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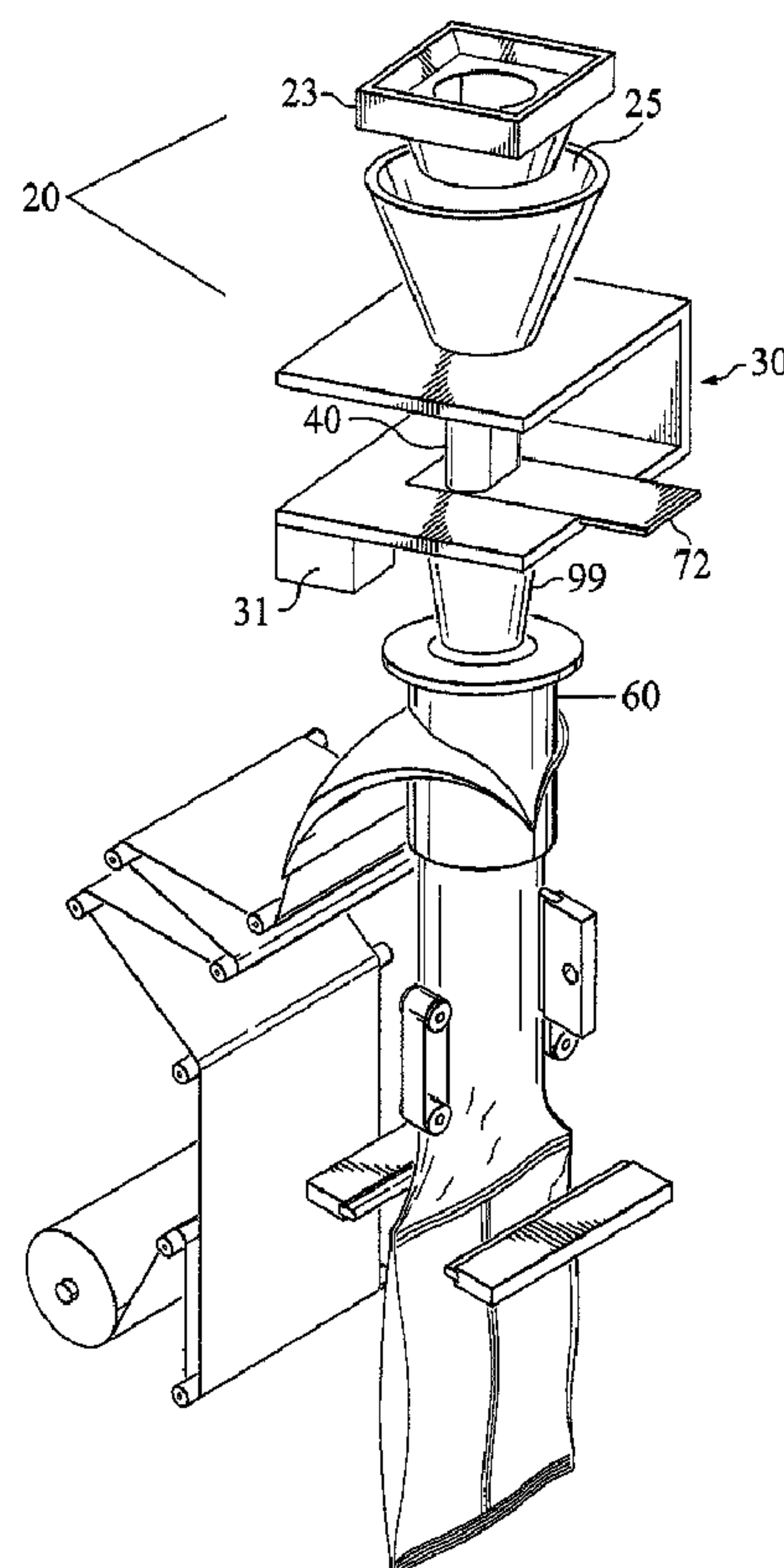
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(71) Demandeurs/Applicants:
FRITO-LAY NORTH AMERICA, INC., US;
DOUGLAS MACHINE INC., US

(72) Inventeurs/Inventors:
BIERSCHENK, PATRICK J., US;
BRENKUS, FRANK M., US;
MELANSON, AMELINDA, US;
REAVES, JERRY M., US;
KRAUSE, LEON J., US;
GUST, RONALD M., US

(74) Agent: DEETH WILLIAMS WALL LLP

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(54) Title: PACKAGING RELATED PROCESS, SYSTEM & APPARATUS



(57) Abrégé/Abstract:

A method for compacting a slug of product and apparatus for accomplishing the same. The invention describes collecting weighed product in an intermediate settling device to form a compact slug of product. The device can comprise a single settling chamber or



(57) **Abrégé(suite)/Abstract(continued):**

can comprise multiple settling chambers which are axially rotatable. The slug can be compacted by jostling and/or vibrating the settling device. Thereafter, the product is discharged to a packaging apparatus. Because the product in the final package is denser, a smaller package can be utilized reducing manufacturing and shipping costs.

ABSTRACT

A method for compacting a slug of product and apparatus for accomplishing the same. The invention describes collecting weighed product in an intermediate settling device to form a compact slug of product. The device can comprise a single settling chamber or can comprise multiple settling chambers which are axially rotatable. The slug can be compacted by jostling and/or vibrating the settling device. Thereafter, the product is discharged to a packaging apparatus. Because the product in the final package is denser, a smaller package can be utilized reducing manufacturing and shipping costs.

PACKAGING RELATED PROCESS, SYSTEM & APPARATUS**Technical Field**

5 The present invention generally relates to the field of packaging, more particularly, to any or all of processes, systems and apparatuses to aid product packaging and/or for combined package manufacturing and product packaging, and more particularly still, but not exclusively, to processes, systems and apparatuses for at least settling a metered charge of a settleable product in advance of packaging/bagging in furtherance of achieving a volumetric
10 reduction of the metered charge of settleable product.

BACKGROUND OF THE INVENTION

Processes for packaging, for instance, bagging, settleable products are well known and numerous. One illustrative, non-limiting class of commonly bagged settleable products is
5 comprised of foodstuffs, more particularly, snack foods.

Arguably, the most well known member of the snack food family are those foodstuffs characterized as "chips," e.g., potato, corn, tortilla, etc., salty, savory, or otherwise. With documented sales of packaged snacks at \$68 billion in 2008 (reportlinker.com), Packaged Facts of Rockville, Maryland (U.S.A.) projects sales to approach \$82 billion by 2013, a total
10 market increase of about 20%. By all accounts, despite the recent/current economic downturn and its impact on household budgets and the like, consumers are snacking more than ever. In as much as a variety of plausible rationales are generally provided for the increased and increasing sales of such foodstuffs, the fact remains that there exists ample opportunity for increased revenues for the manufacturers of such foodstuffs, and, it is hoped, increased
15 profits.

Beyond the introduction of new snack foods (e.g., 350+ new salty snack launches in the U.S. in 2009 as per Mintel's (NY, U.S.A.) Global New Products Database), one of several focus areas believed advantageous with regard to hoped for rising revenues and profit is product packaging. For example, among other things, the sale of a fixed quantity, i.e., mass,
20 in an otherwise smaller bag, sack, etc. (i.e., bag of smaller volume) reduces product packaging material costs via reduced material/resource consumption, thereby positively contributing to a profit and loss statement.

As depicted herewith, FIG. 1, bag manufacturing and packing processes are generally characterized by a metering station 20, a bag manufacturing and packaging station 22, and a
25 bag transfer or conveyance station 24. Such heretofore known bag manufacturing and packing systems are depicted herewith, FIGS. 2 & 3 (U.S. Pat. No. 7,328,544 (Yokota et al.), FIGS. 1 & 2 thereof), with a less "busy" depiction of a bag manufacturing and packaging station depicted herewith FIG. 4 (U.S. Pat. No. 5,732,532 (Fujisaki et al.), FIG. 1 thereof).

Generally, a metered charge (i.e., a select mass of product for packaging) exits a
30 metering station (FIGS. 2 & 3), or a hopper (FIG. 4). The metered charge is directed to a tube, or chute (e.g., a mandrel of a former (FIG. 3)) for passage therethrough. Roll fed film is directed toward and upon the mandrel, and ultimately thereabout, whereupon it is

longitudinally sealed to form a film sleeve (FIG. 4). Thereafter, the sleeve so formed is transversely sealed via a sealer underlaying the tube, so as to thusly receive and retain the metered charge of product, the transverse seal portion likewise cut, and a packaged/bagged product charge thereby formed and transferred from the station, via a chute conveyor or the
5 like, for subsequent post packaging processing.

Needless to say, a variety of real challenges were no doubt confronted, and to at least some extent overcome, in the course of developing the processes, systems and apparatuses of FIGS. 1-4 and the like. While Yokota et al. appear to have focused upon clinging bags exiting the bag manufacturing and packaging station (1:49-67), and Fujisaki et al. upon blockages of
10 the filing passage of the tubular mandrel (2:7-35), little if anything has been done in connection to pre-packaging preparation of the product, aside from establishing a metered feed of the product, to enhance the bag manufacturing and product packaging operations, and the quality and/or character of the packaged product. Thus, in light of at least the forgoing, it is believed that bag manufacturing and product packaging related challenges remain, with
15 real and perceived benefits believed obtainable. In furtherance of, among other things, packaging materials reduction, the delivery of a metered charge of improved character and/or quality, and the production of a bagged snack food or the like possessing a real and/or perceived improved character (e.g., an increased mass to volume ratio for the packaged product, a reduction in the amount of product fines or the like accompanying the packaged
20 product, etc.), it remains advantageous and desirable to provide new and/or improved pre-packaging preparatory steps, and attendant apparatus/systems, and thus an improved packaging related process, system and apparatus for a settleable product.

SUMMARY OF THE INVENTION

An apparatus to facilitate packaging of a settleable product, as well as a system incorporating same, and an attendant process is provided. The apparatus includes an actuable turret assembly, a turret assembly base, and a turret assembly actuator operatively
5 linked to the turret assembly for selectively actuating the turret assembly relative to the turret assembly base. The actuable turret assembly is characterized by product settling bins. Each product settling bin of the product settling bins is positionable, via actuation of the actuable turret assembly, for receipt of a metered charge of settleable product. Successive actuation of
10 the actuable turret assembly settles the metered charge of settleable product in furtherance of a discharge of a settled metered charge of settleable product from the apparatus to a packaging station.

The actuable turret assembly, or the product settling bins thereof, is advantageously, but not necessarily, of a modular design, being readily "changed-out," or in the case of the
15 bins, changed-out or physically altered via adaptation, so as to more efficiently handle the processing of a variety of settleable products, or a packaging objective of a select settleable product. The turret assembly is generally actuated, e.g., via, among other alternatives, an indexed rotation, so as to compact or settle the settleable product retained by a bin of the plurality of product settling bins. Actuation is advantageously, but not necessarily,
20 accomplished by a selectively controlled mechanical system, more particularly, via a servo-drive.

The bins of the product settling bins may be fairly characterized as tubes or sleeves, having "open" opposing ends. Generally, the bins include a metered charge ingress portion and a settled metered charge egress portion, with the ingress portion characterized by a
25 sectional area exceeding a sectional area of the egress portion. In the context of a rotary compaction, the bins are circumferentially arranged within the turret assembly or turret assembly body, and may be positioned in an offset condition to minimize product "mounding." A bin of particular utility is configured so as to include an ingress portion characterized by a funneled free end which delimits a metered charge reservoir which "feeds"
30 the remainder of the bin with successive actuations of the actuable turret assembly.

The turret assembly base is generally adapted to selectively permit passage of a settled metered charge of settleable product from a select bin, at, for example, a bin emptying site. More particularly, passage of the settled metered charge of settleable product from the bin positioned at the emptying site is achieved via a selective actuation of a settled metered

charge discharge port, e.g., gate assembly, over which filled product settling bins are positionable in furtherance of a discharge of a settled metered charge of settleable product from the apparatus to a packaging station, advantageously, to a bag forming mandrel having at least a segment comprising air passage vents.

5 Functionally, the actuatable turret assembly, via selective actuation, moves in relation to the turret base and the metering station overhead. More particularly, the actuation, in the form of an indexed rotation, proceeds in relation to a fill station/locus delimited by the metering station, and an emptying station/locus delimited by the turret base, namely, the discharge port thereof. Preferably, metered product will be received at the loading station and
10 released at the discharge station at approximately the same time.

 As bin "x" of "N" total bins of the actuatable turret assembly is positioned for emptying at the emptying station, bin "x+1" is advantageously positioned for initial filling at the fill station proximal to the emptying station, while bin "x+2" has undergone an initial settling/compaction iteration, and bin "x-1" proceeds to an "on-deck" position for emptying
15 (i.e., next in queue for emptying). Indexing occurs every time a settled and formed metered product charge is discharged from the turret assembly to or into the bag maker funnel/former, advantageously the lumen of a vented tube, with several charges of metered product introduced to the turret assembly throughout an actuation cycle. Via such operation, a settled and formed charge of a metered mass of settleable product, namely, a reduced volume
20 product mass, is ready for packaging. More specific features and advantages obtained in view of those features will become apparent with reference to the drawing figures and DETAILED DESCRIPTION OF THE INVENTION.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts common processing steps of known bag manufacturing and packaging process;

5 FIGS. 2 & 3 depict a known packaging/bagging system of Ishida Co., Ltd. (e.g., U.S. Pat. No. 7,328,544), not inconsistent with the process of FIG. 1;

FIG. 4 depicts a known packaging/bag forming system of House Foods Corp. (e.g., U.S. Pat. No. 5,732,532), not inconsistent with the process of FIG. 1;

FIG. 5 depicts an improved bag manufacturing and packaging process;

10 FIG. 6 is a perspective view of a filling apparatus employing one embodiment of the invention comprising a settling chamber;

FIG. 7 depicts a preferred, not limiting settling assembly, above isometric view, associated with the settling or settling/forming station of the improved bag manufacturing and packaging process of FIG. 5;

15 FIG. 8 is a plan view of the settling assembly of FIG. 7;

FIG. 9 is a below isometric view of the settling assembly of FIG. 7;

FIG. 10 is a top profile view of a rotary settling device comprising multiple settling chambers in their discharging and receiving positions;

20 FIG. 11 is a perspective view of a rotary settling device comprising multiple settling chambers in a mid-rotation position; FIG. 12 is a below perspective view of a subassembly of the settling assembly of FIG. 7, see especially FIG. 9, namely, a gate assembly;

FIG. 13 is an exploded view of the subassembly of FIG. 12;

FIG. 14 is an above isometric view of the turret assembly of the settling assembly of FIG. 7;

25 FIG. 15 is an above isometric view of an alternate turret assembly, with FIG. 15A directed to an alternate sleeve or container configuration;

FIG. 16 is an above isometric view of the settling assembly of FIG. 7 in combination with an improved tube/mandrel of a bag manufacturing station; and,

30 FIG. 17 is an above isometric view of the settling assembly of FIG. 7, with substituted turret assembly, in combination with an improved tube/mandrel of a bag manufacturing station;

FIG. 18 is a perspective view of a filling apparatus similar to that of FIG. 6 comprising a settling chamber and vacuum relief holes;

FIG. 19 depicts, in above isometric, cooperative elements of a combined settling, settling/forming station and bag manufacturing and packaging station, parts removed;

FIG. 20 depicts, in below isometric, the combination of FIG. 19; and,

FIG. 21 is a view as FIG. 20, with bag manufacturing and packaging station elements
5 removed to show underlying details.

DETAILED DESCRIPTION OF THE INVENTION

Generally, this invention relates to a method and apparatus for compacting a slug of product and increasing compaction of product within a package. Compaction refers to the density of product within a package. A goal is to form and compact an intermediate slug of product which is subsequently discharged into a packaging apparatus and eventually into a package. An additional goal in one embodiment is to ensure the increased compaction remains throughout the packaging operation. Applicants have found forming and compacting an intermediate slug and then discharging said slug for packaging results in increased product compaction. A slug of product refers to a collected charge of product.

Because of the resulting increased compaction of the product at the bagmaker, less settling occurs during the subsequent, shipping, handling, and displaying of the package. Thus, the apparatus and method of this invention ensures that the package displayed on the shelf will more resemble the package as seen at the bagmaker. As used herein, a bagmaker refers to any packaging apparatus. The method and apparatus can be utilized on a wide variety of bagmakers including but not limited to a vertical form, fill, and seal machine and horizontal form, fill, and seal machines, bag in a box apparatus, as well as boxing machines. Likewise, a packaging apparatus referred to as a fill seal bagmaker, whereby premade bags are opened, filled, and sealed, can also be utilized. The final packages described herein can comprise traditional flex packages associated with snack product, vertical packages, box packaging, bag in a box packaging, and other products containing product which is subject to settling.

The apparatus and method can be utilized to increase compaction of a variety of products including food products such as chips, pretzels, cookies, noodles, nuts, cereal, and seeds. Likewise, this invention also applies to individually wrapped products such as individually wrapped mints or other candies which are susceptible to settling. The apparatus and method also works for other various dry products including dog food, cat food, etc.

The description next immediately proceeds with general reference to FIG. 5, and FIGS. 6-11 of FIGS. 5-21. Processing steps of an improved bag manufacturing and packaging process are generally depicted in FIG. 5, namely, the addition of a product settling station, more particularly, a metered product settling and metered product charge forming station, to the process of FIG. 1. Preferred, non-limiting apparatuses to facilitate packaging (i.e., improved packaging) of settleable solids are generally depicted in FIG. 6 and the several views of FIGS. 7-11. Particulars with regard to subassemblies thereof, namely, a gate

assembly, as advantageously but not necessarily depicted in the views of FIGS. 12 & 13, and turret assemblies, as advantageously but not necessarily depicted in FIGS. 14 & 15, are likewise provided. Finally, contemplated apparatuses, equipped with the alternate turret assemblies of FIGS. 14 & 15, are depicted in combination with an improved tube/bag forming mandrel in FIGS. 16 & 17 respectively, as well as the major process elements of FIG. 6 likewise equipped in FIG. 18. Prior to proceeding with the detailed description, several preliminary matters warrant mention.

