodiment (not shown), apertures 55 are not formed into the tabletop deck 4, and the machined nozzles may not be replaceable or interchangeable as the nozzles 29 shown in the drawings. Moreover, in such an embodiment, nozzle openings 32 may need more frequent cleaning if filtered dressing water is not used.

A diverter feature 40 such as one or more fang-shaped protrusions may be provided at the discharge end 57 of the shaker table apparatus 100 to prevent sulfides from entering the final

concentrate basin 50, thus improving final concentrate grade. Concentrate basin 50 catches the most highly-refined concentrate in the last drain (i.e., drain number 8). Diverter feature 40 moves sulfide-containing materials to the MIDS2 basin 51, which collects the second highest grade of concentrate of the system 60. A MIDS1 drain basin 52 is provided upstream of the MIDS2 basin 51 and may comprise multiple drains (i.e., drain numbers 4-6 as shown). Materials collected in the MIDS1 drain basin 52 are typically lower in grade than the materials received by the MIDS2 basin and/or concentrate basin 50. TAILS basin 53, which is located the furthest upstream on the tabletop deck assembly 4, may include multiple drains (i.e,, drain numbers 1-3 as shown). Material collected in the TAILS basin 53 may be very low in target value mineral composition, and may therefore be disposed of, recycled, or sent to another coarser concentrating step.

An electrical supply 58 is provided to supply power to the VFD 6. As shown in FIG. 12, the grouping of the shaker table apparatus's drains/buckets include: TAILS (lowest grade), MIDS1 (low grade), MIDS2 (high grade), and CONC (highest grade/smeltable gold). The distribution of recovered gold shows a marked superior performance of embodiments of the invention as compared to a Gemini GT1000 shaker table. It was found by the inventors that, in use, approximately 9% of the total recovered gold is expected in the TAILS sections 1, 2, and 3 -- as compared to approximately 24% for a conventional Gemini GT1000 table. It was also found that approximately 20% of the total recovered gold is to be expected in the MIDS1 sections 4, 5, and 6 -- as compared to approximately 39% for a conventional Gemini GT1000 table. Moreover, it was found that approximately 22% of the total recovered gold is to be expected in the MIDS2 section 7 -- as compared to approximately 28% for a conventional Gemini GT1000 table. It was also found that approximately 56% of the total recovered gold is to be expected in the CONC section number 8 -- as compared to only 9% for a conventional Gemini GT1000 table. It is believed that the one or more diverter features 40 driving sulfides to the MIDS2 section 7 is responsible for increasing the final concentration grade obtained from the CONC basin 50.

FIG. 13 shows that in order to reach the tails trough 53, the feed must pass over approximately 20 processing grooves 59 after coming in contact with the molded infeed pad 5. The feed cannot bypass the grooves 59 in the same way that occurs on prior Gemini table geometries. The rounded feed end of the shaker table apparatus 100 generally prevents wall pounding/standing wave generation which typically occurs in the Gemini table. This prevents feed from 'dancing' or 'floating' its way to TAILS basin 53, and/or from bypassing the

processing grooves 53. However, if the tabletop deck 4 is well-overfed, there may be feed present at the rounded feed end 56 which could result in a bypass route to the TAILS basin 53.

FIG. 15 shows sulfides diverting means 40 according to some embodiments. Sulfides bands required a diverter feature 40 to channel the sulfides to the MIDS2 basin 51, in order to prevent contamination of the CONC trough 50. This diverter feature 40 may be incorporated into tabletop deck assemblies 4 described herein, according to various applications of the invention.

According to some embodiments, groove/separation jump patterns may be provided which are much more extended than prior devices. The result is more processing area, more processing geometry (e.g., grooves and/or separation jumps), and improved feed end geometries. The rounded feed end 56 serves to eliminate any 'bypass-to-tails' avenues for feed to flow. Extended feed end grooves 59 may be incorporated to prevent "straight to tails" waterslide effect, and the rounded feed end 56 profile prevents standing wave creation. Additional feed end upgrade separation jumps may be provided in the tabletop deck 4. Additional grooves 59 may be provided to upgrade more TAILS basin 53-bound concentrate (i.e., material which would otherwise be delivered to one of the TAILS drains 1-3) to the MIDS1 basin 52 and/or MIDS2 basin 51. The dressing length of the tabletop deck 4 may also be increased to provide more upgrading of the concentrate collected from the CONC basin 50.

FIG. 16 shows a table test for shaker table apparatus 100 according to some embodiments. The test was successfully concluded. The feed terminated, and the table cleared itself within 1-2 minutes upon termination of feed.

Turning now to FIG. 20, a separation system 60 incorporating a novel shaker table apparatus 100 according to the invention is shown. The system 60 is similar to one described in US Patent No. US-6,818,042 (which is herein incorporated by reference). The system 60 comprises a shaker table apparatus 100 according to the present invention, a feed auger 61 for moving feed material to the feed end 56 of the tabletop deck assembly 4, an agitated sump 62, a concentrator flush feed point 63, a tails sump and pump 64 to move the tails away for disposal or to recycle to the shaker table apparatus 100, a lockable gold concentrate box 65, one or more easily-accessible dressing water valve manifolds 66, an access platform 67 for an operator, an access ladder 68 for an operator, a magnet belt separator 69 provided closely over the tabletop deck assembly 4 of the feed end 56 of the shaker table apparatus 100, a table feed funnel 70, a user platform 71, and a screen 72. In some embodiments, the screen 72 may be a SWECO-brand screen which may be undersized to the shaker table apparatus 100, but oversized to the

tails sump and pump 64. For example, screen 72 may comprise a 20 mesh vibrating screen, without limitation. In some embodiments, magnet separator 69 may be a 10" x 6' plate magnet with a moving conveyor belt and scraper mechanism. In other embodiments, a drum magnetic separator may be utilized.

In some embodiments, the shaker table apparatus 100 disclosed herein may comprise a variable stroke length in order to fine-tune recovery performance. The apparatus 100 may comprise an adjustable spring intensity to change motion kinetics of the device. A water flowmeter may be provided to accurately measure the amount of feed dilution, which may be subsequently controlled (e.g., using a number of control valves) to adjust feed dilution parameters.

In some embodiments, the shaker table apparatus 100 described herein may comprise a PLC/HMI combination which may be compatible with PROFINET TCP/IP/Ethernet communication protocol. In some embodiments, the dressing water nozzles 29 may be individually-controlled nozzles which allow for finer adjustments of wash water. The nozzles 29 may be manually-controlled, but could be automated with off-the-shelf control valves that communicate with a control system having a CPU or PLC. The CPU/PLC may be operatively coupled with or make up a portion of said aforementioned PLC/HMI. In some embodiments, water filtration steps may be utilized to improve the quality of dressing water and thereby reduce dressing water nozzle 29 clogging. In such instances, filtration means may be provided upstream of the dressing water nozzles 29, tubes 19, and/or manifolds 17, 18, 66. In some embodiments, an accelerometer with HMI readout may be provided for improved repeatability of the motion of tabletop deck 4. In some embodiments, the tabletop deck 4 may be canted at a pitch angle between one and three degrees, and may be preferably canted at a pitch angle of approximately two degrees. Levels, inclinometers, level indicating indicia, or self-leveling apparatus may be employed to maintain tabletop pitch angle. In most simple embodiments, a manual inclinometer may be utilized for initial setup. Buzzers or equivalent awareness means may be employed so that if the pitch angles deviate from optimum operating conditions or predetermined settings having set minimum and/or maximum thresholds, an operator may be alerted to check the table orientation. Table geometry and groove 59 profiles may be designed and optimized for maximized precious metal recovery, without limitation, and the particular unique patterns shown in the figures are for illustrative purposes only.

A contractor or other entity may provide a shaker table apparatus or operate a shaker table apparatus in whole, or in part, as shown and described. For instance, the contractor may

receive a bid request for a project related to designing or operating a shaker table apparatus, or the contractor may offer to design any number of shaker table apparatus or components thereof, or may offer to provide a process for a client involving one or more of the features shown and described herein. The contractor may then provide, for example, any one or more of the devices, features, or steps shown and/or described in the embodiments discussed above. The contractor may provide such devices by selling those devices or by offering to sell those devices. The contractor may provide various embodiments that are sized, shaped, and/or otherwise configured to meet the design criteria of a particular client or customer. The contractor may subcontract the fabrication, delivery, sale, or installation of a shaker table apparatus or a component of the devices disclosed, or of other devices used to provide said devices. The contractor may also survey a site and design or designate one or more storage areas for storing the material used to manufacture the shaker table devices disclosed herein, or for storing the devices themselves and/or components thereof. The contractor may also maintain, modify, or upgrade the provided devices or prior devices. The contractor may provide such maintenance or modifications by subcontracting such services or by directly providing those services or components needed for said maintenance or modifications, and in some cases, the contractor may modify a preexisting shaker table apparatus, manifold, tabletop, or parts thereof with a "retrofit kit" to arrive at a modified apparatus comprising one or more method steps, devices, components, or features of the systems and processes discussed herein.

Although the invention has been described in terms of particular embodiments and applications, one of ordinary skill in the art, in light of this teaching, can generate additional embodiments and modifications without departing from the spirit of or exceeding the scope of the claimed. For example, as previously stated, there may be an angle of tilt of tabletop centerline relative to the horizontal (flat ground) in some embodiments. This angle of tilt may range from 0 to 10 degrees, (e.g., 1-5 degrees, for instance 3.3 degrees without limitation). Moreover, various materials may be used to construct a shaker table according to the invention. In some embodiments, tabletops may be constructed of finished fiberglass formed by urethane toolboard "master patterned" molds. In some embodiments, dressing water nozzles 29 shown may be integral with the table, such that the table is formed or otherwise molded with raised bosses which are machined to integrally form the nozzles 29 to the table. In some embodiments, nozzles may comprise simple low profile pipe tips which are bent at 90 degrees and pressed into small holes in the table. The dressing water tubes 19,

themselves, may be bent and secured to the tabletop deck assembly 4 to form an alternative low-profile dressing water nozzle.

Accordingly, it is to be understood that the drawings and descriptions herein are proffered by way of example to facilitate comprehension of the invention and should not be construed to limit the scope thereof.

REFERENCE NUMERAL IDENTIFIERS

1	SUPPORT FRAME WELDMENT
2	ROCKER PLATE BEARING
3	ROCKER PLATE WELDMENT
4	TABLETOP DECK ASSEMBLY
5	INFEED PAD MOLDED
6	VFD
7	DRIVE GEARMOTOR
8	ECCENTRIC BUSHING
9	DRIVE BEARING
10	DRIVE ADAPTER
11	DRIVE ROD WELDMENT
12	SPRING SEAT (INNER)
13	SPRING SEAT (OUTER)
14	DRIVE SPRING
15	DRAIN AND NUT
16	CAST BUMPER
17	DRESSING WATER VALVE MANIFOLD (LH)
18	DRESSING WATER VALVE MANIFOLD (RH)
19	DRESSING WATER TUBE
20	MANIFOLD SUPPORT 1 -WELDMENT
21	MANIFOLD SUPPORT 2 - WELDMENT
22	DRAIN HOSE
23	FEED HOPPER SUPPORT WELDMENT
24	HOPPER BRACKET - WELDMENT
25	FEED HOPPER - WELDMENT
26	WATER FILTER MANIFOLD ASSEMBLY
27	HOLD DOWN PATTERN
28	WATER SUPPLY HOSE CONNECTION BARB
29	DRESSING WATER NOZZLE
30	HEAD - LOW PROFILE
31	BODY
32	NOZZLE OPENING
33	CENTRAL OPENING
34	O-RING
35	OPTIONAL OUTER THREAD
36	BODY
37	COLLET
38	TORQUE-ENGAGING SURFACE
39	CAVITY
40	DIVERTER FEATURE
50	CONCENTRATE (HIGH GRADE) BASIN (DRAIN #8)
51	MIDS2 (HIGH GRADE) BASIN (DRAIN #7)
52	MIDS1 (LOWER GRADE) BASIN (DRAIN #4, #5, AND #6)
53	TAILS BASIN (DRAIN #1, #2, AND #3)
54	DRESSING WATER NOZZLE ARRAY
55	APERTURES
56	FEED END
57	DISCHARGE END

58	ELECTRICAL SUPPLY TO VFD
59	GROOVES
60	SEPARATION SYSTEM
61	FEED AUGER
62	AGITATED SUMP
63	CONCENTRATOR FLUSH FEED POINT
64	TAILS SUMP AND PUMP
65	LOCKABLE GOLD CONCENTRATE BOX
66	DRESSING WATER VALVE MANIFOLDS
67	ACCESS PLATFORM
68	ACCESS LADDER
69	MAGNETIC SEPARATOR
70	TABLE FEED FUNNEL
71	USER PLATFORM
72	SWECO SCREEN
100	SHAKER TABLE APPARATUS

CLAIMS

We claim:

1. A shaker table apparatus (100) comprising;

a tabletop deck assembly (4) having a feed end and a discharge end;

at least one dressing water nozzle (29) having a low-profile with respect to said tabletop deck assembly (4); and,

at least one outboard dressing water valve manifold (17,18) which is operably connected to the at least one dressing water nozzle (29);

wherein said at least one outboard dressing water valve manifold (17,18) is positioned and configured so as to not require an operator to reach over the tabletop deck assembly (4) to adjust a flow of dressing water to said at least dressing water nozzle (29).

2. The shaker table apparatus of claim 1, wherein a dressing water tube (19) extends between the at least one dressing water nozzle (29) and said at least one outboard dressing water valve manifold (17,18).

3. The shaker table apparatus of claim 1, wherein the feed end of said tabletop deck assembly (4) is rounded, thereby creating a deliberate dead zone which forces material over processing grooves and eliminates short-circuiting found with conventional devices.

4. The shaker table apparatus of claim 1, wherein the feed end of said tabletop deck assembly (4) is located vertically above the discharge end of the table, thereby creating a tabletop deck assembly (4) angle of inclination between approximately 1 and 3 degrees.

5. The shaker table apparatus of claim 1, further comprising one or more diverter features (40) which are configured to improve concentrations at the discharge end.

6. The shaker table apparatus of claim 1, wherein said at least one water dressing nozzle (29) is separately provided to the tabletop deck assembly (4).

7. The shaker table apparatus of claim 6, further comprising a quick connect feature between said at least one water dressing nozzle (29) and said at least one outboard dressing water valve manifold (17,18).

8. The shaker table apparatus of claim 1, further comprising an overhead magnetic separator which is spaced from the tabletop deck assembly (4) by an overhead clearance gap less than 3.5 inches.

9. The shaker table apparatus of claim 1, further comprising a spin filter upstream of said at least one dressing water nozzle (29).

10. The shaker table apparatus of claim 1, wherein said at least one outboard dressing water valve manifold (17, 18) is provided at an easily-accessible peripheral location which is not centrally located on an upper portion of the tabletop deck assembly (4).

11. The shaker table apparatus of claim 1, wherein the at least one outboard dressing water valve manifold (17, 18) comprises two outboard dressing water valve manifolds (17, 18).

12. The shaker table apparatus of claim 11, wherein each of the two outboard dressing water valve manifolds (17, 18) are positioned on opposing sides of the tabletop deck assembly (4).

13. The shaker table apparatus of claim 11, wherein each of the two outboard dressing water valve manifolds (17, 18) are positioned on the same side of the tabletop deck assembly (4).

14. A method of operating a shaker table apparatus (100) comprising a tabletop deck assembly (4) having a feed end and a discharge end; at least one dressing water nozzle (29) having a low-profile with respect to said tabletop deck assembly (4); and, at least one outboard dressing water valve manifold (17,18) which is operably connected to the at least one dressing water nozzle (29); wherein said at least one outboard dressing water valve manifold (17,18) is positioned and configured so as to not require an operator to reach over

the tabletop deck assembly (4) to adjust a flow of dressing water to said at least dressing water nozzle (29); the method comprising:

engaging a portion of the at least one outboard dressing water valve manifold (17,18); and,

adjusting a flow of dressing water said at least one dressing water nozzle (29) without reaching over the tabletop deck assembly (4).

15. A dressing water nozzle (29) for a tabletop deck assembly (4) of a shaker table apparatus (100), the dressing water nozzle (29) comprising:

a cavity (39) for receiving an o-ring (34) and a body (36);

a collet (37)adapted to accept the outer diameter of a tube;

a central opening (33); and,

one or more nozzle openings (32) intersecting the central opening.

16. The dressing water nozzle (29) of claim 15, further comprising a mushroom shape.

17. The dressing water nozzle (29) of claim 16, further comprising a rounded head configured to establish a low-profile with respect to said tabletop deck assembly (4).

18. The dressing water nozzle (29) of claim 15 further comprising one or more torque-engaging surfaces.

19. The dressing water nozzle (29) of claim 18, wherein said one or more torque-engaging surfaces are provided as one or more flats or slots.

20. The dressing water nozzle (29) of claim 15, wherein said nozzle openings are provided on the same side of the dressing water nozzle (29), thereby providing a one-sided dressing water nozzle (29).

21. The nozzle of claim 15 wherein said nozzle openings are provided on opposing sides of the dressing water nozzle (29), thereby providing a double-sided dressing water nozzle (29).