First, in as much as the subject packaging/packaging process improvements have origins in foodstuffs, more particularly, snack foods, and more particularly still, those fairly characterized as "chips," the subsequently disclosed process, system, and apparatus need not be limited to such "product." Settleable solid or semi-solid product, food stuff or otherwise, intended for metering and subsequent packaging, especially bagging, is contemplated for, among other things, an advantageous volume reduction via settling or compaction in advance of packaging. Notionally, a product charge (i.e., a predetermined weight (i.e., mass) of product sought for packaging) is to be volumetrically reduced without any departure in the quality or character of the product (e.g., in the case of chips or the like, appreciable breakage thereof). Volume reductions within a range of about 15-20% have been achieved, and, as should be readily appreciated, are a function of, among other things, the character and quality of the "product."

Second, in as much as the following description proceeds with regard to heretofore know processes and systems, it is not necessarily so limited. Commercially, it is believed advantageous and/or desirable, and arguable a necessity in relation to current "in-plant" operations, to provide a settling or settling/product charge forming station within the frame or frame work of an existing bag manufacturing and packaging station. A retrofit settling system (i.e., a modular or turn key station, which in turn may be adapted so as to have a modular character) is intended to fit above or into an existing bag maker frame in the area above an existing product funnel/former, with minimal bag maker modifications. Moreover, it is believed advantageous that the station itself be amenable to adaptation so as to accommodate the processing of a variety of products, products styles, and/or products charges (i.e., metered product quantities as manifest in a "small" or "large" package (e.g., bag) volume).

Third, in connection to a desire to produce a variety of different product "sizes," and again, as noted above, process a variety of products or product styles, product loss is to be minimized (i.e., the entirety of the product charge is to be packaged or bagged). For example, and without limitation, processing chips for the production of single serving bags presents

greater loss potential than processing chips for the production of "family size" bags. In as much as it has proven advantageous to form a settled metered product charge, it has been especially advantageous to produce and maintain a settled metered charge, namely, produce a settled and formed metered charge that is packaged or bagged. More particularly still, via the following processing steps, systems and apparatus, a settled metered charge is advantageously formed into the shape of the bag (i.e., the settled and formed metered charge is generally configured so as to mimic a configuration of the bag within which it is to reside, advantageously, but not exclusively or even necessarily, a section of the settled and formed metered charge dimensionally mimics the section of a bag former or bag forming mandrel). Thus, in light of the foregoing, a more consistent and thorough bagging operation is realized.

With reference now to FIG. 5, an improved bag manufacturing and packing process is disclosed, namely, a process characterized by a settling or settling/forming step, more particularly, a metered product charge settling or settling/forming step 21. In lieu of a metered product charge passing directly to a bag manufacturing and packing station, e.g., introduction of the metered product charge for passage through a bag former (i.e., through a lumen of a bag forming mandrel or tube (FIG. 4)), the instant process advantageously includes an intervening step, namely, that of compacting, settling, and/or forming a settled preselect arrangement of the metered product charge. As will be subsequently detailed in connection to a presentation of system and apparatus particulars, an improved, non-limiting bag manufacturing and packing process may be fairly characterized by the step of agitating a metered product charge, as by one or more inertial changes imparted in respect of an actuatable turret assembly which retains, via at least a single settling or settling/forming chamber, the metered product charge. As should be readily appreciated, for product or products amenable or prone to settling, e.g., chips, as opposed to, for example, shelled nuts, a volumetric reduction of a given product mass (i.e., metered product charge) is achieved, and results in, among other things, a commensurate reduction in packaging (e.g., bag forming) materials.

FIG. 6 provides a perspective view of a filling apparatus employing one embodiment of the invention comprising a settling chamber. In FIG. 6, a settling device 30 is located between a metering station 20, characterized by a weigher 23 and a receiving funnel 25, and the product delivery cylinder 60 of a vertical form, fill, and seal machine. The weigher 23 can comprise virtually any weigher known in the art. In one embodiment, the weigher 23 is a statistical weigher. As depicted, downstream of the weigher 23 is a receiving funnel 25. A receiving funnel 25, or a series of funnels, receives and guides product to the downstream

bagmaker. As used herein a receiving funnel 25 refers to any device downstream of a weigher but upstream from a settling device which collects and directs product. The receiving funnel 25 can be attached and part of the weigher 23 and can comprise vertical or slanted walls. In one embodiment, there is a metal detector located between the weigher 23 and the receiving funnel 25 to monitor foreign debris. Those skilled in the art will appreciate that a receiving funnel 25 is not necessary in all embodiments. Downstream of the receiving funnel 25 and the weigher 23 is the settling device 30.

As depicted the settling device 30 comprises a single settling chamber 40, a vibrator 31, and a gate 72 of a gate assembly 38. A settling device, as used herein, refers to a device which receives and captures an amount of product in order to form an intermediate slug of compacted product. A settling chamber 40 is a distinct chamber which receives and retains product. In one embodiment the settling chamber 40 has four vertical walls and an open top and bottom.

Applicants have found that collecting product discharged from the weigher 23 and holding product, for a period of time, in the settling chamber 40 facilitates settling of the product and increases compaction of the product. Increasing the settling of the product during packaging results in a decrease of post manufacturing settling. The settling chamber 40 can be jostled or vibrated via a vibrator 31 to facilitate and speed up the settling of the product. The time necessary and the amount of external energy, such as vibrations, required to facilitate settling is dependent upon many factors including but not limited to the geometry of the product, the size and geometry of the settling chamber, the size of the slug, and the level of compaction desired. Those skilled in the art will be able to determine the amount of time and energy required to yield a desired level of compaction. Other movements such as vertical, horizontal, rotational, vibrational, and mixtures thereof can also be imparted to the settling chamber to facilitate settling of the product which results in increased compaction. The vibrator 31, which is optional, can comprise any device which vibrates the settling chamber 40. The vibrator 31 can be located in various places throughout the settling device 30.

Applicants have found that the geometry of the settling chamber 40 has an effect on the shape of the packaged slug as well as the shape of the final package, especially if the final package is a traditional flex bag. In one embodiment the cross-sectional shape of the settling chamber 40 is substantially similar to the desired shape of the slug. For example, in one embodiment the settling chamber 40 has a substantially oval cross-section to mimic the

substantially oval cross-section of a traditional flex bag. Other cross-sections may be utilized including but not limited to a circular and square cross-section.

The height of the settling chamber 40 can be varied according to the desired size and shape of the intermediate slug which ultimately dictates the size and shape of the finished product. In one embodiment the size of the settling chamber 40 is approximately 0.5 to 2.5 times the height of the final package, and in one embodiment the settling chamber 40 is approximately 1.25 times the height of the final package. The size of the chamber is dependent upon a variety of factors including the amount of settling required. In one embodiment, the height of the settling chamber 40 is chosen so as to properly fit between the weigher and the packing apparatus without raising the weigher.

In one embodiment, the bottom of the settling chamber 40 has a larger opening than the top of the settling chamber. For some products susceptible to bridging, having a larger exit diameter minimizes bridging. This helps the product maintain its desired compact shape and results in faster and more efficient discharges.

At the bottom of the settling chamber 40 is gate 72. The gate 72 can comprise many types of gates including sliding and swinging gates. In one embodiment the gate 72 is a sliding gate which allows for quick and efficient discharge of the product from the settling chamber 40.

Downstream of the gate 72 is the product delivery cylinder 60. In some embodiments there is an intermediate funnel 99 which directs product discharged from the gate 72 to the product delivery cylinder 60. The intermediate funnel 99 can comprise one or more funnels which can comprise straight or slanted walls. Further, the intermediate funnel 99 can comprise a variety of shapes. In one embodiment, the intermediate funnel 99 has a shape similar to the shape of the settling chamber 40.

In some embodiments, as the process moves downstream from the receiving funnel 25 to the product delivery cylinder 60, each subsequent downstream transition point has a larger diameter than the upstream transition point. Thus, in such an embodiment, the intermediate funnel 99 has a larger diameter than the settling chamber 40 but a smaller diameter than the product delivery cylinder 60. Such an arrangement minimizes bridging and any other disruption to the united slug.

Thus, the method for compacting a slug of product begins by weighing an amount of product in a weigher. Then, the product is directed and received into a settling device. Once the product is in the settling device, the product is compacted to form a slug of product. As discussed, this can be accomplished by storing the product for a time, or by jostling, rotating,

and/or vibrating the settling device. After compacting the product, the product is discharged to a product delivery cylinder. It should be noted that the product can be directly discharged into the product delivery cylinder or it can be discharged into an intermediate funnel or chute before reaching the product delivery cylinder. Thereafter the slug is deposited from the product delivery cylinder into a package. As discussed above, the settling device is located downstream from a weigher and upstream from the product delivery cylinder. Further, the settling device can comprise only a single settling chamber, or the device can comprise more than one settling chamber.

In one embodiment the settling device 30 comprises only a single settling chamber 40. However, in other embodiments the settling device 30 comprises more than one settling chamber 40. In one embodiment, two or more settling chambers 40 act in parallel, each discharging its slug to the downstream product delivery cylinder 60. In other embodiments at least two chambers 40 act in series whereby a first chamber is located below a second chamber and product is partially settled in a first chamber before being deposited for further settling in a second chamber. In one embodiment, one or more settling chambers 40 are located on a rotary settling device. In one embodiment each subsequent chamber results in increased settling.

With reference now to FIGS. 7-11, there is generally shown an apparatus 30 to facilitate the packaging, i.e., improved packaging, of settleable product by rotary charge compaction. The apparatus, alone or in select combination with further process related components, may be fairly characterized as a product settling or product settling/forming system or station. Advantageously, but not necessarily, as previously noted, the general apparatus or assembly of FIGS. 7-11 is configured, dimensioned and/or readily adapted or adaptable for inclusion or incorporation, as by a retrofit, in or into known bag manufacturing and packaging systems, e.g., and without limitation, those of Ishida Co., Ltd. (Japan).

Generally, the apparatus 30 includes an actuatable turret assembly 32 (reference also FIGS. 11 & 12), a turret assembly base 34, a turret assembly actuator 36 operatively linked to the actuatable turret assembly 32 for selectively actuating the actuatable turret assembly 32 relative to the turret base 34. Moreover, a gate subassembly 38 (reference also FIGS. 9 & 10) is advantageously provided, namely, a selectively operable gate assembly for permitting egress of a settled and formed metered product charge from the actuatable turret assembly 32, via the turret assembly base 34.

The actuatable turret assembly 32 generally comprises product settling bins or containers 40, advantageously, open ended bins (i.e., sleeves or tubes) which will be

subsequently detailed, and an assembly body 42, e.g., mounting plates or spacers, upper 44 and lower 46 as shown, for retaining the product settling bins and thereby define the assembly. Each product settling bin 40 of the product settling bins is selectively positionable, via select actuation of the actuatable turret assembly 32 (e.g., as by a mechanical, hydraulic
 5 or pneumatic drive, and advantageously, as shown, via a servo-drive 48), for receipt of a metered charge of settleable product. Via an actuation, reversible or otherwise, of the actuatable turret assembly 32, e.g., indexed rotation, or more generally, a successive or sequential agitating actuation, settling of the metered product charge of settleable product in furtherance of a discharge of a settled, settled and formed metered charge of settleable
 10 product from the apparatus to a packaging station is achieved.

Notionally, with respect to the metered product settling and forming bins, a preselect equilibrium or pseudo-equilibrium state for ingress and egress of product to and from the turret assembly is preferable but not necessary. As will be later detailed in connection to a discussion of a preferred sequence of operation, a content discharging bin at time t_0 is
 15 thereafter relocated, via turret assembly actuation, so as to underlay a discharge of the metering station, and is there filled at time t_1 . A "filling" bin (FB) is preferably, but not necessarily immediately adjacent (i.e., "down stream" of) an "emptying" bin (EB), see e.g., FIG. 9 (i.e., bin emptying and filling operations are advantageously, but not necessarily adjacent one another). As the next earliest filled bin, essentially retaining the settled and
 20 formed metered charge, is positioned relative to the turret assembly base for content discharge, the initially "filled" bin commensurately proceeds in relation to the turret assembly base, and via an inertial change, may be fairly characterized as having transitioned from an initially filled state or condition to an initially settled, settled and formed state or condition.

The actuatable turret assembly 32 is generally supported, more particularly and
 25 advantageously, rotatably supported, with respect to the turret assembly base or base plate 34. A servo motor 50 of the servo-drive 48 is operatively linked, via a shaft, 52 a shaft hub 54, and a shaft bushing 56 as indicated, to or with the assembly, namely, the assembly body 42, so as to selectively impart motion thereupon.

The turret assembly base 34 is generally adapted to permit selective passage of
 30 processed metered product charges from the bins 40 of the turret assembly 32. Toward that end, and with specific reference to FIG. 9, the turret base 34 includes an egress port, e.g., a cut out or aperture 58 as shown, which is (see e.g., FIG. 16) or may be (FIG. 9) operatively linked to a bag former/mandrel 60, and a slotted peripheral edge 61 (i.e., a slot 62) which permits and/or accommodates reversible translation or reciprocation of the gate subassembly

38 of FIG. 12. Further non-limiting advantageous features of the turret assembly base 34 include, but need not be limited to, the inclusion of an elongate through hole, e.g., a slot 64, extending adjacent and parallel to the egress port 58, an upper surface recess, more particularly, a channeled recess 66 as shown, and the addition of a track or track segment 68 depending or otherwise extending from a lower surface 70 of the turret base 34 so as to be adjacent and parallel to the slot 62 of the slotted peripheral edge 61. As should be appreciated with reference to FIGS. 8 & 9, the interior turret base slot 64 is positioned "downstream" of egress port 58, and is generally dimensioned and configured so as to selectively receive and pass product fines, crumbs, etc.

10 With reference now to FIG. 10, a rotary settling device 30 is depicted comprising eight settling chambers 40a-h located above the stationary turret table 34, a gate 72, and a vibrator 31. While the figure illustrates eight settling chambers 40a-h, other numbers of settling chambers may also be utilized. Those skilled in the art will understand that the number of required settling chambers is dependent upon a variety of factors including but not limited to the geometry of the product, the desired size and weight of each slug, and the desired throughput in bags per minute, amount of settling time required, etc.

In a rotary settling device 30, the settling chambers 40a-h can be arranged in a variety of positions. In one embodiment, the centers of each settling chamber are evenly spaced along the turret table 34. In one embodiment the chambers are evenly spaced and oriented like a wagon spoke. As depicted, the settling chambers 40 are angled relative to the turret table 34 to maximize the number of chambers which will fit on the turret table 34.

In the embodiment depicted, the settling chambers 40 have an open top and bottom so the product is maintained within the settling chambers 40 by the presence of the stationary turret table 34. In such an embodiment the settling chambers 40 glide and rotate over the turret table 34. There is an opening 92 in the turret table 34 located above the gate 72. In one embodiment, the shape of the opening corresponds to the shape of the settling chamber 40. The chamber located in the position above the gate 72, and aligned with the opening 92, is referred to as the discharge chamber 40a. The product in the discharge chamber 40a is maintained by the gate 72. Accordingly, when the gate 72 is opened, via sliding or otherwise, the product falls through the opening 92 in the turret table 34 and passes the open gate 72. Those skilled in the art will understand that there are other ways of maintaining product within each settling chamber such as having a separate gate for each settling chamber.

In one embodiment, downstream and below the gate 72 is the product delivery cylinder 60. In such an embodiment, the compacted slug is discharged from the discharge

chamber and into the product delivery cylinder 60 where it is subsequently packaged in a bagmaker.

The settling chambers 40 can be filled in a variety of locations. In one embodiment, the discharge chamber 40a is also the same settling chamber which receives product, called the receiving chamber. In such an embodiment, after discharging product in the discharge chamber 40a the gate 72 will close. Thereafter, the discharge chamber 40a will then receive product. All of the settling chambers 40 in turn will then move one spot in the progression, during which time the product in the settling chamber settles and becomes more compact. Thus, in some embodiments the receiving and discharging do not take place simultaneously.

FIGS. 10 and 11, however, depict an embodiment in which the receiving and discharging does not take place in the same chamber. As depicted in FIG. 10, the discharging chamber 40a discharges product and a different chamber, the receiving chamber 40c receives product from the receiving funnel 25. In one embodiment, the discharging and the receiving takes place simultaneously. Thus, after the discharge chamber 40a discharges its product, it rotates two positions to become the receiving chamber 40c at which time it receives product. In other embodiments the discharge chamber 40a will only rotate one spot before becoming the receiving chamber whereas in other embodiments the discharge chamber will rotate multiple positions before becoming the receiving chamber. The location of the receiving and discharging positions depends on a variety of factors including but not limited to the location of the receiving funnel 25 and the product delivery cylinder 60 and the required amount of settling.

After the receiving chamber 40c has received its product, it rotates clockwise throughout the positions until it again becomes the discharge chamber 40a. While the example has been described as rotating clockwise, this should not be deemed limiting as the device can also rotate counterclockwise.

While the settling chambers 40 are rotating, the product becomes more compact. In one embodiment, a vibrator 31 vibrates the product within the settling chambers 40 to facilitate settling of the product. The vibrator 31 can be placed on a variety of places, including but not limited to, on the stationary turret table 44, attached to the chambers 40, or otherwise attached to the rotary settling device 30 or other supporting structure.

As shown in FIGS. 10 & 11, the receiving funnel 25 is located atop the rotary settling device 30. The receiving funnel 25 directs product to the receiving chamber. As noted above, the receiving funnel 25 may be directly below the weigher 23 or it may be below another funnel or series of funnels.

FIG. 11 is a perspective view of a rotary settling device comprising multiple settling chambers in a mid-rotation position, the opening 92 located on the stationary table 44 likewise visible. As depicted, the chambers are in mid-rotation so the chambers are not receiving or discharging product. In other embodiments, however, product is received and/or
 5 discharged during rotation. In some embodiments, however, it is desired that the compact slug is maintained in its compact state after the slug has been formed.

In FIG. 11, a stationary top 35 is depicted. The top 35 acts to ensure that the product within the settling chambers 40 does not escape the settling chambers 40. Further, the top 35 acts to keep external items from entering the settling device and subsequently becoming
 10 packaged. The top 35 is not necessary in all embodiments, and those skilled in the art will understand which processing conditions will warrant such a top.

As depicted, the intermediate funnel 99 and the product receiving cylinder 60 are depicted downstream of the opening 92. In FIG. 11, the product receiving cylinder 60 is part of the bag former in a vertical form, fill, and seal, machine. In one embodiment, the product
 15 receiving cylinder 60 is directly connected to the rotary device 30. In other embodiments the product receiving cylinder 60 is not directly attached to the rotary device 30. The product receiving cylinder 60 may be separated from the rotary device 30 by a gap or it may be connected via other equipment such as the intermediate funnel 99.

In one embodiment, the product in the package comprises product from only a single
 20 settling chamber. In such an embodiment, the amount of product received in the receiving chamber is equal to the amount of product in the final package. In still other embodiments, the final package comprises two slugs of product. In one embodiment the package comprises product from at least two different settling chambers. In other
 25 embodiments the package comprises two slugs of product from the same chamber. In such an embodiment a first slug is first formed and discharged and then subsequently a second slug is formed in the same chamber and then discharged.

Applicants have found that in some products the compaction is further increased when two or more smaller slugs are compacted separately and then added into a single package. For example, if the final product is to comprise two slugs of product, then the slugs formed
 30 from two different chambers will both be deposited to a single package. Referring back to FIG. 10, in such an embodiment a single package will comprise product discharged from the discharge chamber 40a as well as product from the chamber 40h located one spot behind the discharge chamber 40a. Thus, product from both chambers 40a/40h is deposited to a vertical form, fill, and seal machine to be packaged in a single package.

In one embodiment, the height of each chamber is selected so that existing apparatuses can be retrofitted with charge compaction without, for example, raising the weigher. As an example, in one embodiment, due to the multi-charge method, the settling chambers can be made shorter in height, due to the height being spread amongst multiple chambers, and as a result the weigher does not have to be moved. This results in decreased capital costs to retrofit an existing apparatus.

Applicants have found that after inducing settling the slug maintains its shape and compaction as it is packaged. This results in less settling after packaging giving the consumer a fuller package which more resembles the fuller look of a bag at the bagmaker. As previously discussed, increasing settling during packaging reduces post package settling which results in several benefits. One such benefit is the ability to use a comparatively smaller package for the same product weight. This results in decreased production costs as less material is required to manufacture the package. Additionally this results in decreased shipping costs as more packages can fit in a given volume. Further, this allows more packages to be displayed on the retail shelf as smaller packages occupy less space. Likewise, a smaller package allows a consumer to store the same amount of product in a smaller space, thus freeing valuable pantry space.

As discussed, this apparatus and method provide the opportunity to package the same quantity of product in a comparatively smaller package. The smaller package can have a decreased height, width, or combinations thereof compared to the previous package. In one embodiment the width of the package is not altered and only the height dimension is changed. Such an embodiment minimizes the modifications required to the bagmaker. The following examples demonstrate the effectiveness of one embodiment of the instant invention and are for illustrative purposes only. Accordingly, the following examples should not be deemed limiting.

Control

A trial was conducted using chips with a product weight of 21.5 ounces. The wheat chips were thin wafers having ridges. A settling device was not used on the control. The bags had a width of 12 inches, a total height of 18.75 inches and a usable height of 17.75 inches after deducting one inch for the top and bottom seals. The void space in each package was measured and the fullness level of each bag calculated. The void space was measured by measuring the average level of product in the package. The packages removed from the bagmaker, which was a vertical form, fill, and seal machine, were approximately 86% full on average and had an average product level of 15.25 inches. Thereafter to determine the

conditions of the packages after sitting on the shelf, the packages were subjected to a simulated retail process which included simulating the transporting, handling, and shelf time of a typical package. After simulation, the void space was measured and the fullness of each bag was calculated to be approximately 78% on average with a product level of 13.85 inches.

- 5 Thus, the fullness of the packages decreased by about 8% on average after the shelf simulation, and the product level decreased by an average of 1.4 inches.

Single Charge

- In the next trial, a non-rotary settling apparatus comprising a single settling chamber, similar to that of Figure 2 in operation, was utilized using the single charge method whereby
 10 each package comprised a single slug of product. The settling device had settling chambers comprising a substantially oval cross section and a width of 12 inches. Because of the settling of the product, a smaller bag was utilized. The smaller bag had a width of 12 inches and a height of 16.75 inches with about 15.75 inches of useable space. At the bagmaker the packages were approximately 86% full and had a product level of about 13.55 inches. Thus,
 15 the settling device decreased the same quantity of product in a bag with the same width from a product level of 15.25 inches to a product level of 13.55 inches at the bagmaker. After the shelf simulation, the packages were approximately 82% full and had a product level of about 12.85 inches. Thus, the fullness of the package decreased by only about 4% and resulted in a fuller bag compared to the control. Further, the product level dropped only about 0.7 inches
 20 which is about half of the drop experienced in the control.

Multi-Charge

- In the next trial, the same apparatus was utilized using the multi-charge method wherein the final package comprised two slugs of product. Thus, in this embodiment, the settling chamber formed and discharged a slug, and then the same settling chamber
 25 subsequently formed and discharged a second slug into the same package as the first discharged slug. The same size bag as the single charge was also used in the multi-charge trial. At the bagmaker the packages were approximately 87% full and had product levels of about 13.65 inches. After the shelf simulation, the packages were approximately 83% full and had a product level of about 13.15 inches. Thus, compared to the single-charge method,
 30 the multi-charge method resulted in a fuller bag both at the bagmaker and after shelf-simulations.

In both the single-charge and the double-charge, a smaller package was produced which held the same quantity of product as the larger bag in the control, but which required less material to manufacture. Accordingly, compacting the product results in decreased

manufacturing costs, decreased shipping costs, an increased number of packages available for a given amount of retail space, a package which required less pantry space, and a package which appeared fuller to the retail consumer.

With renewed general reference to FIGS. 7-11, and particular reference to FIGS. 12 & 13, there is depicted an advantageous, non-limiting gate subassembly, more particularly, a selectively actuatable gate subassembly 38. The selectively actuatable gate subassembly 38 generally includes a gate 72, and a gate base 74 operatively supporting the gate 72. The gate base 74 in turn generally, but not necessarily, includes an upper gate guide or tray 76, united with the gate 72, for reversible sliding retention within the gate path 66 (FIG. 9), and a lower gate guide, namely, a track guide 78 for travel upon the track or track segment 68 in furtherance of operatively supporting the upper gate guide 76/gate 72. While a non-limiting gate "sliding" is indicated, alternate gating or regulating solutions (i.e., actions) may be suitable provided.

As shown, the selectively actuatable gate subassembly 38 is advantageously actuated by a further servo-drive 48', namely, a servo motor 50' and linkage arm 80 which converts rotational motion to translation or reciprocation so as to provide, among other things, a swift and certain reversible gate motion. The linkage arm 80 generally includes a pivot segment or element 82, united with the servo drive shaft 53 so as to extend therefrom, and a link 84, a first end portion thereof secured to a free end of the pivot segment, and a second end portion thereof anchored upon a portion of the lower gate guide 78. As should be readily appreciated, and apparent via reference to e.g., FIG. 7, one or more structural elements, or a support assembly 86 as depicted, retain the servo-drive 48' in operative proximity to the turret assembly base 34.

Operatively, and with reference to FIG. 9, as the free end of the pivot segment 82 is drawn distally from the turret assembly base 34, clockwise rotation of the servo drive shaft 53 in the figure as indicated, the link 84 likewise responds so as to result in a pull (i.e., retraction or gate "opening") motion or action being imparted to the gate subassembly 38. Contrariwise, subsequent to product release/egress, the free end of the pivot segment 82 is drawn proximally towards the turret assembly base 84, counterclockwise rotation of the servo drive shaft 53 in the figure, the link 84 likewise responds so as to result in a push (i.e., gate "closing") motion or action being imparted to the gate subassembly. It is to be noted that extremely fast gate actuation is advantageous, as it avoids disturbance of the settled and formed metered product charge and allows the contents of the discharging bin to maintain its

status or condition as it passes from the bin to/into the lumen of the bag former/bag forming mandrel.

Applicants have found that a slow moving gate 72 decreases the compaction of the slug whereas a fast acting gate 72 allows the slug to remain compact. As used herein a fast acting gate is a gate which is completely open in less than about 50 milliseconds. There are a variety of ways to minimize the effect that the gate 72 has on the compaction of the slug. In one embodiment the speed of the gate 72 is increased. In another embodiment, the gate 72 is completely open in as little as about 40 milliseconds. As discussed, this fast acting gate 72 acts to minimize the decrease in compaction. In one embodiment the length of the gate 72 is increased. This allows the velocity of the gate 72 to increase before the opening 92 is opened. Further, as depicted the gate 72 and the opening 92 are positioned so that the shortest distance in the opening 92 is in the same direction that the gate 72 is opened. The fast acting gate 72 can be implemented in any device described herein.

With particular reference now to FIGS. 14 & 15, two advantageous, non-limiting actuatable turret assemblies 32, 132 are shown, namely, assemblies intended to produce a "large" (FIG. 14), and "small" (FIG. 15) settled and formed metered charges. As was previously referenced, it is not uncommon during product processing to alter the mass of the metered charge for packaging. As evident by perusal of the grocer shelves, a variety of package sizes are available, ranging from single serve multi-packs to "family" or "party" size bags. Via a modular approach, one actuatable turret assembly may be readily exchanged for another actuatable turret assembly, or alternately, an exchange or retrofit of the bins of given assembly to accommodate variable production objectives is contemplated. Prior to a presentation of the particulars of the actuatable turret assemblies of FIGS. 14 & 15, namely, characteristic details with regard to the product settling/product settling and forming bins thereof, some general observations are warranted.

A plurality of settling/product settling and forming bins 40, 140 are generally shown circumscribing an axis of rotation, namely, an axis corresponding to an axial centerline 88 of shaft 52 of the turret assembly driver 48. The product settling/product settling and forming bins of the preferred apparatus may be fairly characterized as vertical tubes or vertically oriented sleeves (i.e., a structure having an "open" top and bottom). Each bin or tube is characterized by a metered product charge ingress portion 90, 190, and a settled metered product charge egress portion 92, 192 opposite thereof, and may be fairly characterized as having an axially extending centerline 94, 194. Preferably, but not necessarily, the sectional area of the bin generally increases toward the egress portion from the ingress portion (e.g.,

the ingress portion of the settling/settling and forming chamber tapers toward the egress portion thereof). Likewise, a maximum dimension of or for the bin generally increases toward the egress portion from the ingress portion. Moreover, the bins are advantageously configured so as to be fairly characterized by a cross section selected from the group
 5 consisting of circular, oblong or oval, however, other cross sections may prove beneficial.

With continued and general reference to FIG. 14, and particular reference to FIG. 8, it is to be noted that the circumferentially arranged bins 40 would appear askew within the turret assembly body 42. The solid settling and forming bins 40 are circumferentially arranged within the turret assembly body 42 such that an offset angle θ is defined by an
 10 intersection of an axis of elongation 96 for each solid settling and forming bin 40 and a ray 98 linking an axial centerline of the actuatable turret assembly (i.e., axial centerline 88 of shaft 52) and a mid-point of the axis of elongation 96 (i.e., the previously noted axially extending centerline 94 of the bin 40). Via such arrangement or configuration, a level or substantially uniform filling/filled height of metered product charge is generally maintained within the
 15 sleeve as the turret assembly is periodically and/or selectively actuated (e.g., stopped or abruptly stopped) while rotating from a metered product filling locus to a settled and formed metered product discharge locus (i.e., product "mounding," owing to centrifugal forces/inertial changes, is, if not eliminated, greatly and advantageously reduced). As should be appreciated in light of the foregoing, the particulars of the FIG. 14 turret assembly, more
 20 particularly the bins and their arrangement within the assembly, facilitate the formation of a settled and formed metered product for subsequent packaging. While it is believed that an offset angle θ of up to about 45E might be sufficient in furtherance of the stated objective, it is believed that an offset angle θ within the range of about 20-40E is advantageous.

With reference again and specifically to FIG. 15, a plurality of settling/settling
 25 forming sleeves 140, characterized by a substantially circular cross section, are shown circumferentially arranged about the axis 88 of turret assembly rotation. The sleeves 140, as shown, generally include an upper portion or segment characterized by a pronounced reducing sectional area, more particularly, and advantageously, the ingress portion 190 of the settling/settling forming sleeves 140 includes a funneled free end, e.g., a metered charge
 30 reservoir 189, which receives at least an initial metered product charge. Subsequent actuation of the turret assembly 132, e.g., indexed rotation resulting in successive or sequential travel and stopping of the initially charged sleeve, transfers at least a portion of the initial metered charge from the reservoir 189 to a sleeve segment 191 of reduced and generally reducing

sectional area which includes the egress portion 192. Via select actuation of the actuatable turret assembly 132, and in advance of contents discharge or egress in furtherance of packaging, a settled and formed metered product charge results in the reducing diameter portion of the sleeve. Advantageously, but not necessarily, the sectional area of the ingress
 5 portion (i.e., the metered charge reservoir 189) is within a range of about 1.25-2.5 times greater than a sectional area of the settled charge forming and/or egress portion 192.

With reference now to FIG. 15A, a portion of a further alternate settling/settling forming sleeve is depicted, namely, a metered charge reservoir 189'. The reservoir has ingress 190', fairly characterized as a triangle with rounded apexes. In relation to its arrangement
 10 within the turret assembly, a "nose" of the reservoir is intended to be directed toward axial centerline 88. A taper characterizes the transition from the reservoir 189' to the settled charge portion of the sleeve which includes egress portion (not shown). The lower sleeve portion of reservoir 189' may be configured so as to have an oval cross section as should be appreciated with reference to the lower portion thereof, however, this portion is not intended to be so
 15 limited.

With reference now to FIGS. 16 & 17, contemplated metered product settling systems are depicted in combination with product transfer means, namely, an improved bag former or bag forming mandrel 60, 160 (reference also FIG. 18, and generally, FIGS. 4 & 6). In keeping with the foregoing details, the combination of FIG. 16 is characterized by the turret
 20 assembly of FIG. 14, whereas the combination of FIG. 17 is characterized by the turret assembly of FIG. 15, more particularly, the metered charge receiving bins/sleeves of FIGS. 14 & 15 respectively. As indicated, the bag forming mandrel cross section generally mimics the cross section of the egress portion of the product settling bins, e.g., oblong (FIG. 14), and circular (FIG. 15).

With regard to the bag forming mandrel 60, 160 it is fairly characterized as a sleeve which defines a lumen 63, 163 for the receipt and passage of, in the instant description, a settled and formed metered product charge. Although not shown, it is contemplated that the mandrel support or be equipped with a gas charging tube(s) or the like so as to facilitate the introduction of a gas charge, e.g., nitrogen, to the product package in advance of closure. The
 30 mandrel 60, 160, more particularly, the sleeve as shown, advantageously includes at least a longitudinal segment with passages therethrough. In as much as perforations or apertures 65, 165 are shown, the passages need not be so limited. As part of film processing in furtherance of forming a film/bag sleeve about the mandrel, bag forming operations, namely, transverse sealing/sealing cutting in furtherance of forming closed top and bottom bag sleeve portions so

as to thusly define a bag top/bottom, result in air displacement within the lumen of the mandrel in an upward direction (i.e., toward the metered charge forming operations). A mandrel comprising an apertured or otherwise vented tube or sleeve/sleeve segment allows for the inevitable countercurrent "updraft" to short circuit in advance of encountering the falling charged of settled and formed metered product so that the compacted charge remains substantially compact.

Now referring to FIG. 18, there is shown a perspective view of a further filling apparatus employing a settling chamber and vacuum relief holes. FIG. 18 is similar to FIG. 6 except that FIG. 18 also illustrates vacuum relief holes 65 in a portion of bag forming mandrel 60. FIG. 18 illustrates the settling device 30 located downstream from a weigher 23 and upstream from a product delivery cylinder 60, wherein the product delivery cylinder 60 comprises a forming collar 27, and wherein the product delivery cylinder 60 comprises vacuum relief holes 65 located above the forming collar 27. As discussed, in one embodiment a compact slug of product is formed prior to depositing said product in the product delivery cylinder 60. As earlier noted, this compact slug creates a vacuum in the product delivery cylinder 60 as it falls within the product delivery cylinder 60. This did not occur in the prior art as the product had sufficient spread to prevent the formation of a vacuum. Additionally, there was no slide gate 72 to cut off the flow of air and thus form a vacuum. However, the compact slug does create a vacuum above the slug within the product delivery cylinder 60 when the product delivery cylinder 60 is sealed. In one embodiment the product delivery cylinder 60 is sealed when the upstream gate 72 is closed. This vacuum decreases the speed with which the slug can fall. To minimize the created vacuum, vacuum relief holes 65 are positioned above the forming collar 27 which directs the packaging material. The vacuum relief holes 65 allow air to be pulled within the product delivery cylinder 60 and break the vacuum. The vacuum relief holes 65 may comprise a single hole or may comprise two or more holes. In one embodiment the holes are sized from about 1/8th of an inch to about 1/4th of an inch.

In one embodiment the holes do not begin in the first three inches of the product delivery cylinder 60. Applicants have found that some product comprising edges or corners can catch on the holes 65, and thus disrupt the flow of the product. To overcome this problem, in one embodiment the product is allowed to build momentum in a section of the product delivery cylinder 60 which does not comprise holes before introducing the product into a section of the product delivery cylinder 60 comprising holes 65. In another embodiment the holes 65 are sized so as to minimize product catching on the holes 65. As

depicted FIG. 18 does not comprise an intermediate funnel 99, however other embodiments comprise an intermediate funnel 99. Such an intermediate piece allows product to build momentum which can also reduce the likelihood of product being snagged or caught on the holes 65.