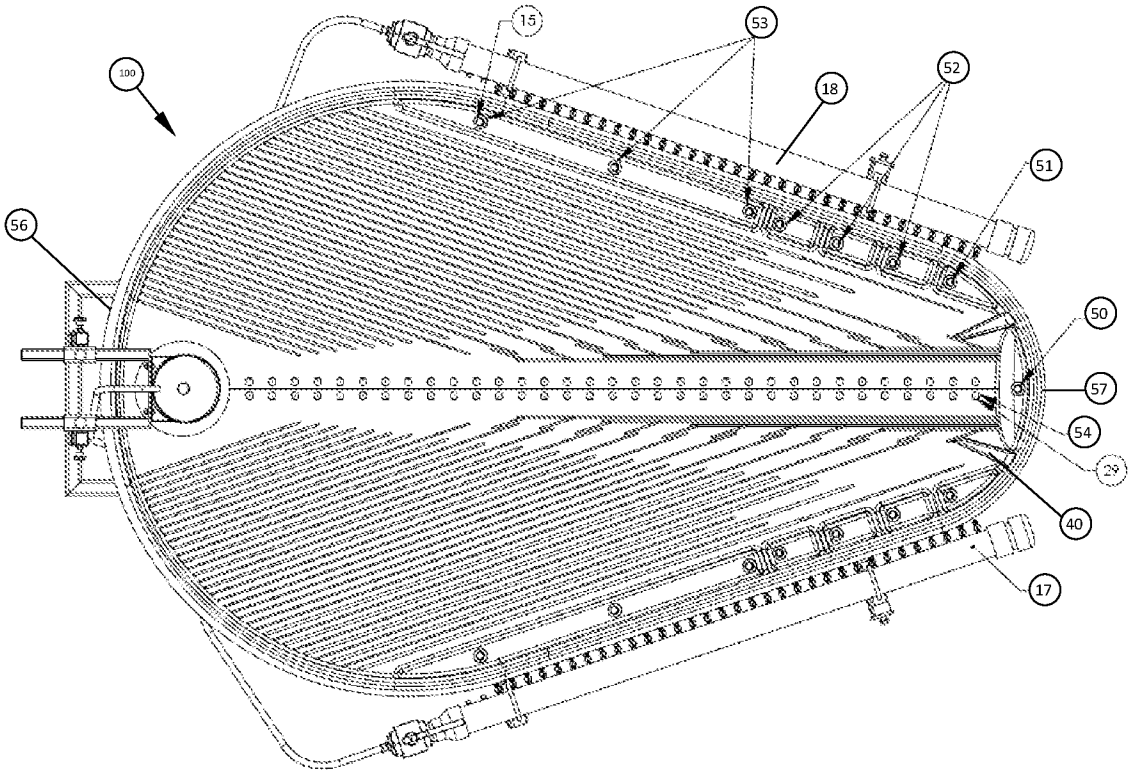


FIGURE 1

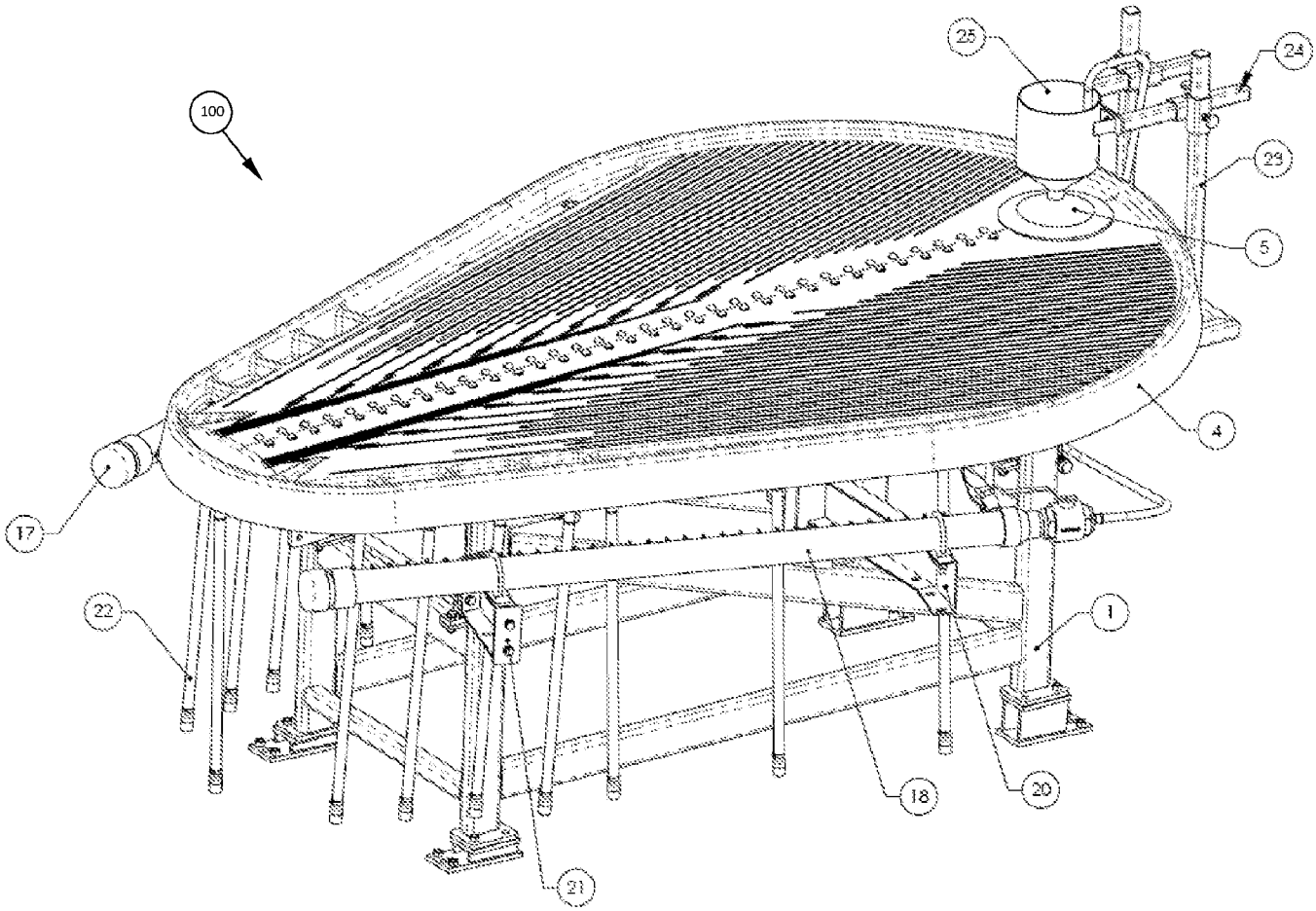


FIGURE 2

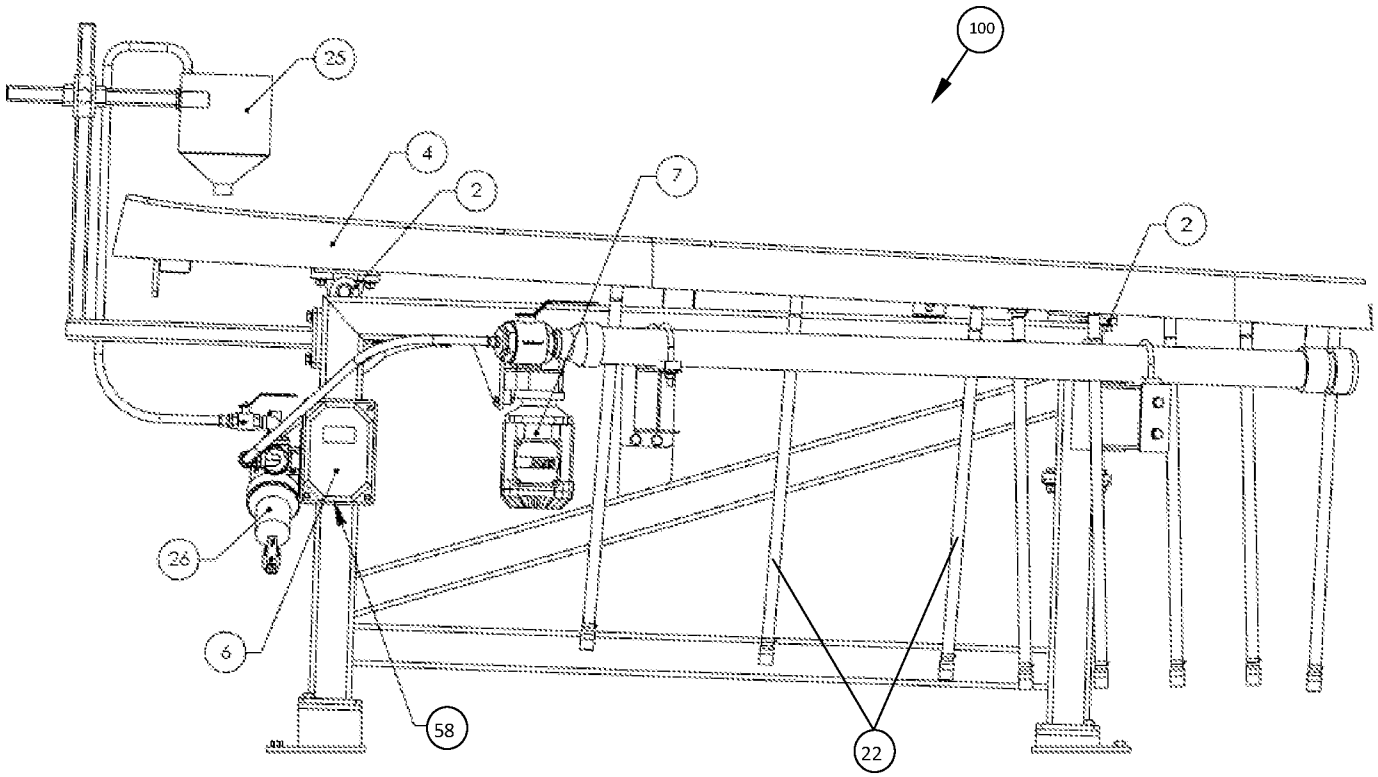


FIGURE 3