5 The vacuum holes 65 can be implemented in any bagmaker comprising a product delivery cylinder 60 which comprises a collar 27. In one embodiment, the bagmaker comprises a vertical form, fill, and seal bagmaker comprising a weigher and product delivery cylinder.

Referring back generally to, for example FIGS. 6-11, another embodiment of the
10 invention is now discussed. In one embodiment the discharge chamber 40a is monitored with a sensor. A sensor can comprise any sensor known in the art. In one embodiment the sensor comprises a digital or analog sensor. In another embodiment the sensor comprises a photo eye. As an example, in one embodiment a sensor is located above the discharge chamber 40a. The sensor can determine the presence of product in the chamber which would indicate
15 that not all of the product has exited the discharge chamber 40a. With such condition detected, a poker can assist in clearing the remaining product from the discharge chamber 40a. A poker can comprise any mechanical device which can forcibly remove product from a chamber. In one embodiment the poker comprises a mechanical rod which forces the product from the chamber. In another embodiment the poker comprises a piston which forces the
20 product from the chamber. In another embodiment the poker comprises a blast of air, nitrogen, etc. to force the remaining product to discharge the discharge chamber 204a. It is to be further noted that a sensing and agitation functionality may be readily associated with a variety of the contemplated settling, settling/forming approaches previously or subsequently discussed and/or contemplated.

25 The poker can be located at the discharge chamber 40a, or it can be located adjacent to the discharge chamber 40. Moreover, in connection to settling containers or chambers characterized by a reservoir, it is believed advantageous to provide agitation directed to both the reservoir and the settled charge portion thereof (see e.g., the chambers of FIG. 15/15A. In one embodiment the poker is located above the discharge chamber 40a and may be
30 configured and/or actuated to "nudge" the chambered product or chamber, or the poker may be configured and/or actuated so as to travel, top to bottom if you will, through at least an upper portion of the chamber. In one embodiment the poker is actively coupled to the sensor. As used herein actively coupled refers to a device which receives a signal from another device. Thus, the poker receives a signal, either directly or indirectly, from the sensor.

Finally, in as much as sensing or an on demand functionality is contemplated, poker actuation may likewise be a coincident with the noted discharge cycle, i.e. a given rather than a select operation.

With reference now to FIGS. 19-21, attention is particularly directed to structural departures of select subassemblies, structures and/or elements of settling apparatus 30 (e.g., that of FIG. 7). In advance of further particulars, it is to be noted that a portion of base 34, see e.g., FIG. 7, is absent from the FIG. 19 depiction to facilitate a view of structures/features otherwise not visible from "above." Moreover, in as much as FIG. 20 is an underside view of the apparatus of FIG. 19 which, among other things, illustrates operably positioned bag forming elements of the bag forming/bag filling station, FIG. 21 depicts a detailed view as FIG. 20 with the bag forming elements of the bag forming/bag filling station absent to facilitate a view of structures/features otherwise not visible.

In the instant embodiment, assembly body 42 comprises selectively configured assembly body plates, more particularly, stylized upper 44' and lower 46' assembly plates which might be fairly characterized as "starwheels." Generally, the plates include U-shaped peripheral "cutouts" 45, the "legs" thereof in outward extension, i.e., away from axial centerline 88. While a hub and spoke or wagon wheel arrangement is depicted, an arrangement commensurate with the off-set container arrangement of either FIGS. 8 or 10 is likewise contemplated.

While the peripheral profile of the plate depicted is amenable to direct receipt of a companion settling container within the U-shaped recesses, indirect receipt of a variety of alternately dimensioned and/or configured settling containers is contemplated. Towards that end, one or more "sets" of alternative configured sleeves, such as sleeve 47 of a "first" sleeve set is provided so as to enable quick, ready receipt and retention of a variety of diverse settling container configurations by the assembly plates. In the as shown sleeve, an aperture 101 is positioned adjacent a trailing end or edge 103 of sleeve 47 so as to receive and retain a portion of settling container 40, e.g., as shown, container segment 191, while a funneled end or reservoir 189 is, via such sleeve configuration, selectively spaced from axial centerline 88. The sleeves, an "upper" and "lower" for each container as shown, in turn are readily received and reliable retained with the assembly body plates, more particularly, by each of the U-shaped peripheral cutouts. In as much as wholesale change out or change over of a turret assembly is contemplated, via the noted adaptation of the assembly body plates, alternately equipping the turret assembly with one or more select settling containers is hereby realized.

In furtherance of reducing processing or line down time, additional features are to be noted. Namely, a quick and sure reversible release assembly, characterized by clamps 105 (e.g., FIG. 20) for reversibly retaining the bag forming mandrel (FIGS. 20 & 21), and a man way 107 to accommodate settling container passage to and from the turret assembly body from below are provided.

As should be appreciated in connection to a contrasting of the views of FIGS. 20 & 21, the turret base 34 includes a passage in the form of aperture or cutout 58, generally provided to permit/facilitate egress of settled, settled and formed metered product charge(s) from the settling, settling forming station to the bag manufacturing and packaging station (see FIG. 5). As illustrated, a portion of aperture 58 is traversed, traversable or otherwise overlain in furtherance of a selective discharge of a settled product charge from a settling container, as by gate 72 (FIG. 19) which, as previously described, is quickly cycled between first and second operative positions in furtherance of permitting passage of the settled product charge to, into and through the underlying bag forming mandrel via the guarded/gated portion of the aperture. In connection to the arrangement of FIG. 19, the gate is in an egress blocking position in relation to an aperture 109 of apertured plate 111 retained upon underside 70 of turret base 34 (FIG. 20, see especially FIG. 21) and is in general alignment with the bag forming mandrel (FIG. 20).

Adjacent the gate from above and the apertured plate from below, and thusly essentially delimited thereby (FIGS. 19 & 21 respectively), is the "remainder" of the aperture (i.e., the aperture portion not overlain with the gate/apertured plate) which serves as a man way or access point (FIG. 20 or 21) to facilitate selective settling chamber change outs or change overs. More particularly, as should be appreciated with inspection of either FIG. 20 or 21, passage of a settling cannister through turret base 34, for securement within the assembly body plates is possible via the man way.

As to a preferred sequence of operation, the actuatable turret assembly selectively rotates in relation to the turret base and the metering station overhead. More particularly, the actuation, in the form of an indexed rotation, proceeds in relation to a fill station/locus delimited by the metering station, and an emptying station/locus delimited by the turret base. Preferably, metered product will be received at the loading station and released at the discharge station at approximately the same time.

As tube "x" of "N" total tubes of the assembly is positioned for emptying at the emptying station, tube "x+1" is advantageously positioned for initial filling at the fill station proximal to the emptying station while tube "x+2" has undergone an initial

settling/compaction iteration, and tube "x-1" proceeds to an "on-deck" position for emptying (i.e., next in queue for emptying). Indexing occurs every time a settled and formed metered product charge is discharged from the turret assembly to or into the bag maker funnel/former, advantageously the lumen of a vented tube as per FIG. 16 or 17, with several charges of
5 metered product introduced to the turret assembly throughout an actuation cycle. By way of non-limiting example, with the filling and emptying stations adjacent or neighboring, and no otherwise "empty" settling and forming chambers, the number of travel "stops" for the turret assembly will be equal to N-2, i.e., two less than the number of bins.

For the larger/largest bag size(s) there are preferably seven or eight bins/tubes
10 retained in the turret assembly body which receive metered product charges, one at a time/sequentially, from the metering station. The number of sleeves or tubes is variable, a function of, among other things, the type of product for processing and the processing objectives for the product, e.g., the quantity or number could possibly double when smaller bags are contemplated. Insert or change out bins, via a mix and match approach, may be used
15 to satisfy one or more alternate product processing objectives.

As the turret rotates it settles the product in the turret by a quick cessation and restart of a unidirectional motion. In as much as the contemplated motion is "start/stop," and the motion is unidirectional rotation, it need not be so limited. For instance, inertial changes generally are believed satisfactory for aiding and/or performing settling operation, e.g.,
20 changes in turret assembly velocity or acceleration, and, a back and forth cycling of the turret assembly, whether via forward and rearward rotation of the assembly depicted herein, or, via a bi-directional motion via a modified or alternately configured turret assembly, is likewise a contemplated option.

Thus, since the steps, assemblies, and/or structures of the packaging related process,
25 system and apparatus disclosed herein may be embodied in other specific forms without departing from the spirit or general characteristics thereof, some of which forms have been indicated, the features described and depicted herein/with are to be considered in all respects illustrative and not restrictive. Accordingly, the scope of the disclosed invention is as defined in the language of the appended claims, and includes liberal, not insubstantial equivalents
30 thereto.

CLAIMS

What is claimed is:

1. A vertical form, fill, and seal machine, said vertical form, fill and seal machine comprising:
 - a weigher upstream from a product delivery cylinder, wherein said product delivery cylinder comprises a forming collar, and
 - a product delivery cylinder comprising at least one vacuum relief hole located above said forming collar.
2. The vertical form, fill, and seal machine of claim 1 further comprising a gate located upstream from said product delivery cylinder.
3. An apparatus for compacting a product slug, said apparatus comprising:
 - a weigher;
 - a product delivery cylinder;
 - a settling device; and
 - a gate;
 wherein said settling device is located between said weigher and said product delivery cylinder, wherein said gate is located upstream from said product delivery cylinder, wherein said product delivery cylinder comprises a forming collar, and wherein said product delivery cylinder comprises at least one vacuum relief hole located above said forming collar.
4. The apparatus of claim 3 wherein said at least one vacuum relief hole is located three inches from the top of said product delivery cylinder.
5. The apparatus of claim 3 wherein said fast acting gate is located upstream from said product delivery cylinder, wherein said fast acting gate can be completely open in less than about 50 milliseconds.

6. The apparatus of claim 3 wherein said settling device comprises a settling chamber.
7. The apparatus of claim 6 wherein said settling chamber is acted upon to facilitate and speed up a settling of product received and retained therein.
8. The apparatus of claim 6 wherein said settling chamber is characterized by an open top and an open bottom.
9. The apparatus of claim 6 wherein said settling chamber has a height of about 0.5 to 2.5 times a height of a package of packaged product.
10. The apparatus of claim 3 further comprising a funnel, said funnel intermediate said gate and said product delivery cylinder.
11. The apparatus of claim 10 wherein said funnel has a diameter larger than a diameter of a settling chamber of said settling device but smaller than a diameter of said product delivery cylinder.

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KNOWN
BAG MANUFACTURING
AND
PACKING PROCESS

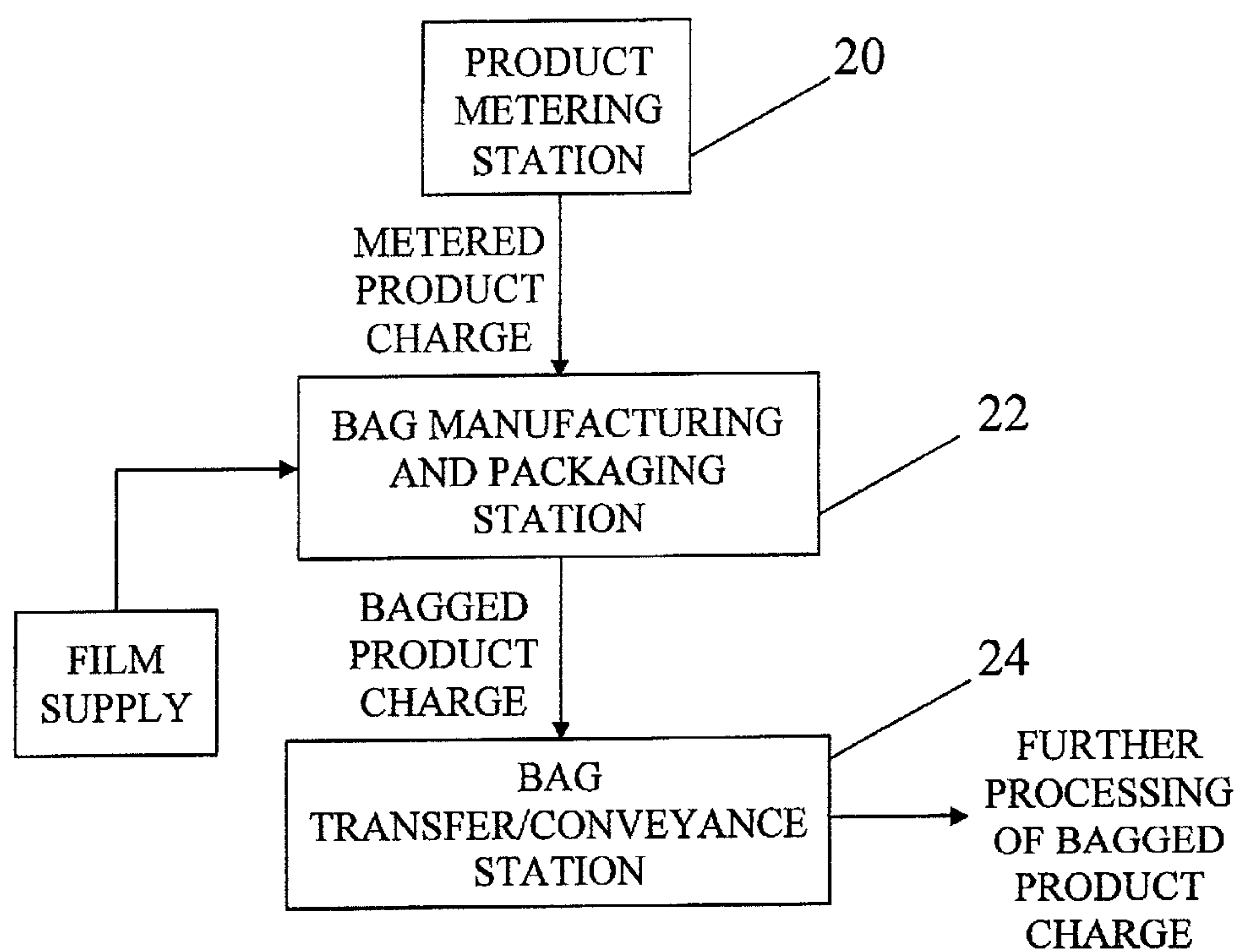


FIG. 1

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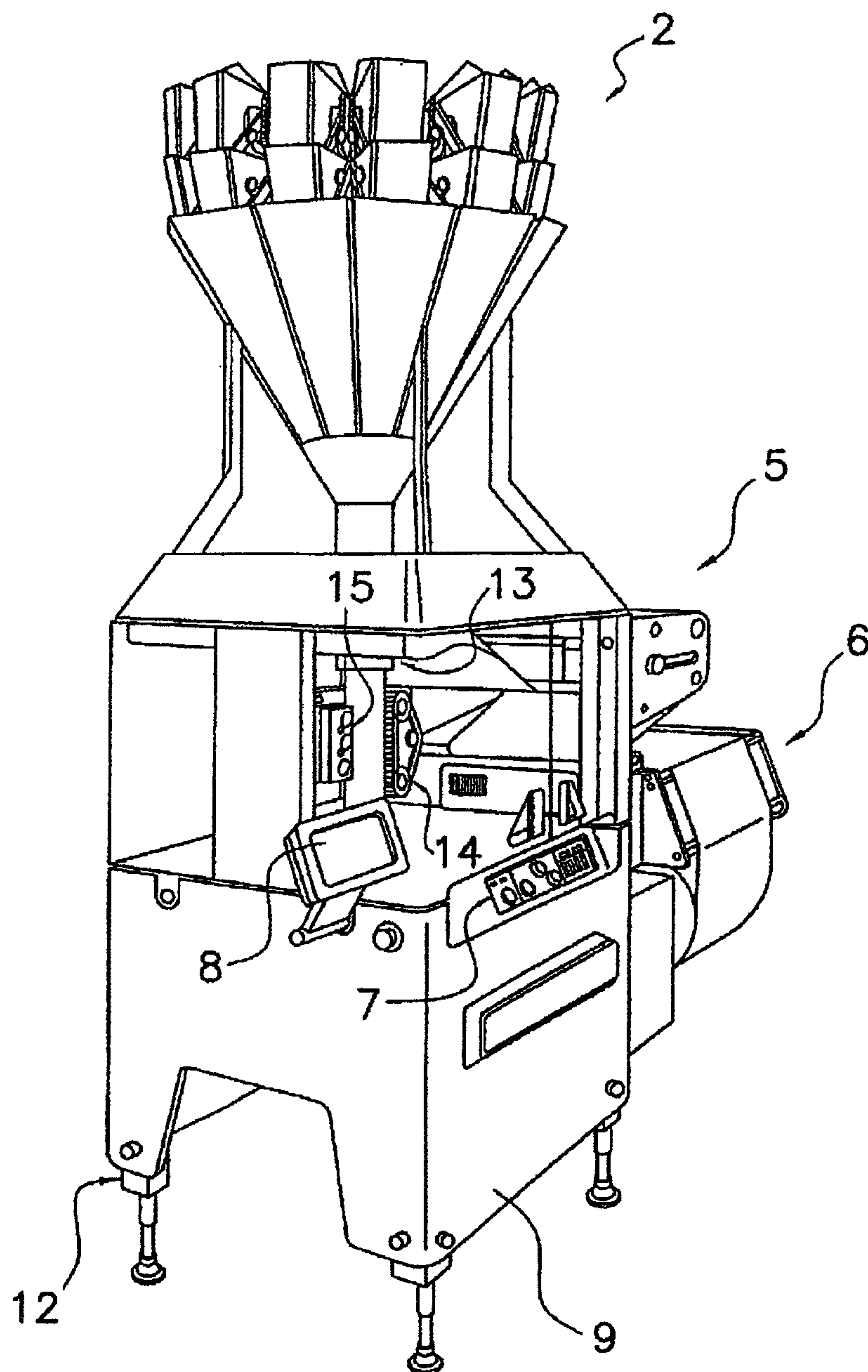
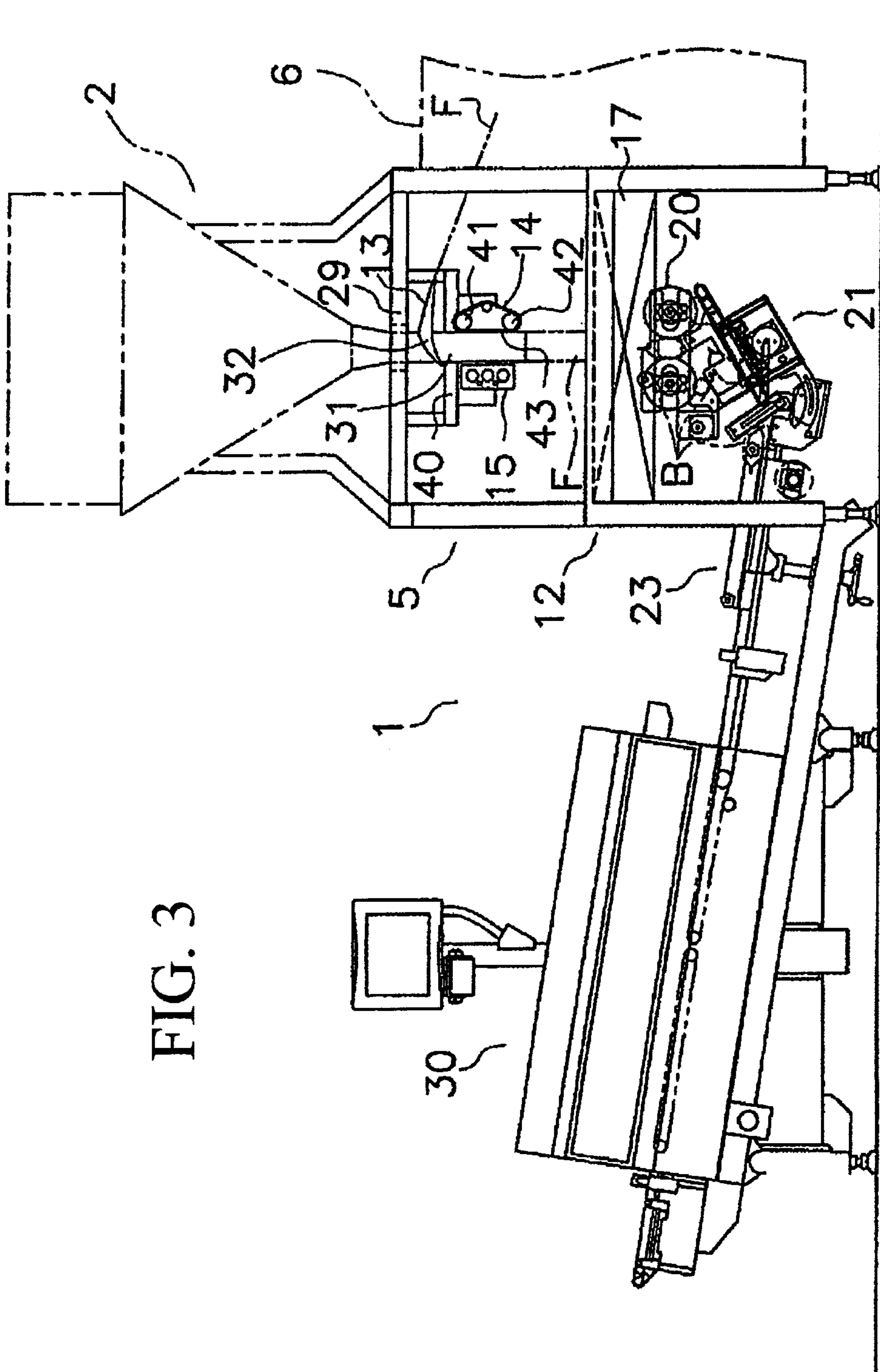