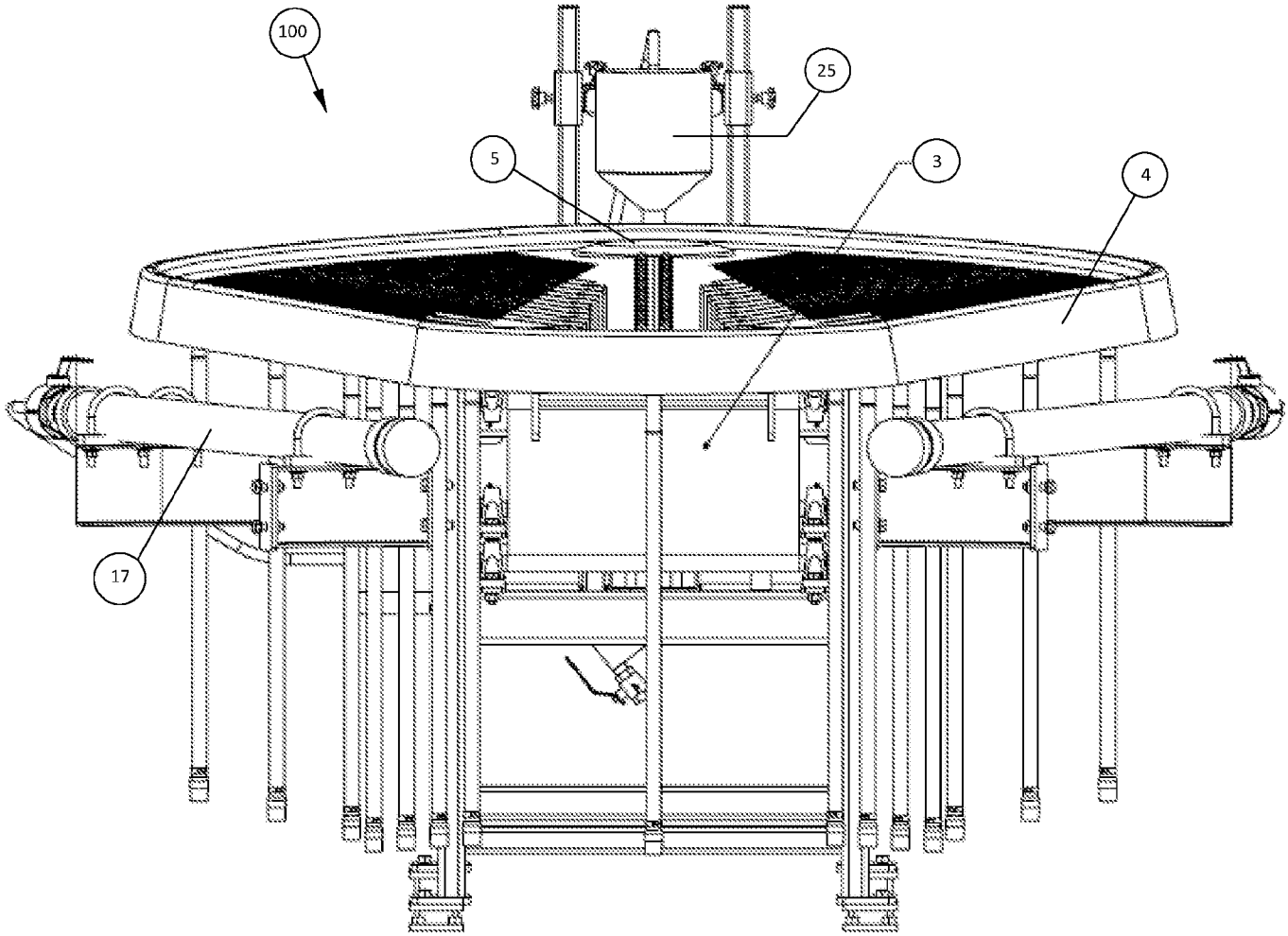


FIGURE 4

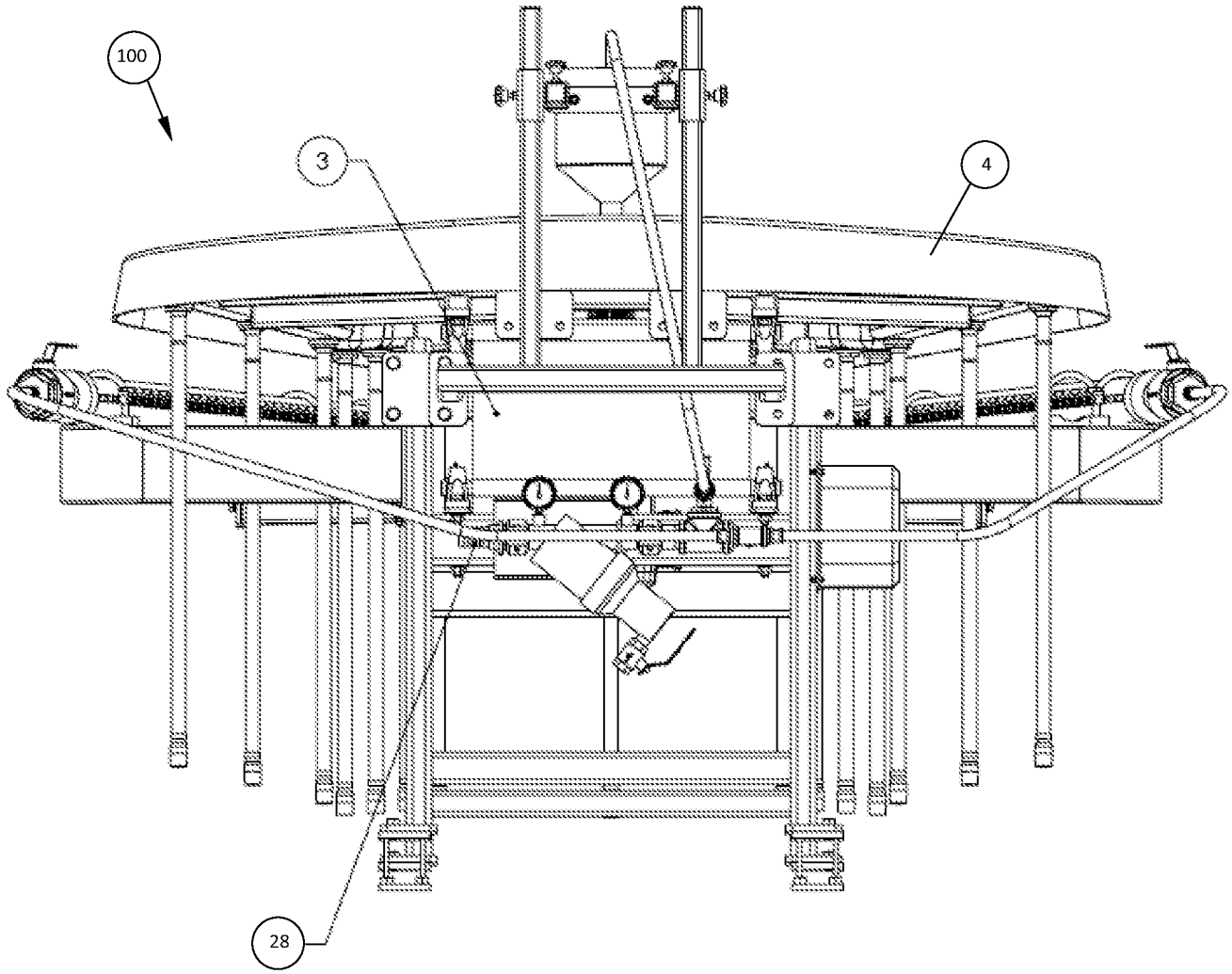


FIGURE 5

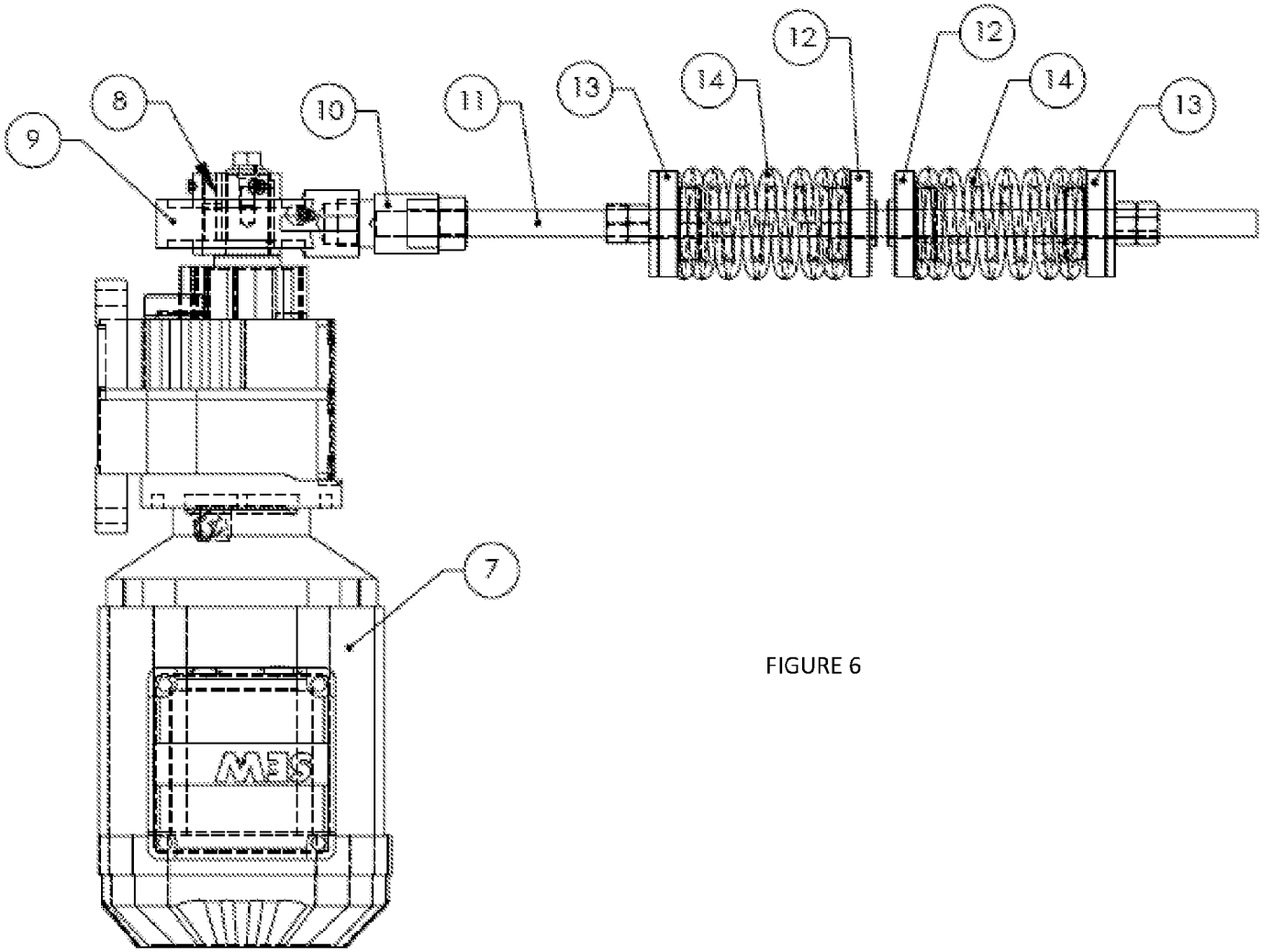


FIGURE 6

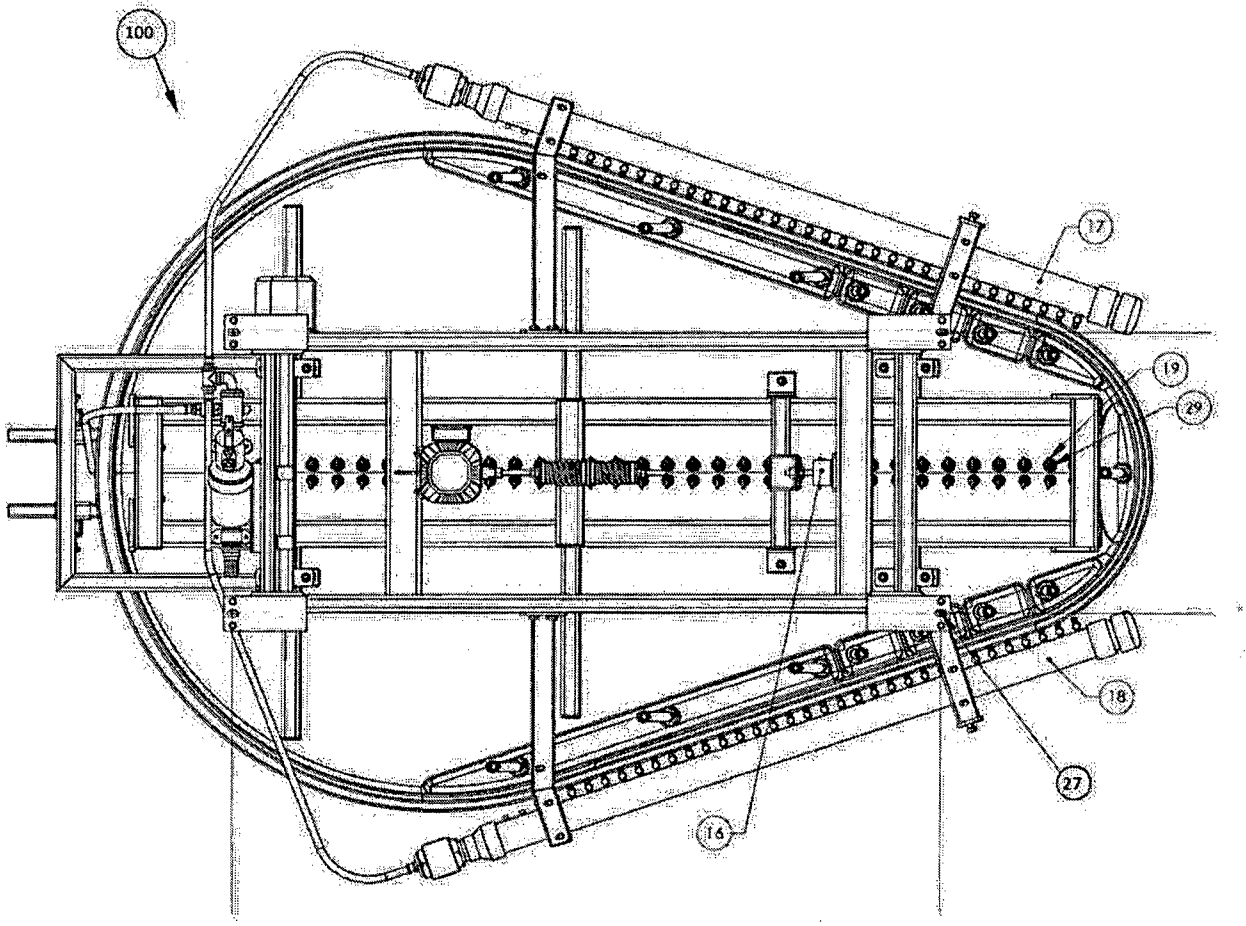


FIGURE 7



FIGURE 8

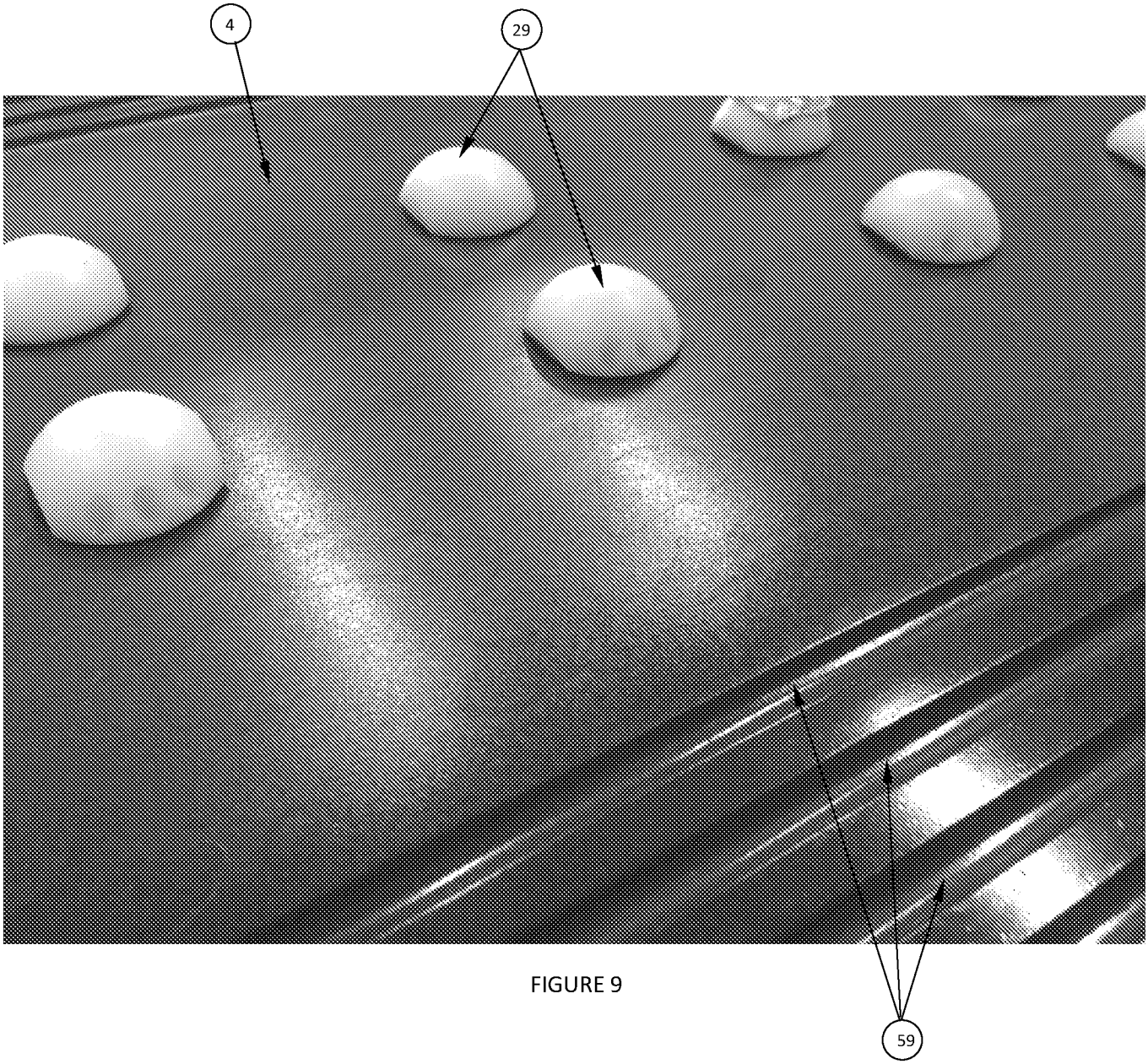


FIGURE 9

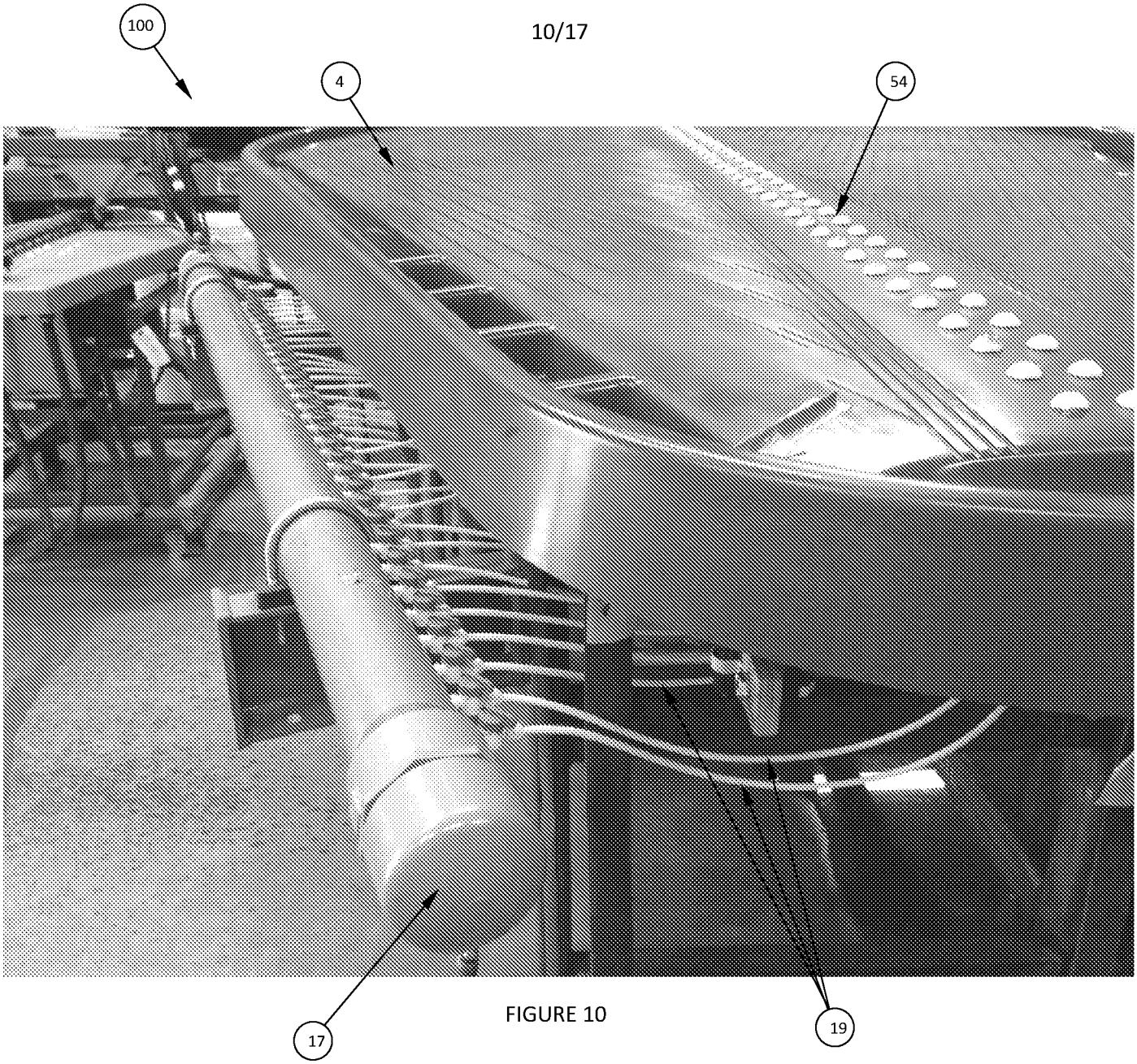


FIGURE 10

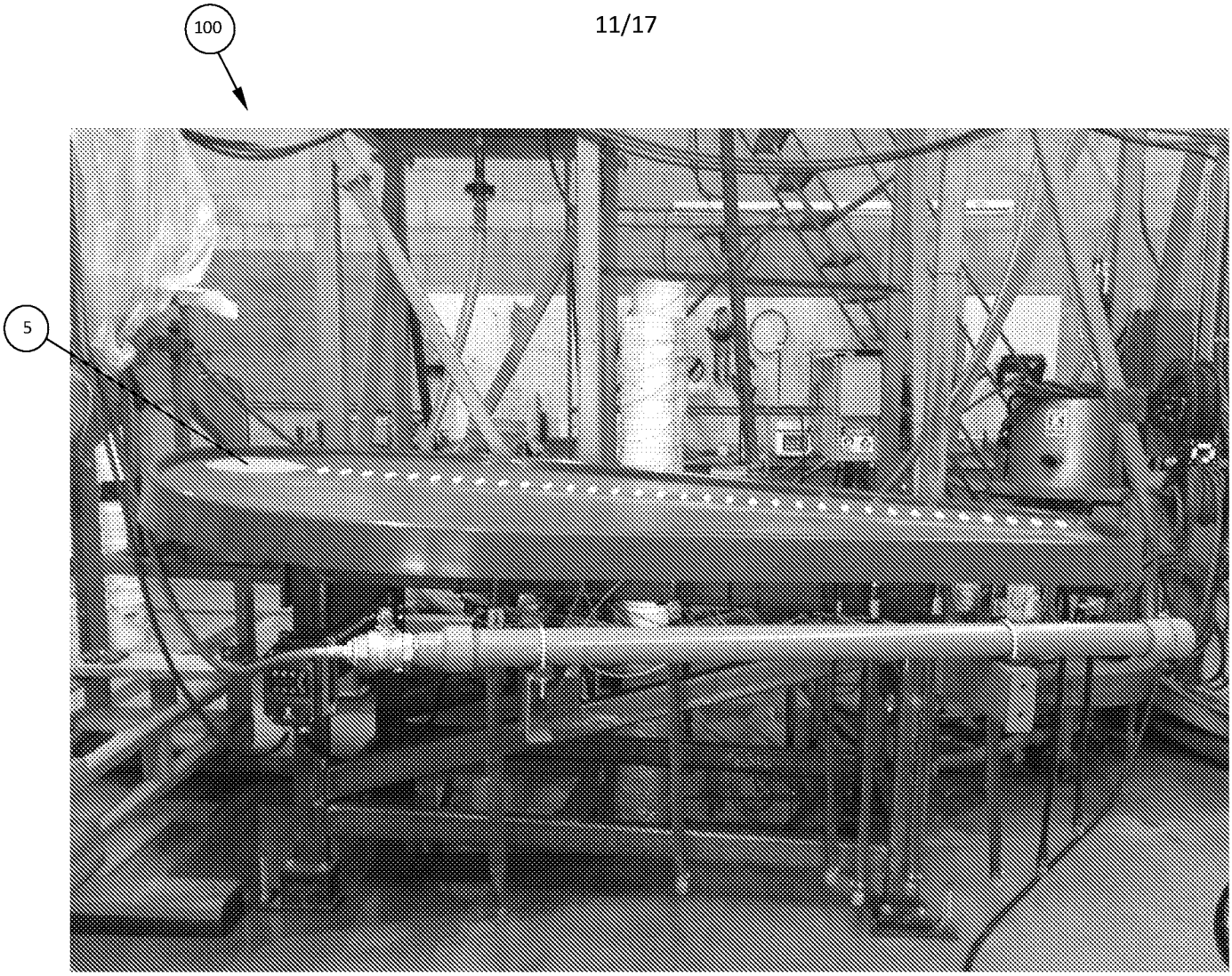