FIG. 2
KNOWN SYSTEM
PACKAGING/BAGGING

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FIG. 3



KNOWN SYSTEM
PACKAGING/BAGGING

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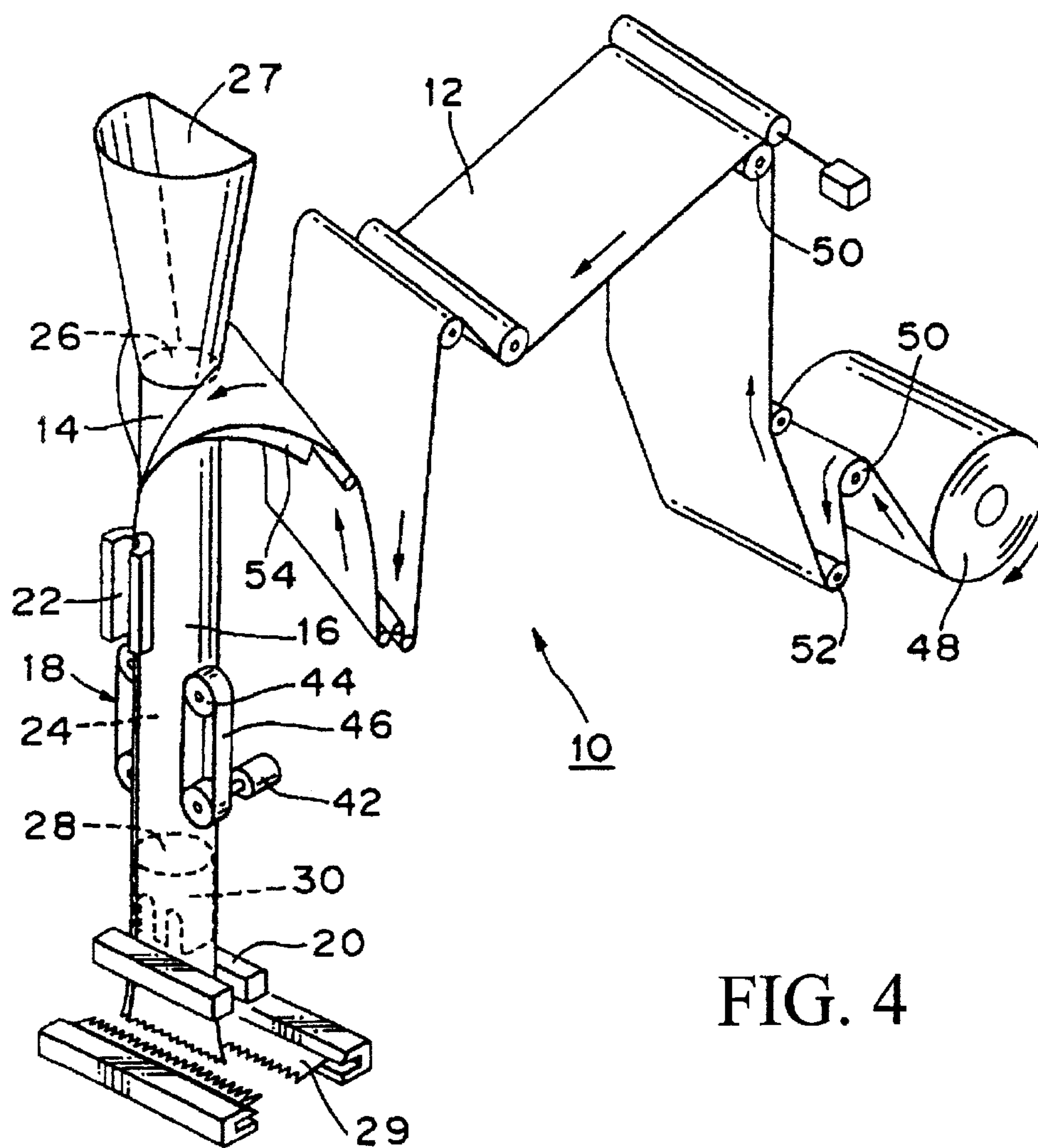


FIG. 4

KNOWN SYSTEM
PACKAGING/BAG FORMING

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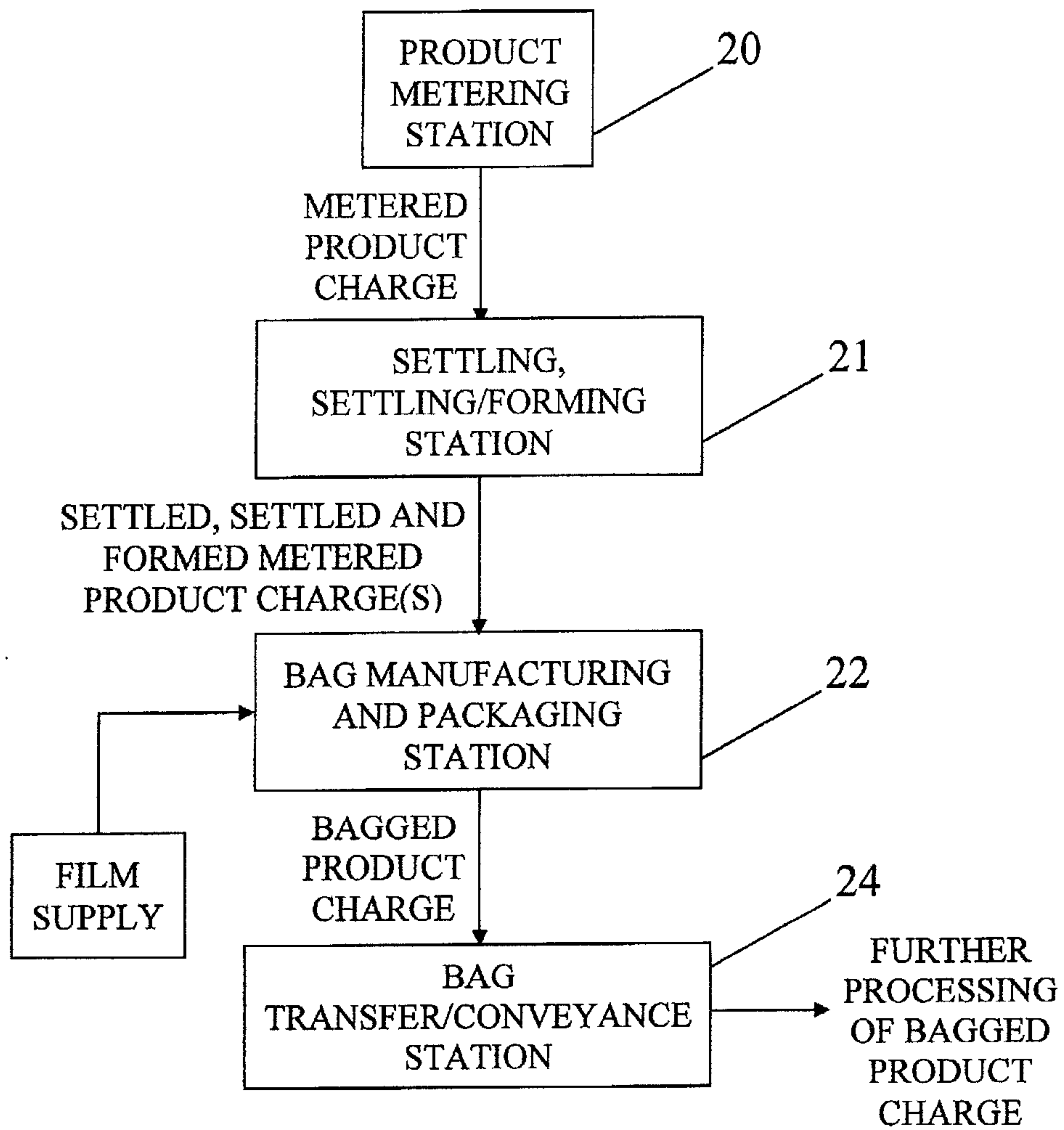
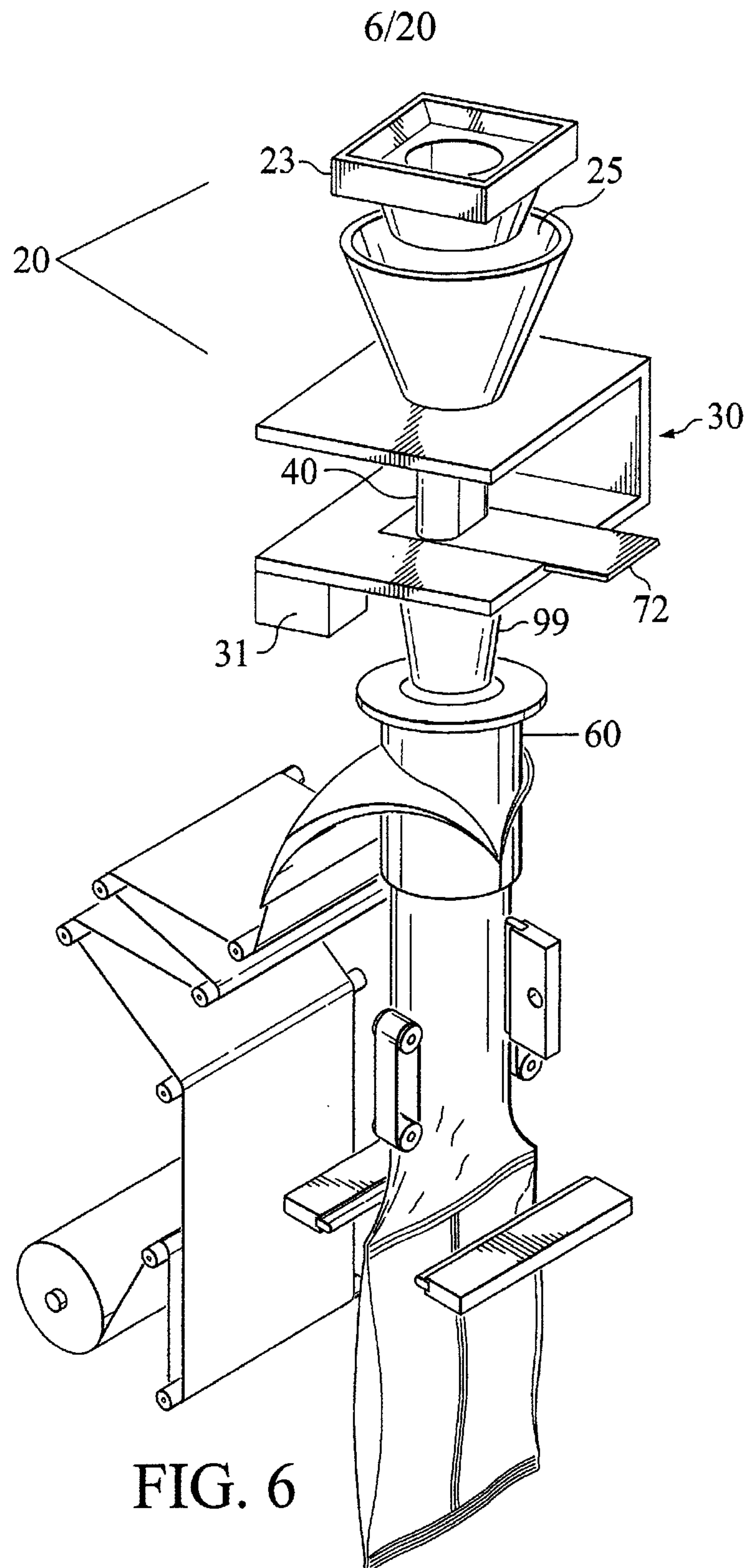
IMPROVED
BAG MANUFACTURING
AND
PACKING PROCESS