FIGURE 11

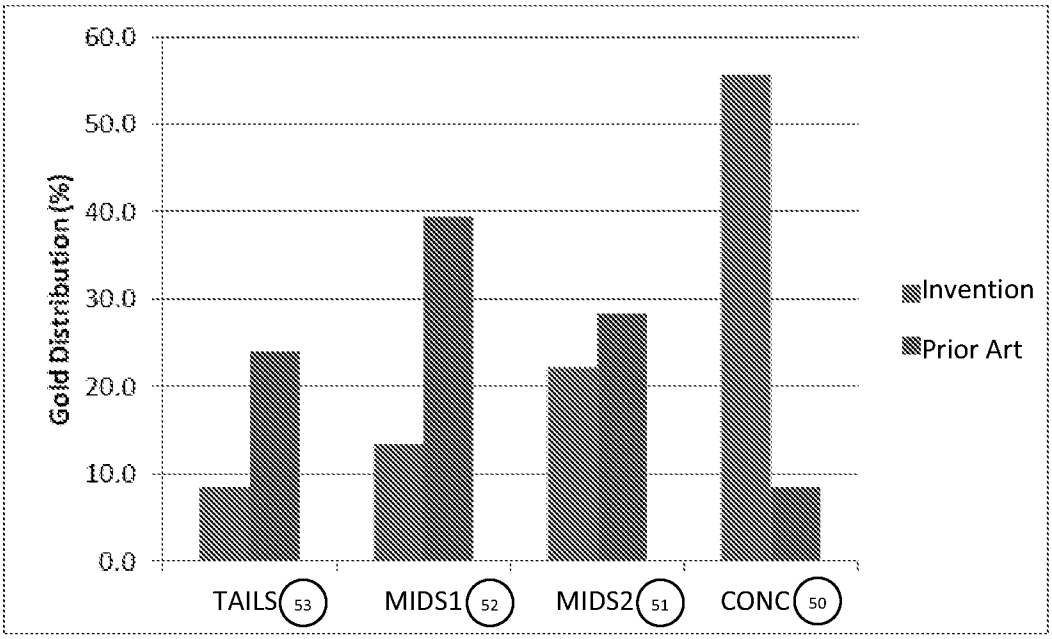

60.0
50.0
40.0
30.0
20.0
10.0
0.0
Gold Distribution (%)
TAILS 53
MIDS1 52
MIDS2 51
CONC 50
Invention
Prior Art

FIGURE 12

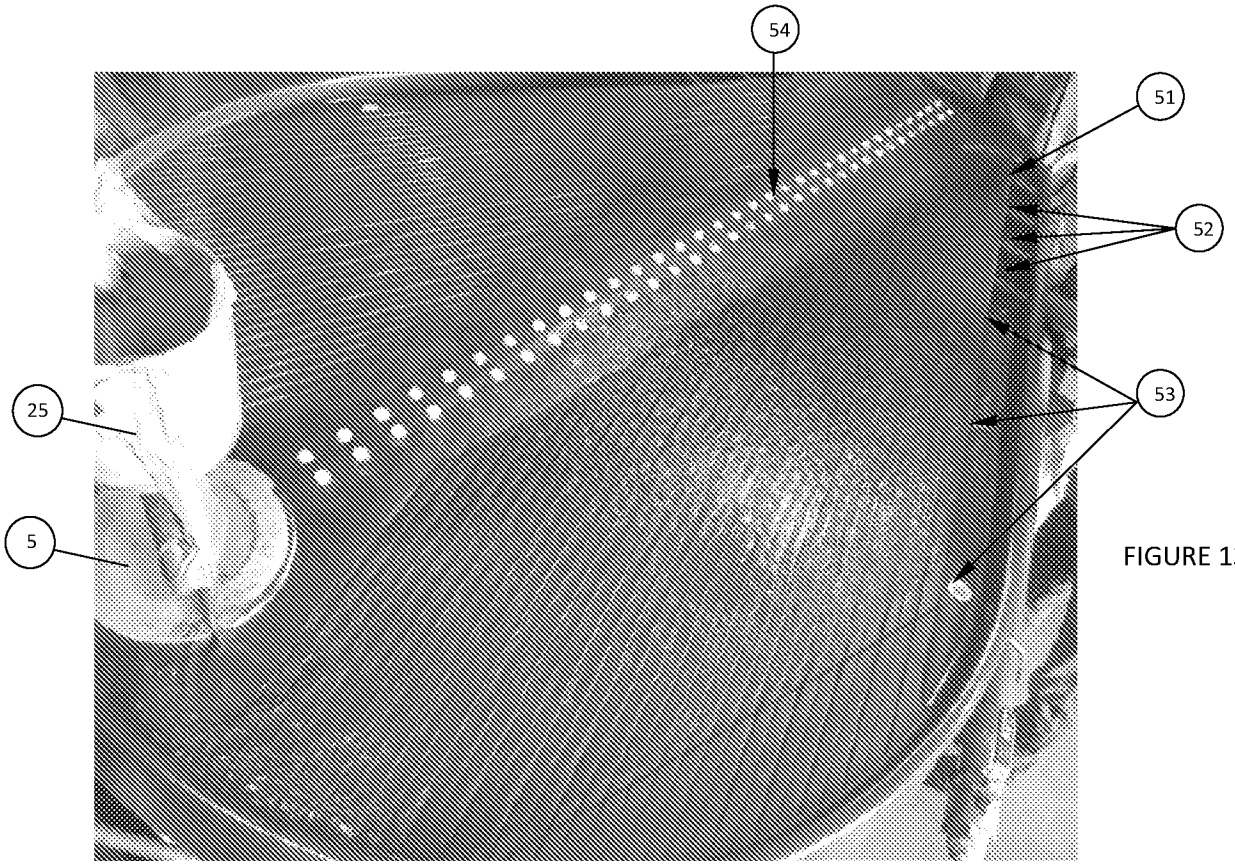


FIGURE 13

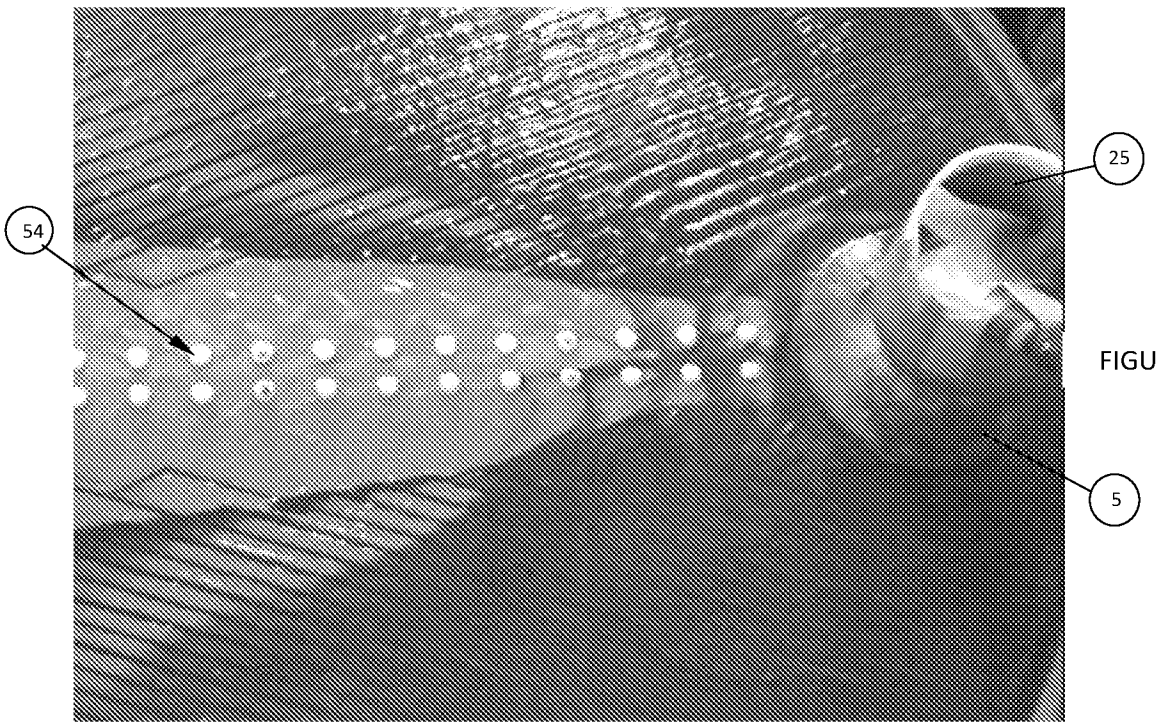


FIGURE 14

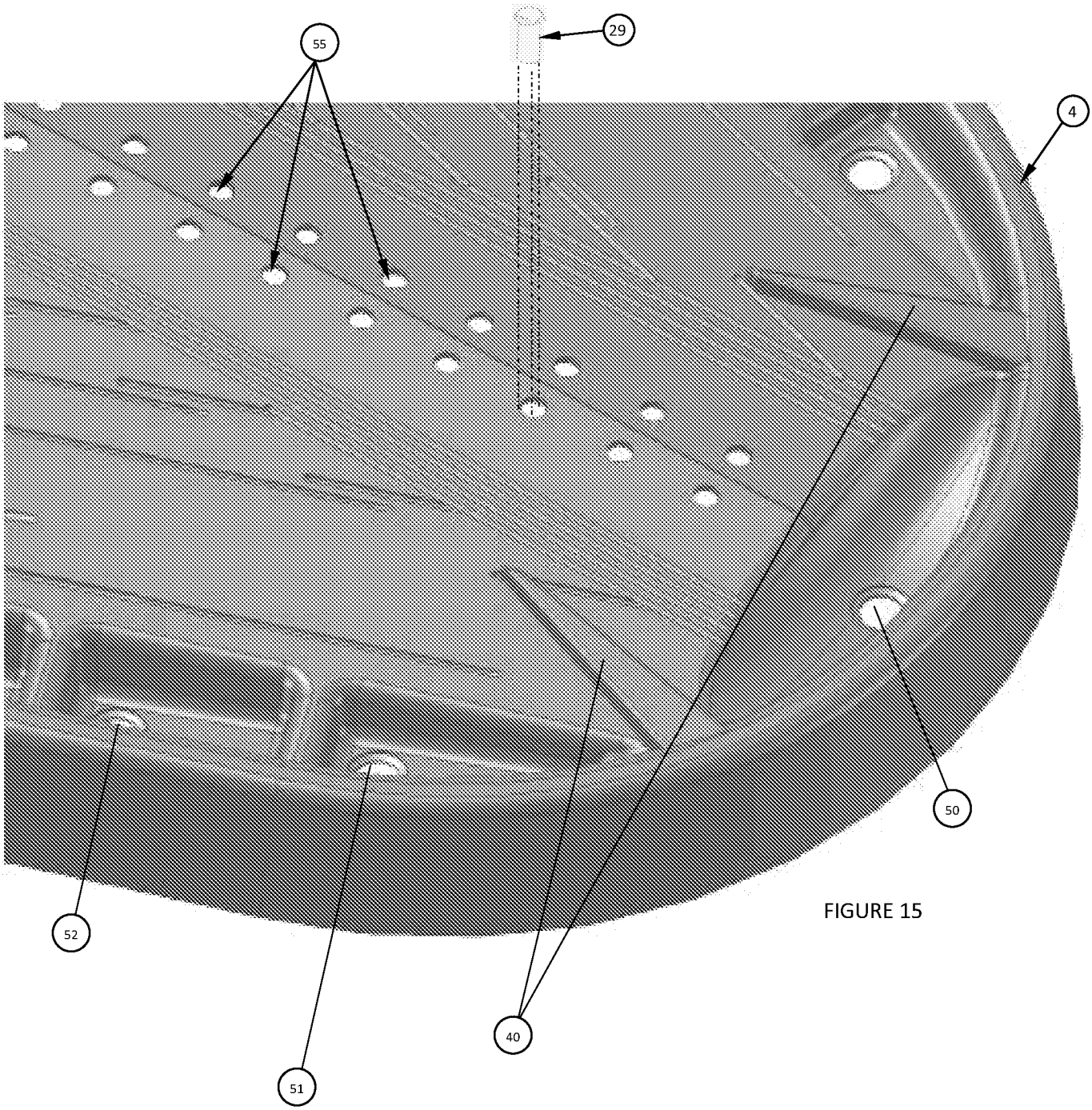


FIGURE 15

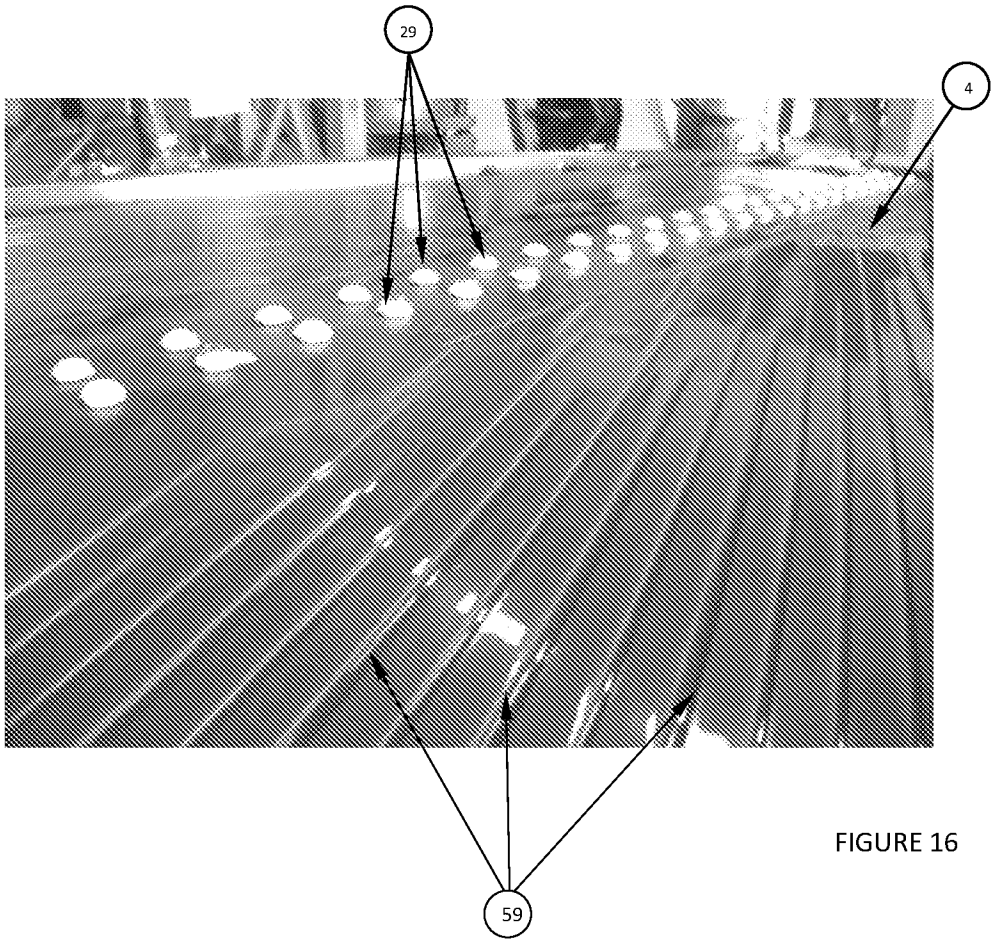