FIG. 5



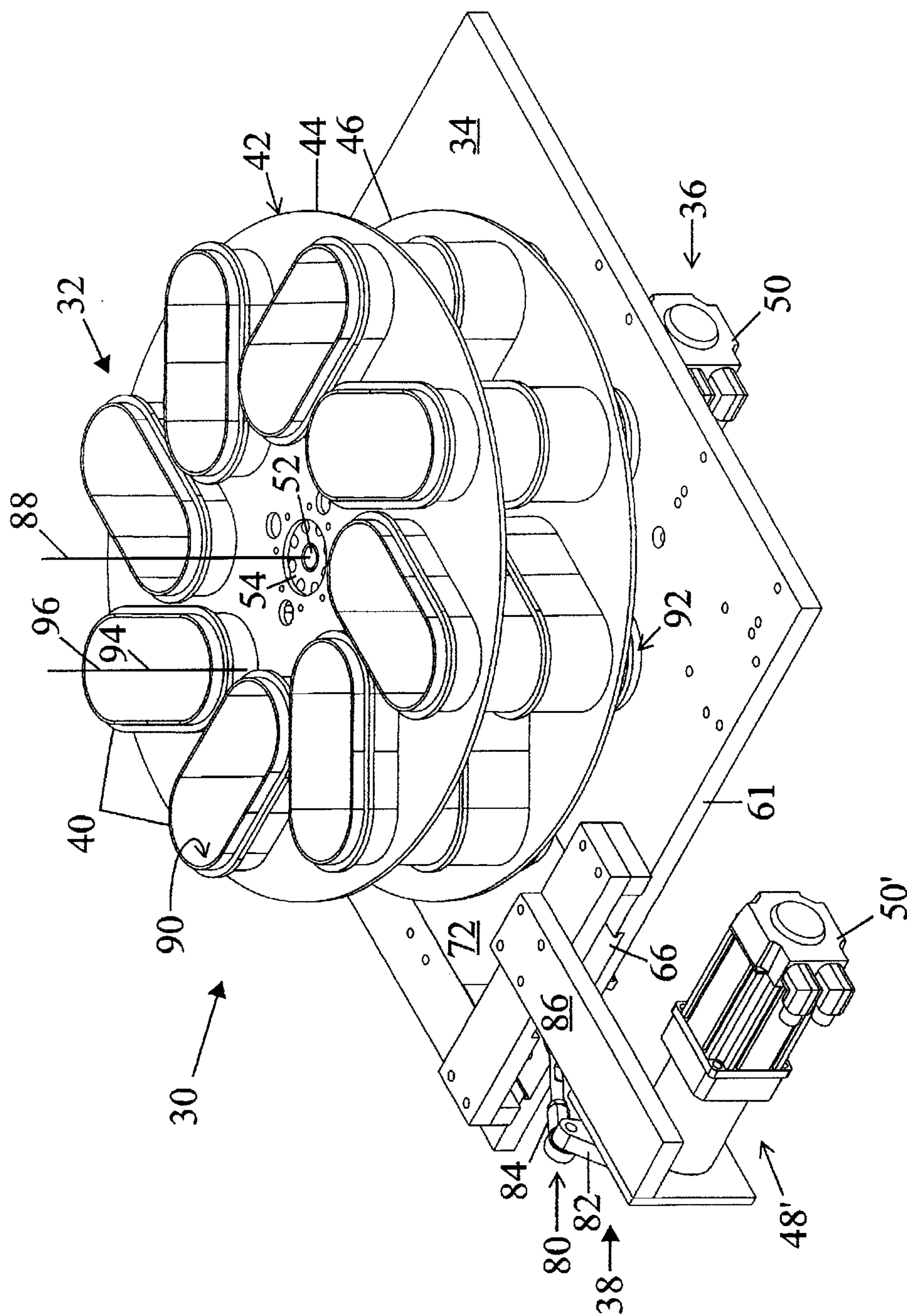


FIG. 7

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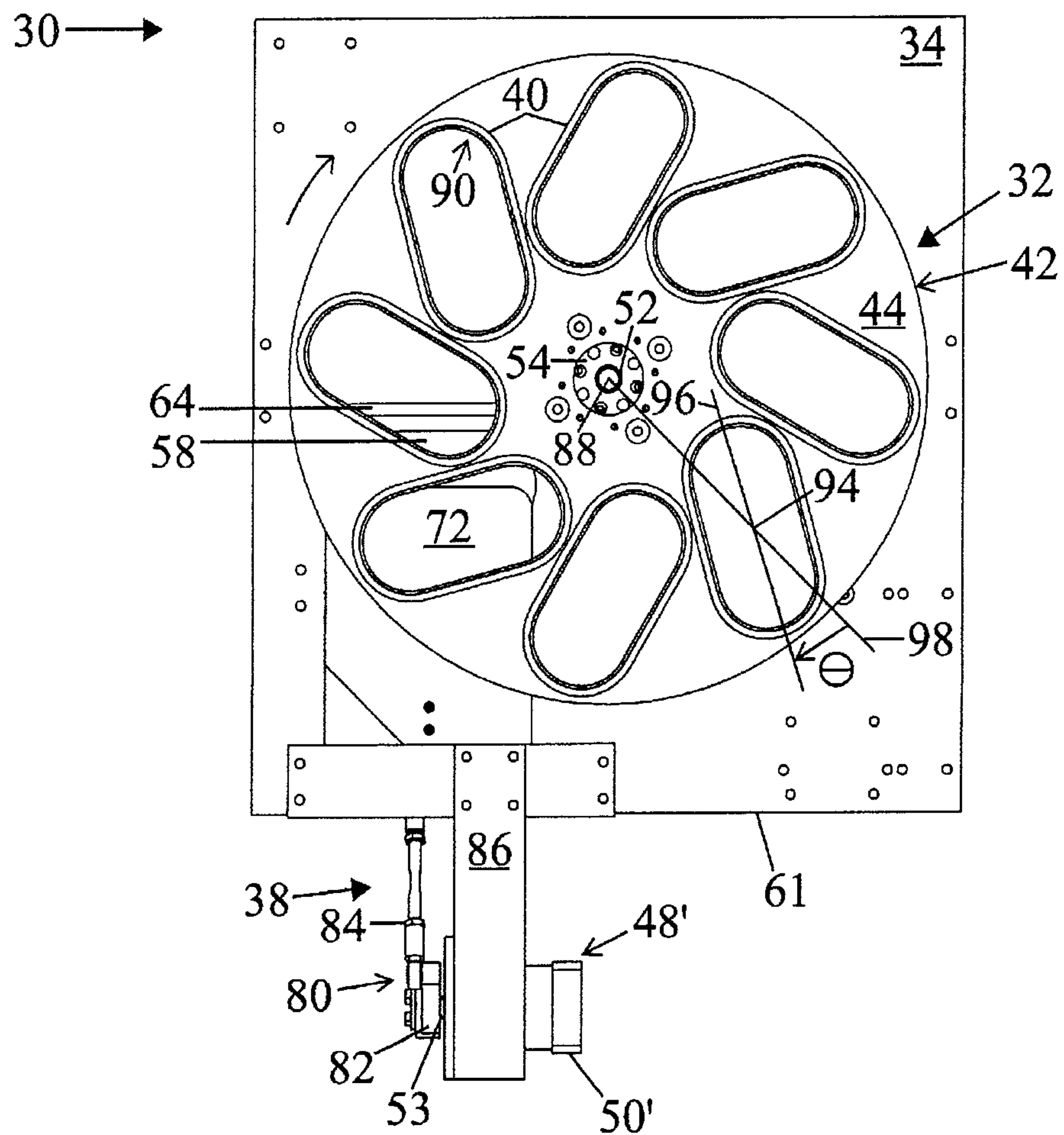


FIG. 8

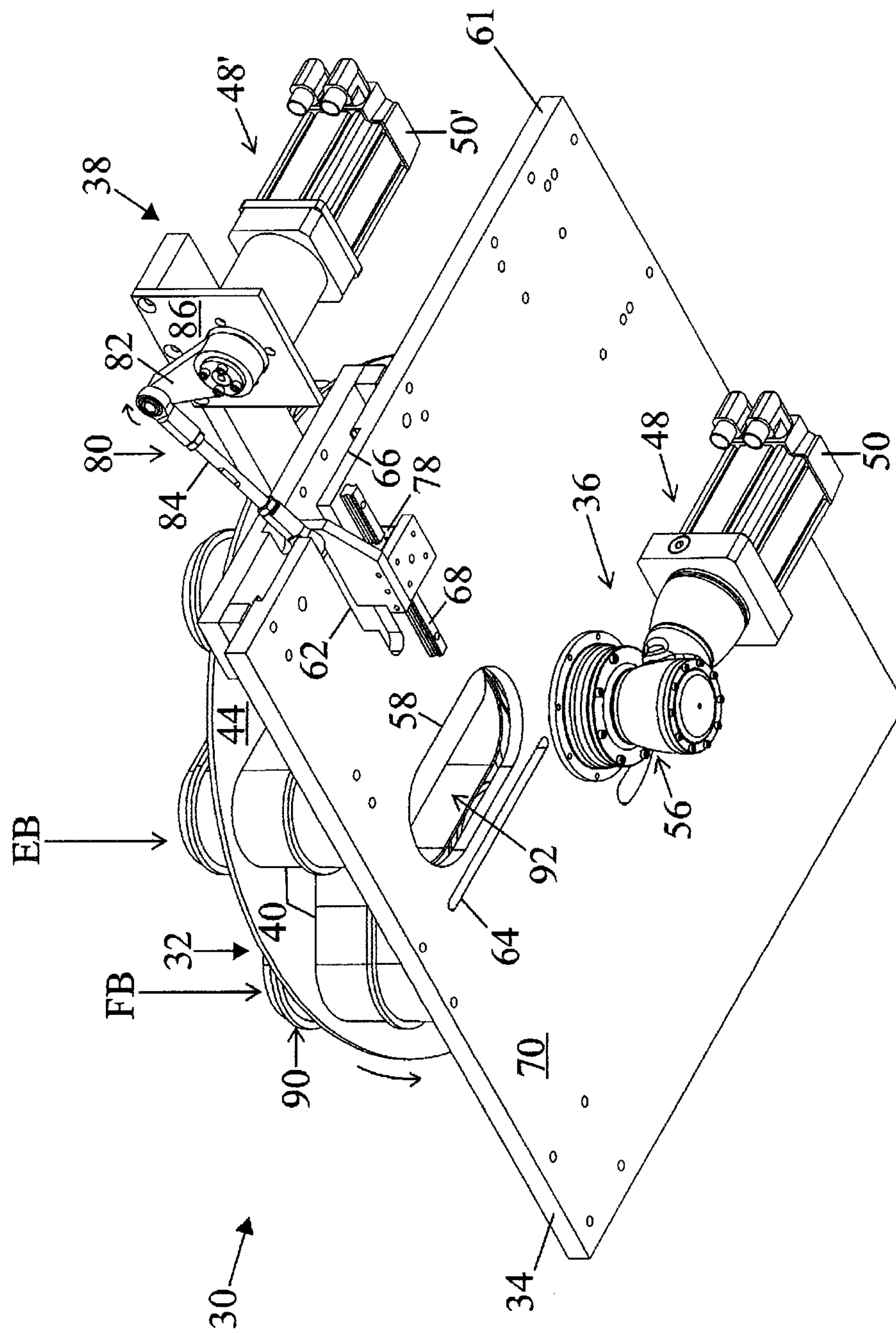


FIG. 9

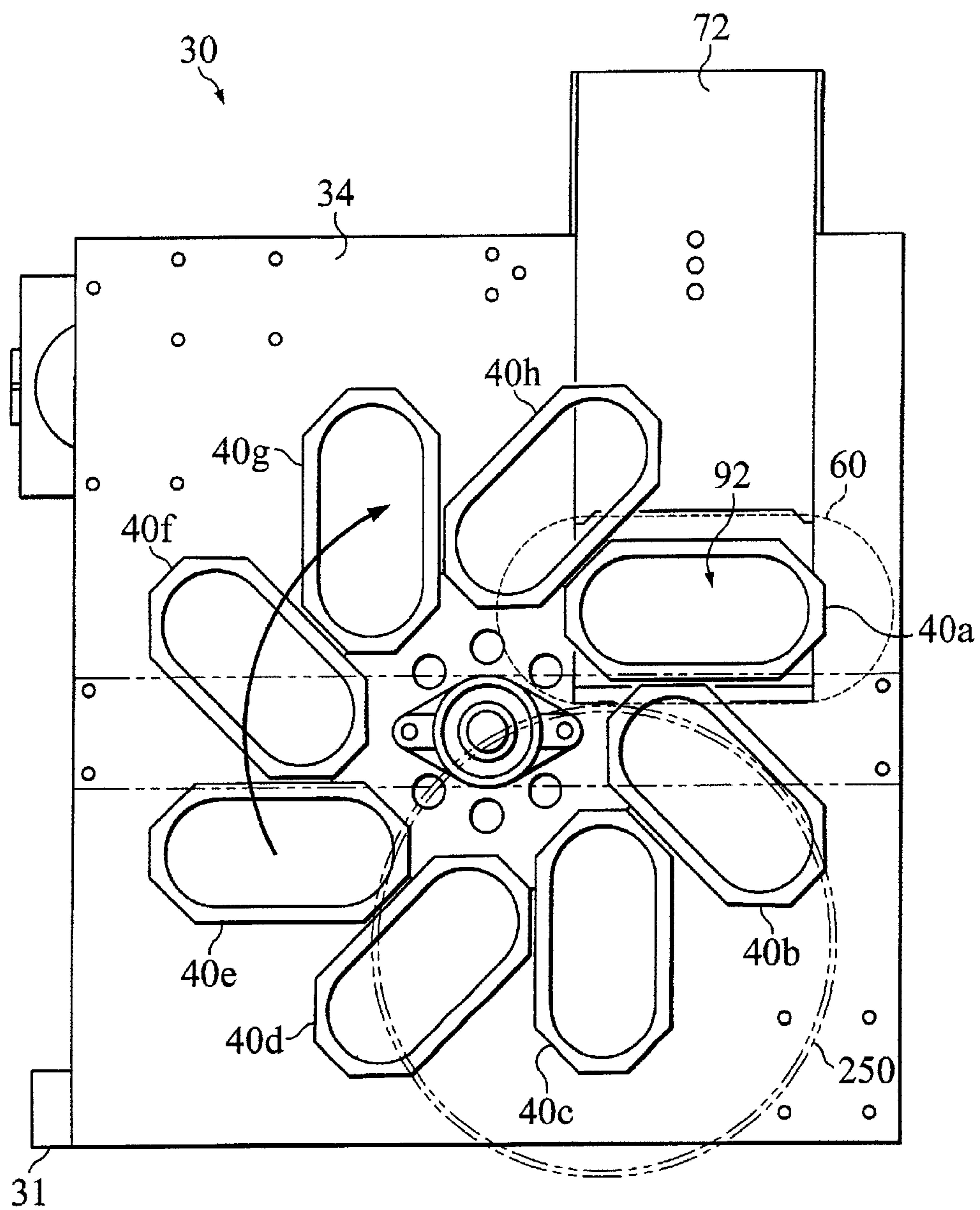


FIG. 10

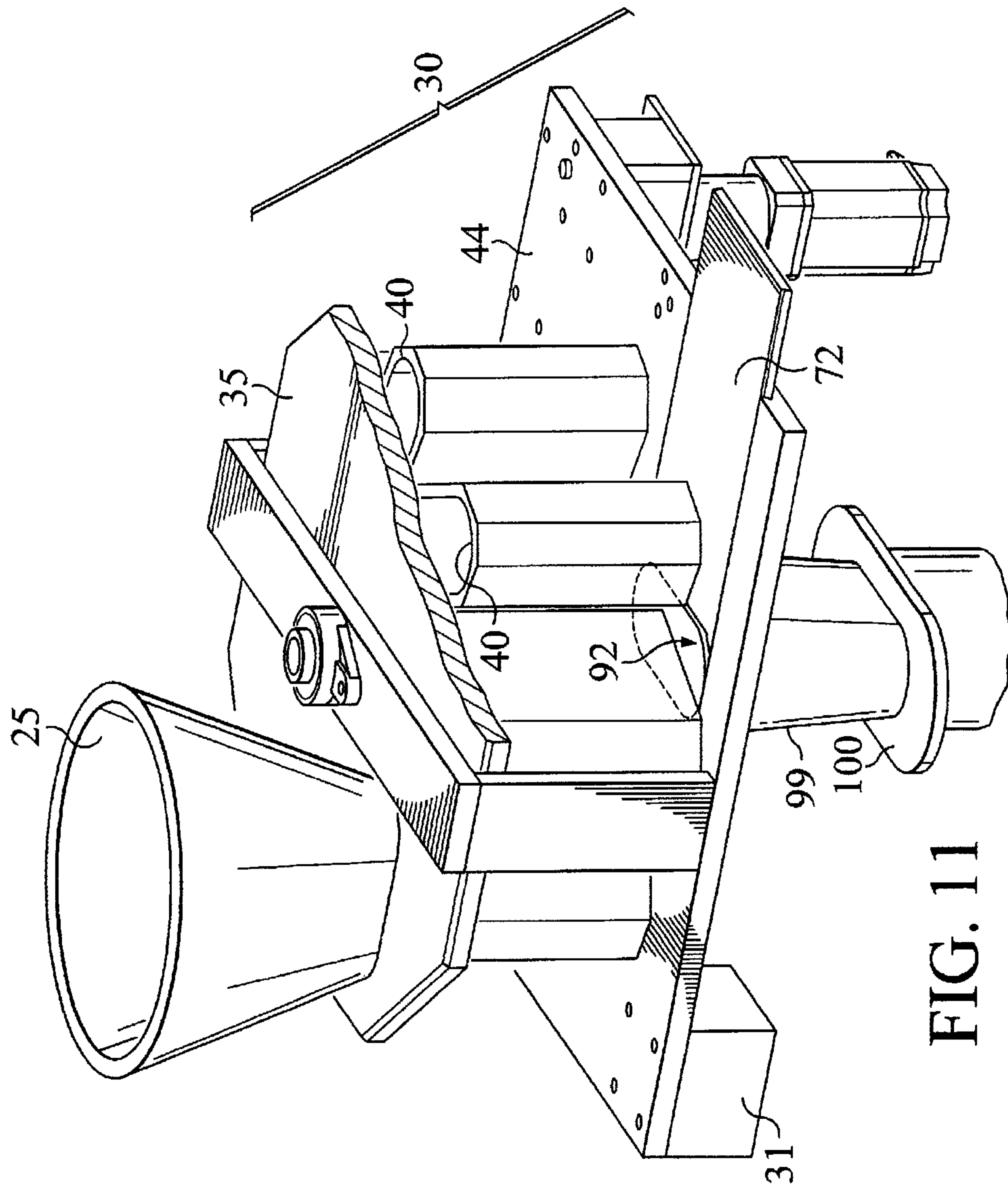


FIG. 11

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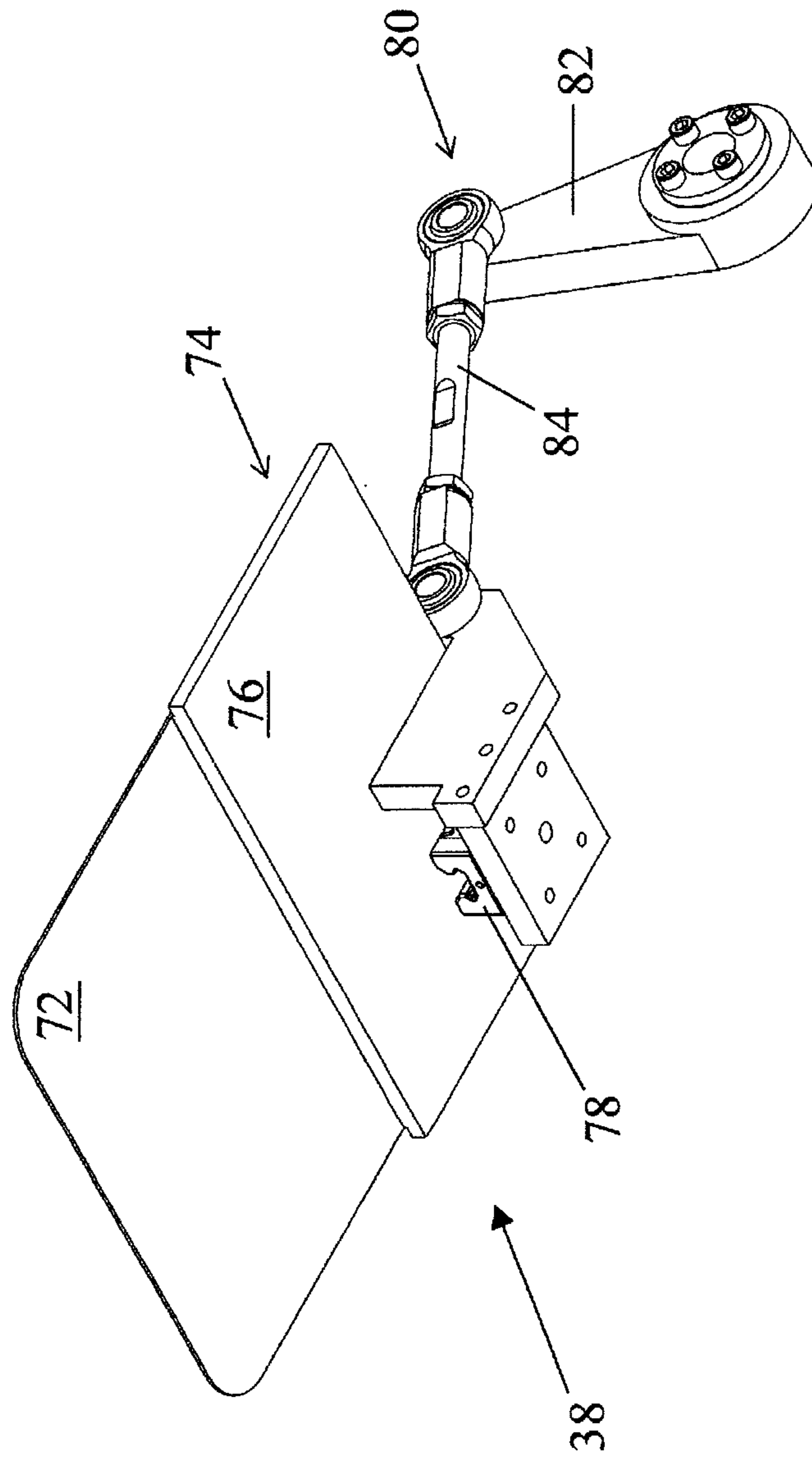


FIG. 12

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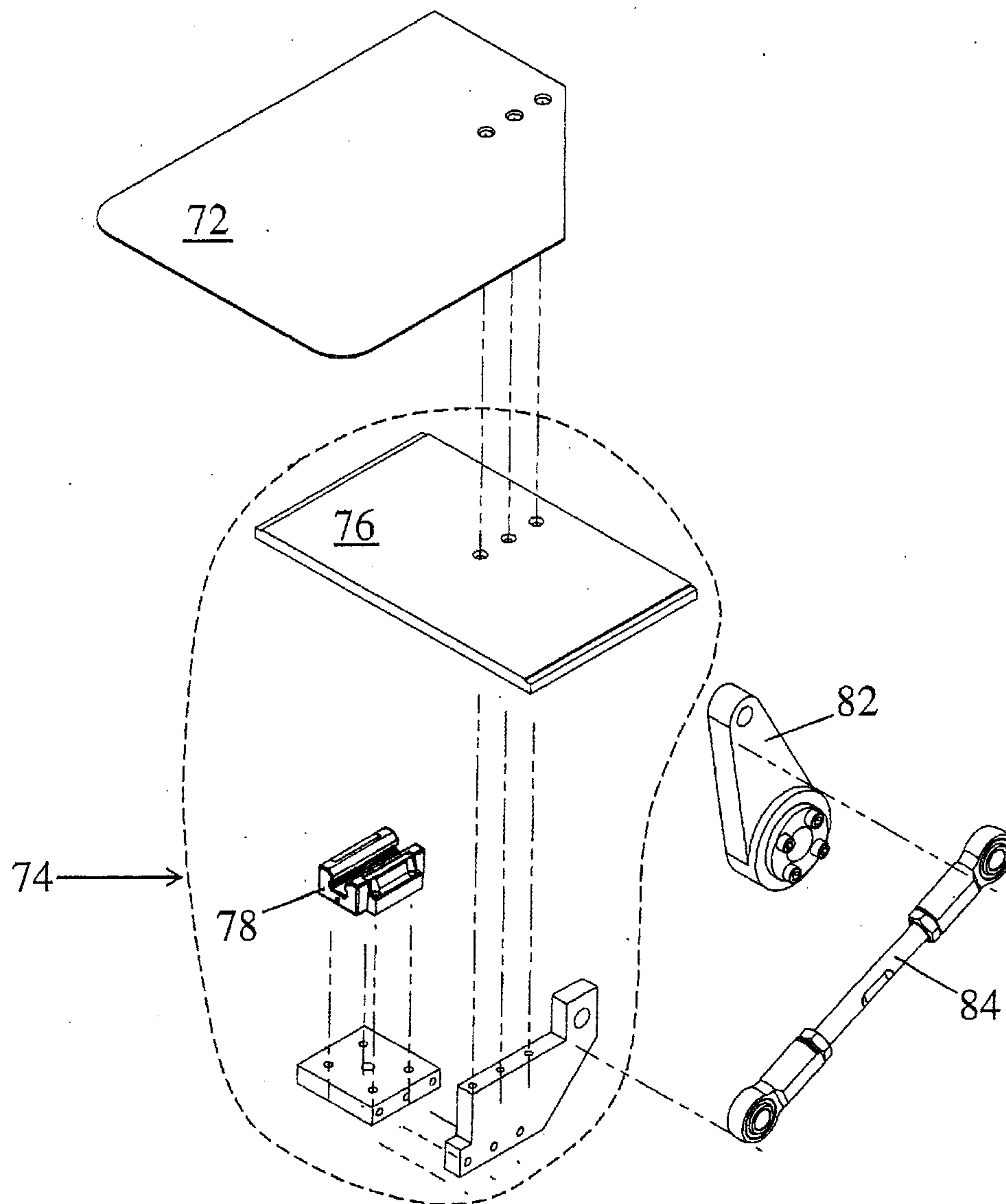


FIG. 13

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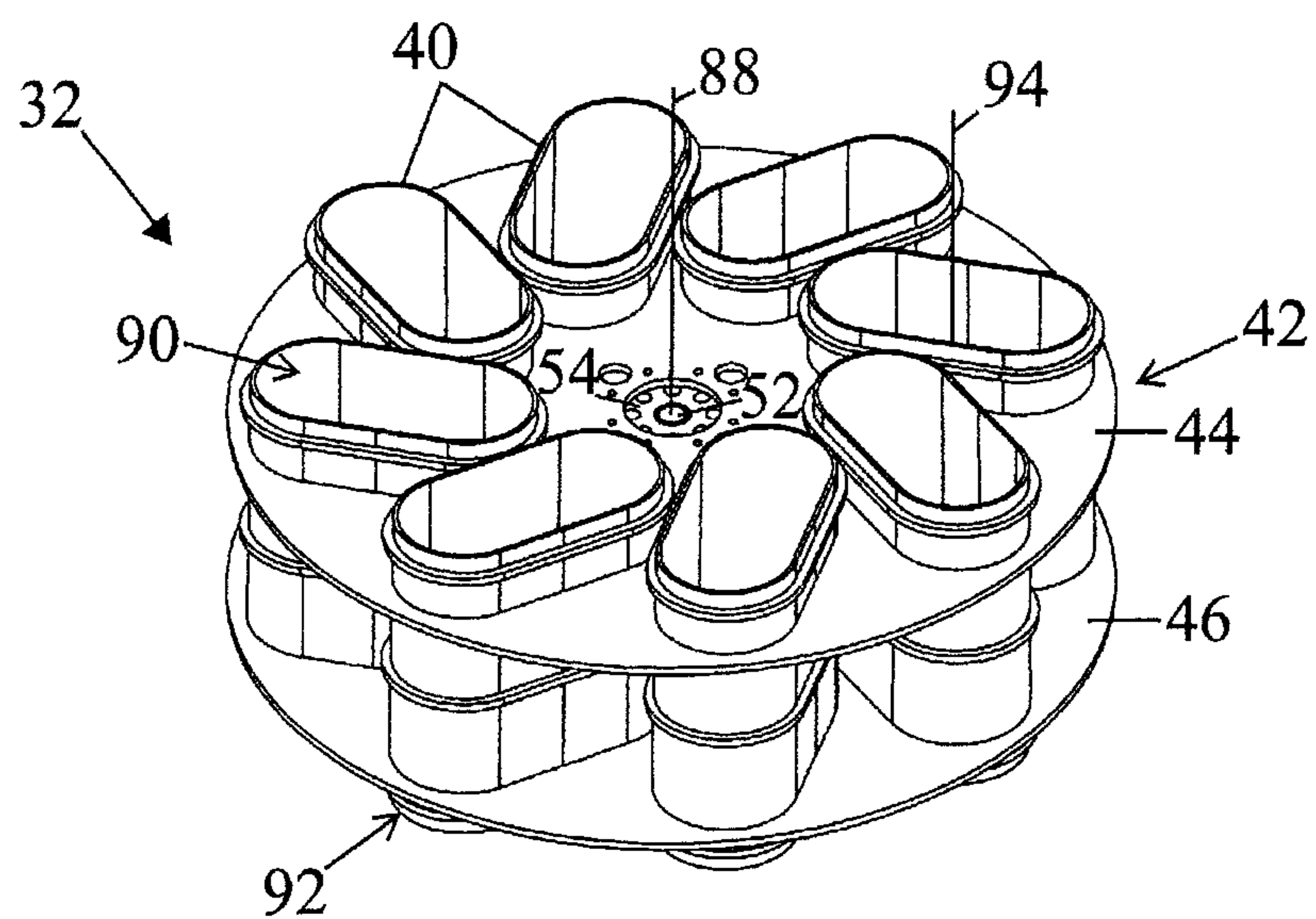


FIG. 14

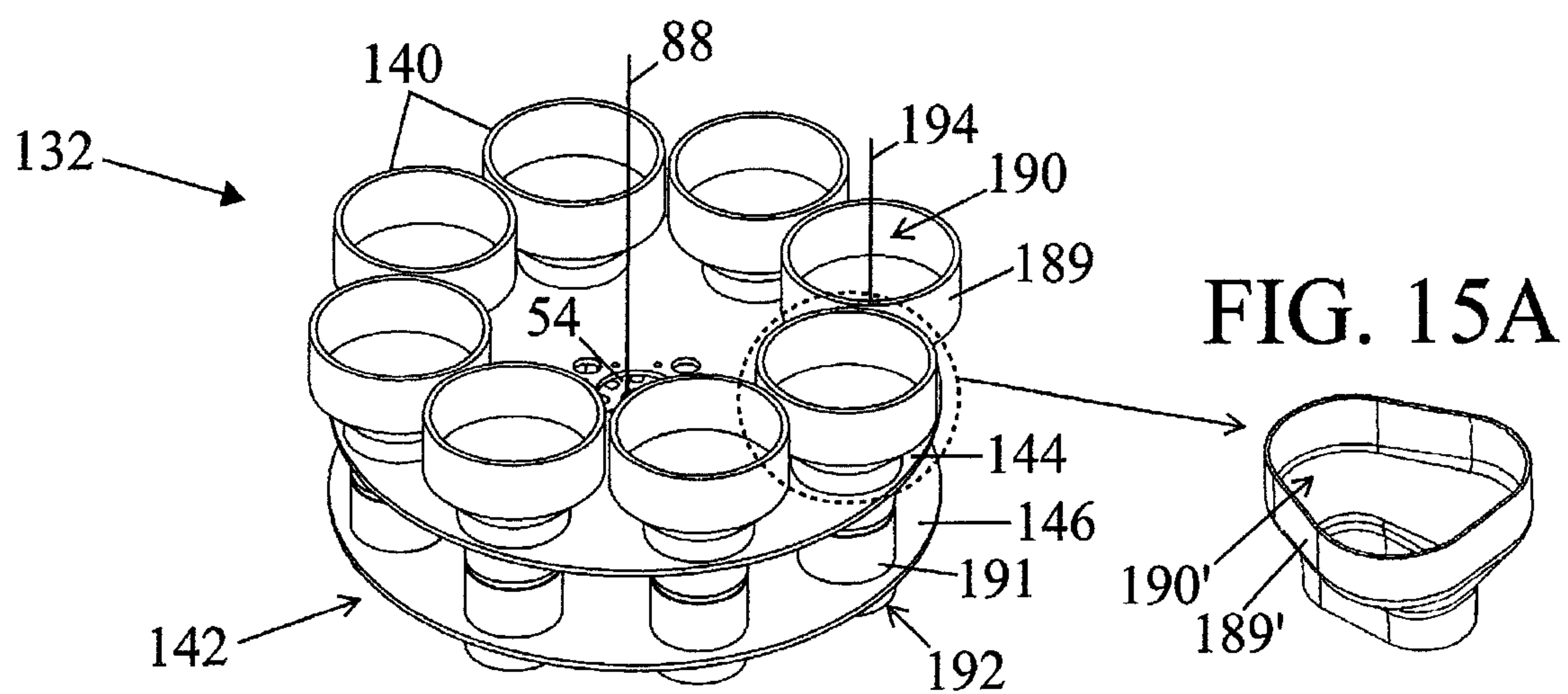


FIG. 15A

FIG. 15

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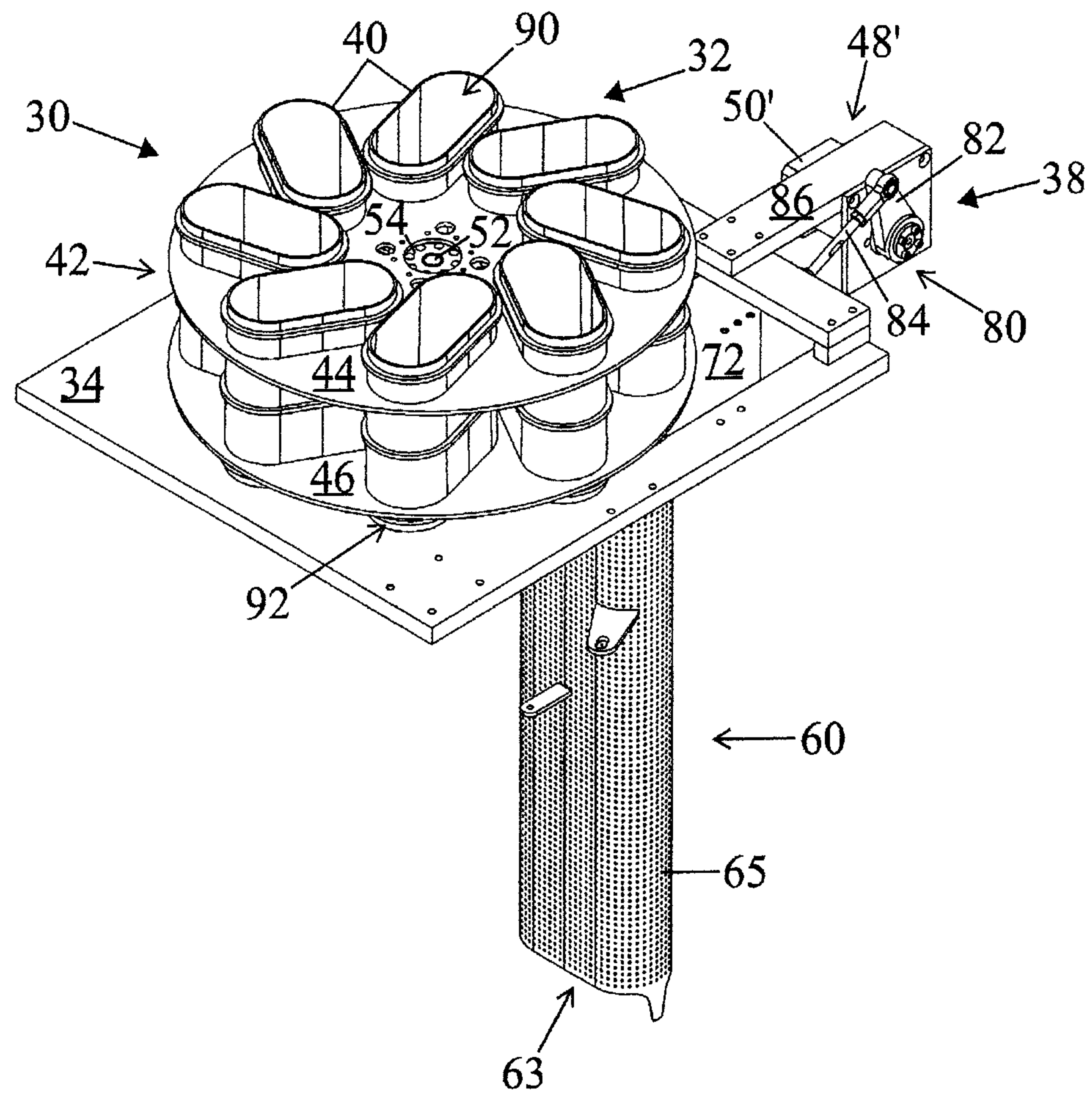