FIGURE 16

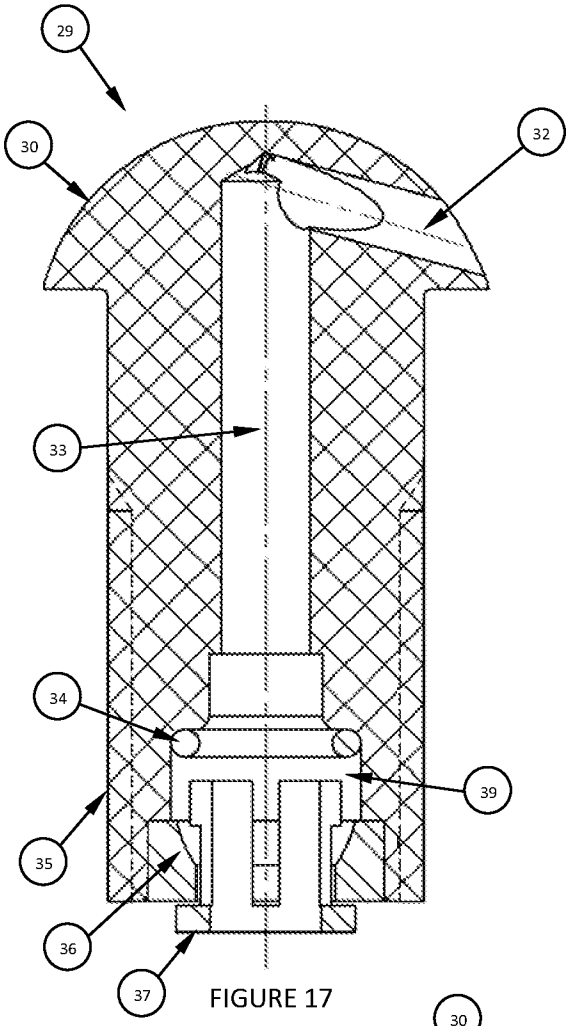


FIGURE 17

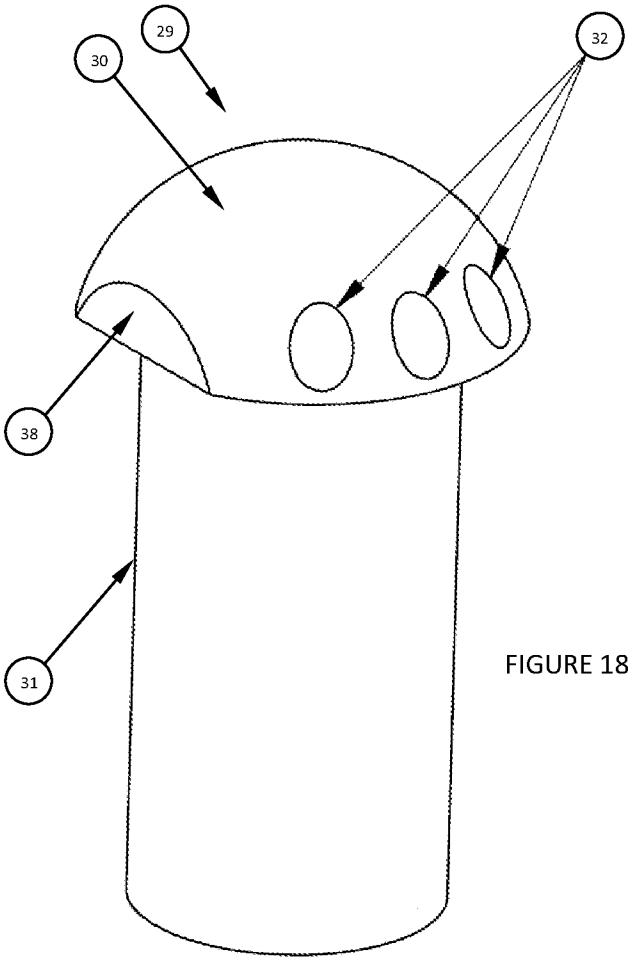


FIGURE 18

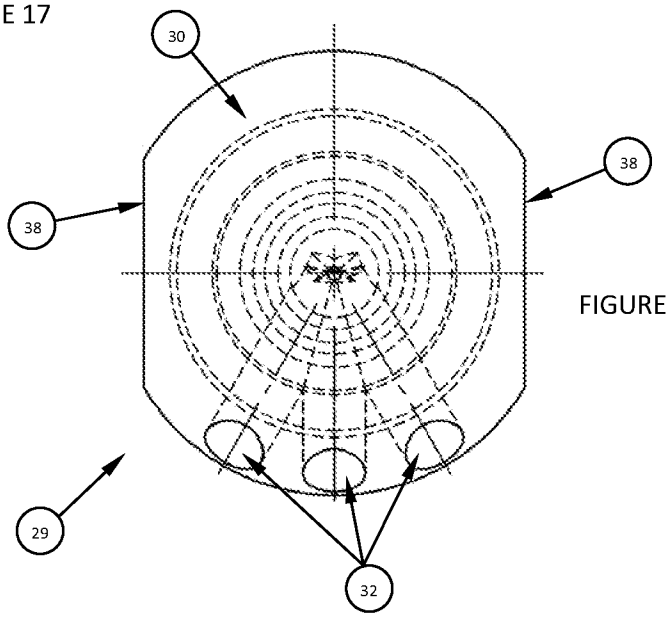


FIGURE 19

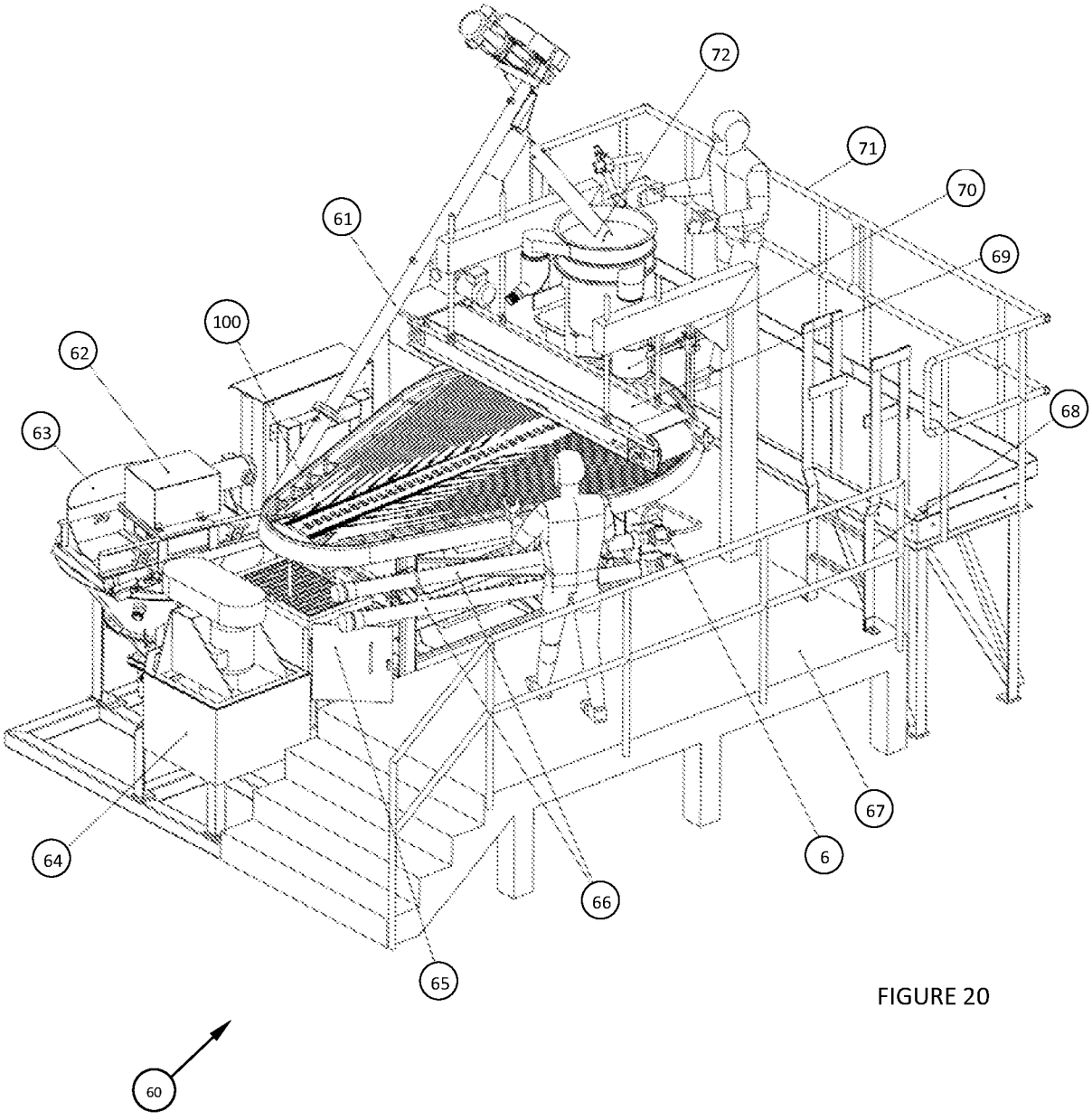


FIGURE 20