FIG. 16

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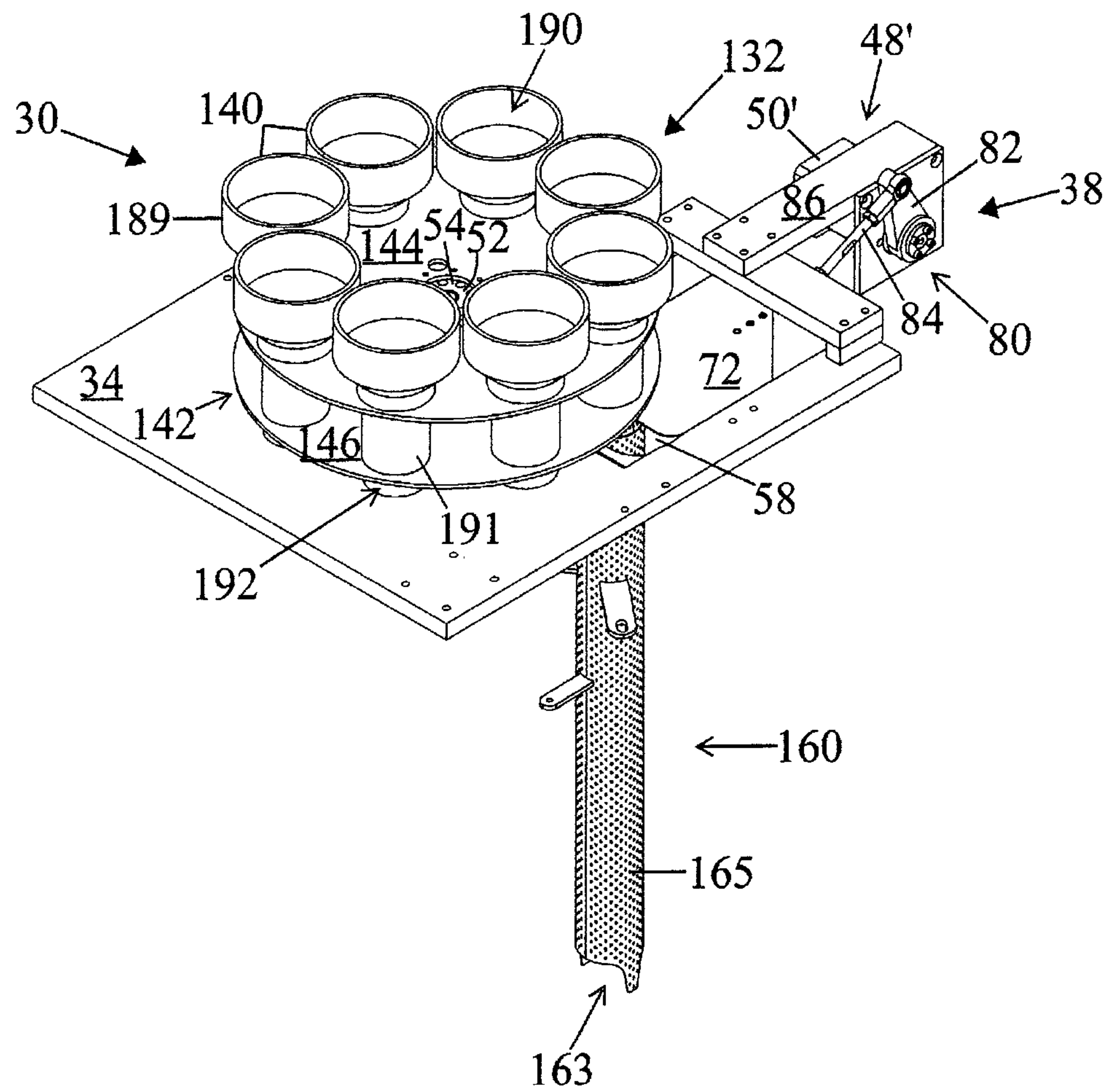


FIG. 17

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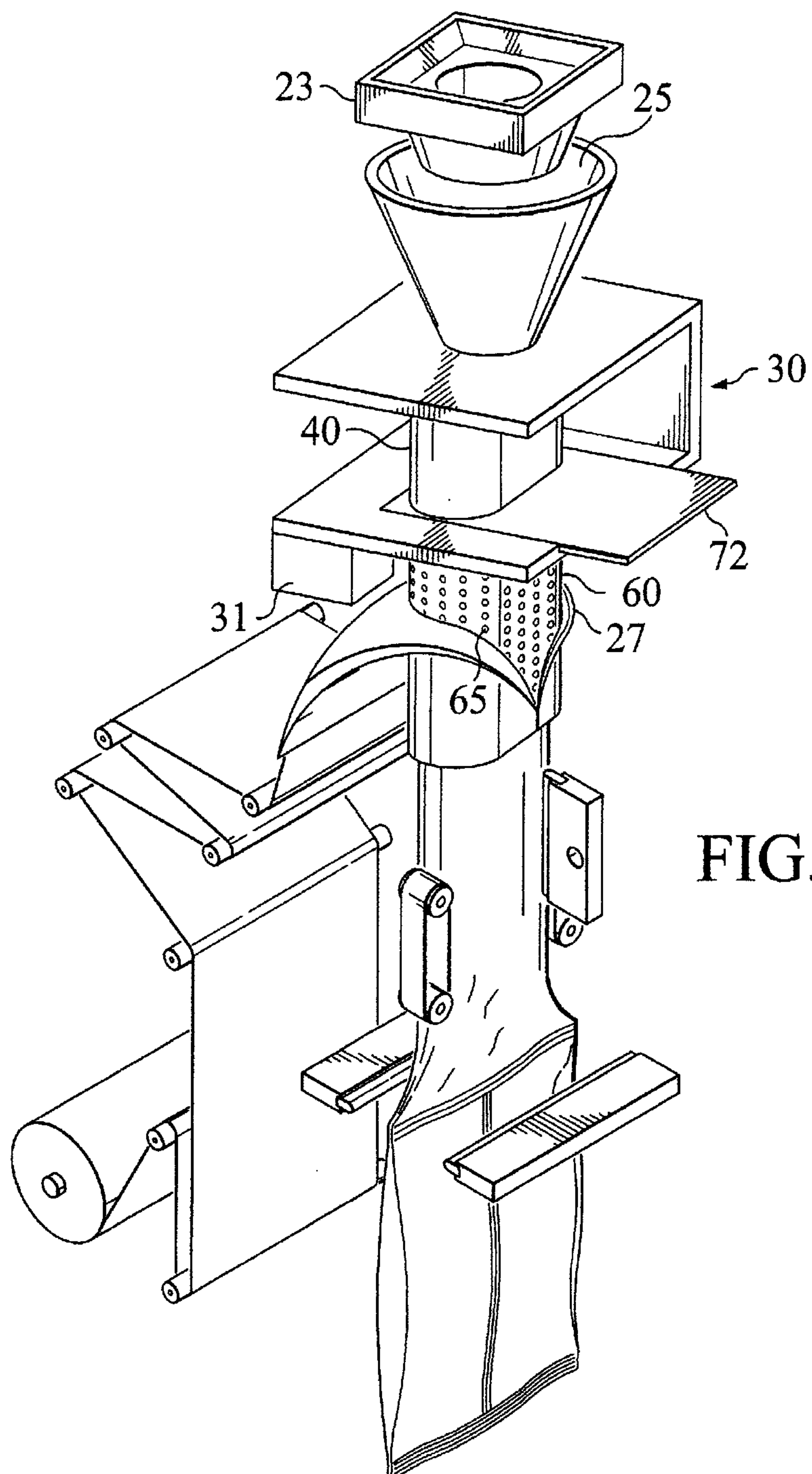


FIG. 18

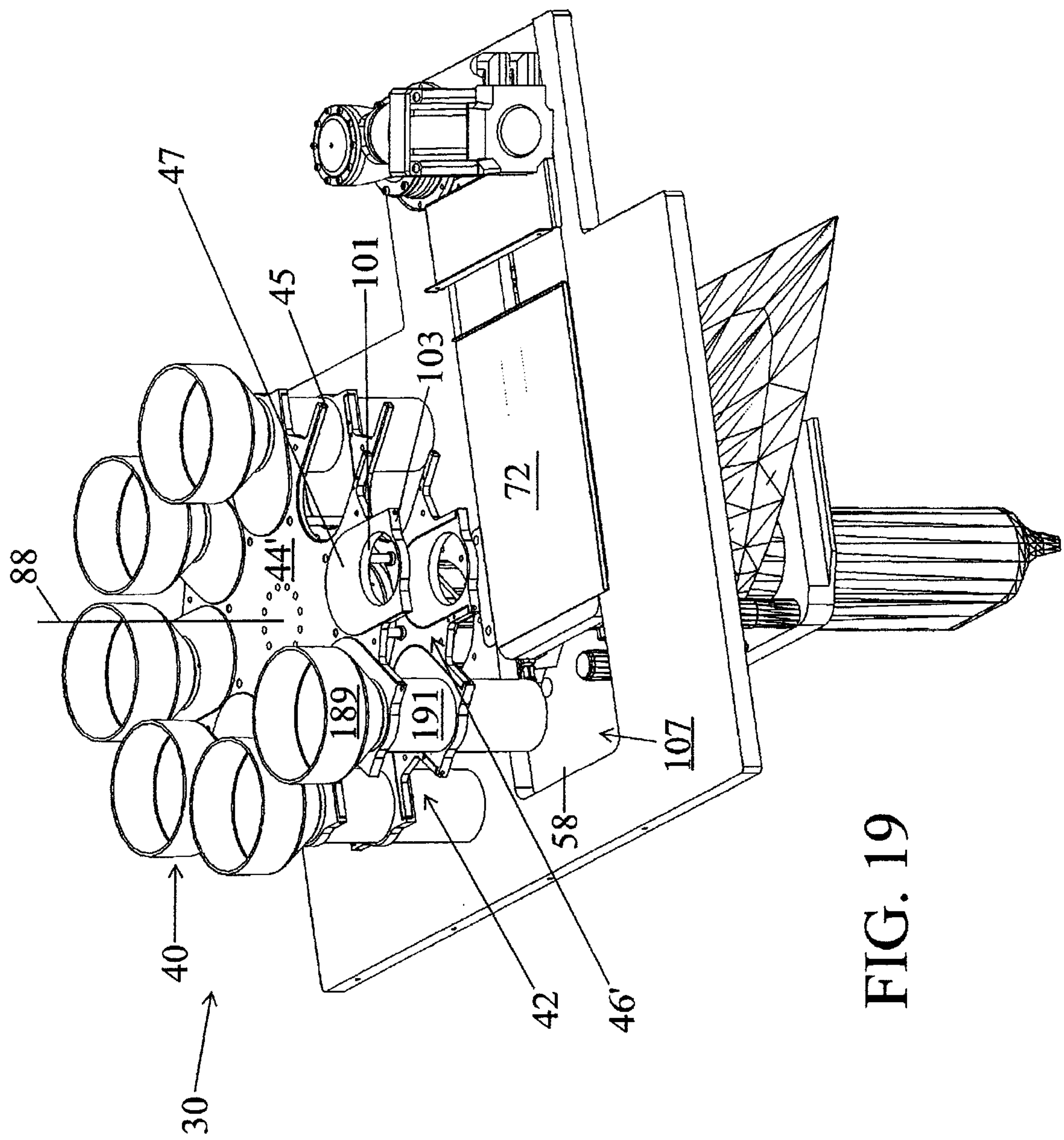


FIG. 19

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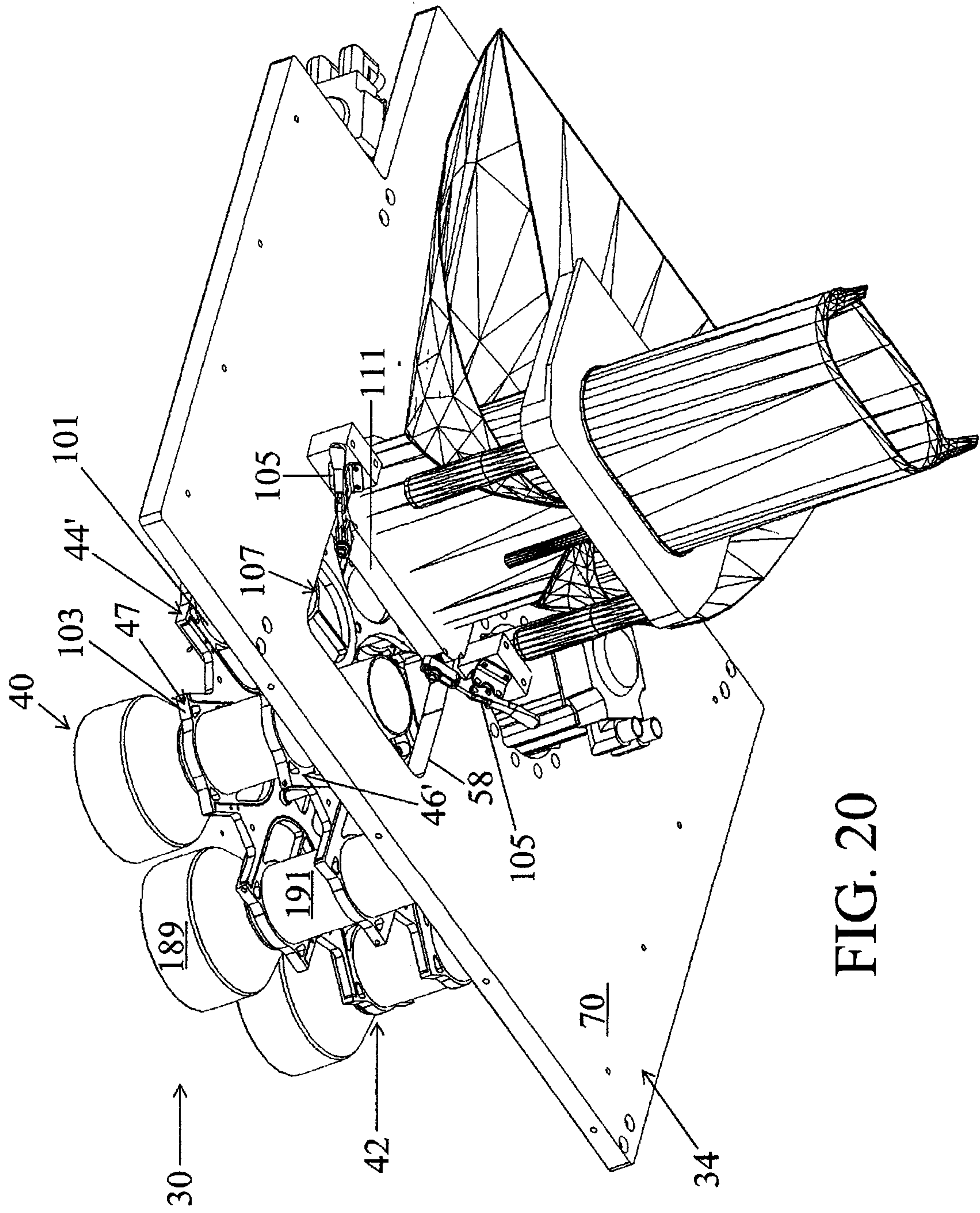


FIG. 20

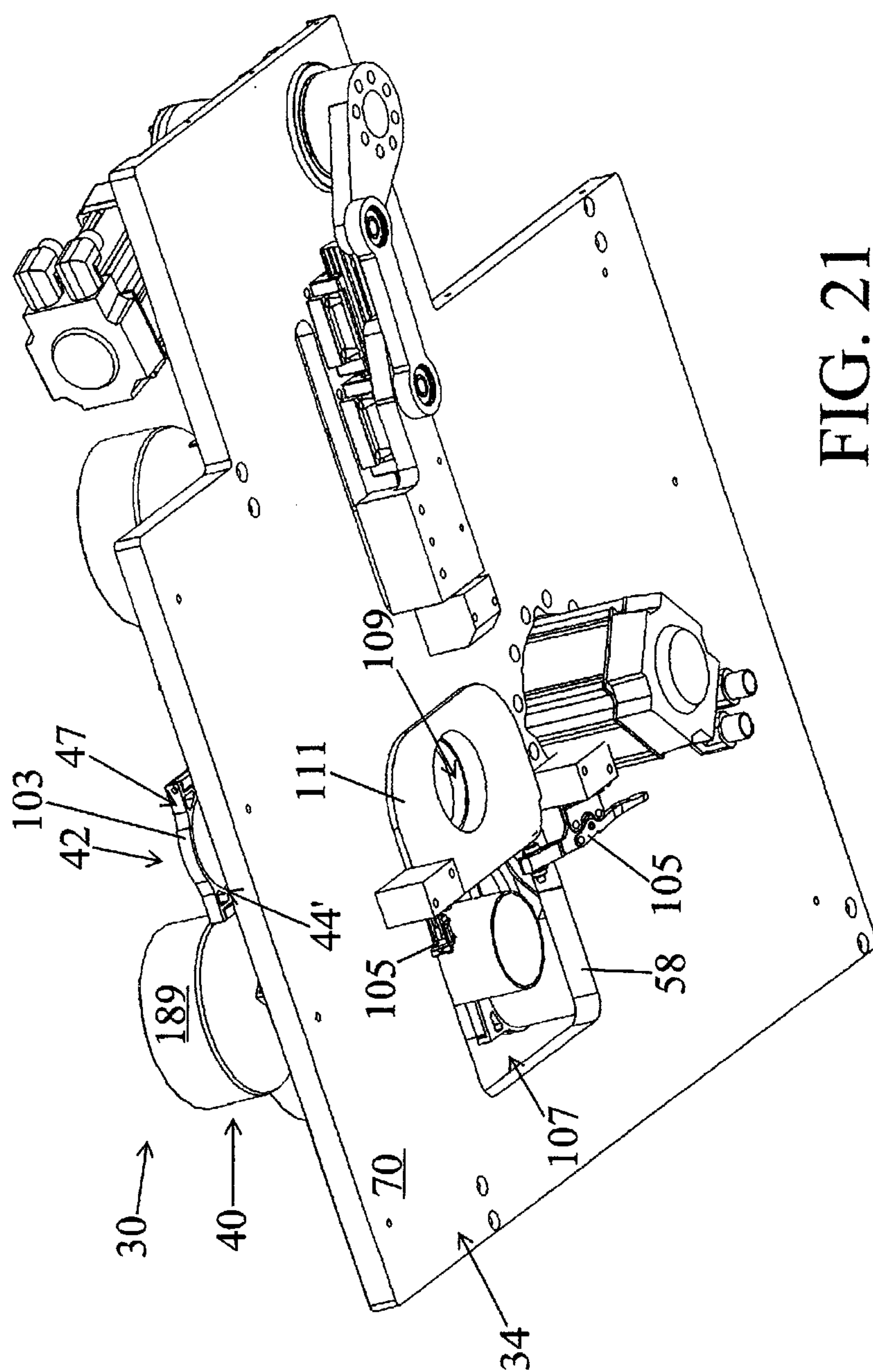


FIG. 21