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ABSTRACT

A blender (1) has a frame (2). A number of raw material storage bins (3) are mounted at a top of the frame (2). Suspended on the frame (2) beneath the raw material storage bins (3) is a weigh hopper (4). Mounted beneath the weigh hopper (4) on the frame (2) is a mixing chamber (5) for reception of materials to be blended from the weigh hopper (4). A mixer, in this case provided by a mixing screw (6), is provided at a bottom of the mixing chamber (50 for blending materials within the mixing chamber prior to discharge of blended materials through a material outlet (7) at a bottom of the mixing chamber (5). The material outlet (7) discharges blended material into a material discharge pipe (8) and through an outlet duct (9) having a flanged end (10) for mounting the blender (1) on a processing line such as a plastics extruder. The mixing chamber (5) is mounted on a cantilevered support platform (12) on a base plate (140 of the frame (2) and cooperates with a load cell (15) mounted on the base plate (14) to provide a measurement of the weight of the mixing chamber and materials therein to determine the weight of the materials within the mixing chamber.

(Fig.1)

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B01F 3/00
B01F 15/00

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"A Blender"

Introduction

This invention relates to blenders, and in particular to gravimetric batch blenders.

The invention particularly relates to blenders of the type described in our previous Patent Numbers EP 0911130 and EP 2143484. Such blenders are useful for accurate blending of particulate ingredient materials and controlled delivery of blended materials into a processing line such as a plastics extrusion process line.

It is an object of the present invention to provide an improved blender of this type.

Summary of the Invention

According to the invention, there is provided a blender, including:

a mixing chamber for reception of materials to be blended,

said mixing chamber having a material outlet,

a mixer for mixing materials within the mixing chamber for blending the materials within the mixing chamber prior to discharge of blended materials through the material outlet of the mixing chamber,

characterised in that the blender includes a weigher for weighing the mixing chamber to determine the weight of materials therein.

In another embodiment of the invention, the weigher is connected to a controller which is operable to control a process to which the blended materials are being supplied from the blender in use in response to the sensed weight of material being discharged from the mixing chamber. Alternatively, the controller could regulate the rate of discharge of blended material from the mixing chamber to the process. The controller could also be used to keep the weight in the mixing chamber constant, compensating for the discharge rate.

In another embodiment, the weigher is operable to continuously weigh the mixing chamber and contents therein.

In another embodiment, the weigher comprises a load cell.

In a further embodiment, the mixing chamber is mounted on a cantilevered support platform which engages the load cell to provide a measurement of the weight of the mixing chamber and contents therein.

In another embodiment, the blender comprises a frame having a base plate, the cantilevered support platform being mounted by pivots to upstanding support rods on the base plate, a free end of the cantilevered support platform resting on the load cell which is carried on the base plate.

In another embodiment, a discharge pipe is provided at the material outlet, said discharge pipe having a baffle to regulate the flow of blended materials through the discharge pipe.

In another embodiment, the baffle comprises at least one baffle plate mounted within a bore of the discharge pipe and partially blocking the bore.

In another embodiment, a plurality of spaced-apart baffle plates is mounted within the bore of the discharge pipe defining a tortuous path for blended material through the discharge pipe.

In another embodiment the, or each, baffle plate is mounted on a side wall of the bore and extends outwardly and downwardly from the side wall.

In another embodiment of the invention inner free ends of the baffle plates overlap.

In another embodiment of the invention each baffle plate terminates at a central portion of the bore.

In another embodiment of the invention the baffle plates are vertically spaced-apart

within the bore of the discharge pipe.

In a preferred embodiment of the invention, a pair of spaced-apart baffle plates is mounted within the bore of the discharge pipe.

In another embodiment of the invention the mixing chamber is mounted by the discharge pipe on the cantilevered support platform.

In another embodiment of the invention the discharge pipe is mounted intermediate the ends of the cantilevered support platform.

In another embodiment of the invention a lower end of the discharge pipe projects through a complementary opening in the base plate for discharge into an outlet duct mounted on an underside of the base plate.

In another aspect the invention provides a blender, including:

a mixing chamber for reception of materials to be blended,

said mixing chamber having a material outlet,

a mixer for mixing materials within the mixing chamber for blending the materials within the mixing chamber prior to discharge of blended materials through the material outlet of the mixing chamber,

characterised in that a discharge pipe is provided at the material outlet, said discharge pipe having a baffle to regulate the flow of blended materials through the discharge pipe.

In another embodiment, the baffle comprises at least one baffle plate mounted within a bore of the discharge pipe and partially blocking the bore.

In another embodiment, a plurality of spaced-apart baffle plates is mounted within the bore of the discharge pipe defining a tortuous path for blended material through the discharge pipe.

In another embodiment the, or each, baffle plate is mounted on a side wall of the bore and extends outwardly and downwardly from the side wall.

In another embodiment of the invention inner free ends of the baffle plates overlap.

In another embodiment of the invention each baffle plate terminates at a central portion of the bore.

In another embodiment of the invention the baffle plates are vertically spaced-apart within the bore of the discharge pipe.

In a preferred embodiment of the invention, a pair of spaced-apart baffle plates is mounted within the bore of the discharge pipe.

In another embodiment of the invention the mixing chamber is mounted by the discharge pipe on the cantilevered support platform.

In another embodiment of the invention the discharge pipe is mounted intermediate the ends of the cantilevered support platform.

In another embodiment of the invention a lower end of the discharge pipe projects through a complementary opening in the base plate for discharge into an outlet duct mounted on an underside of the base plate.

Brief Description of the Drawings

The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only, in which:

Fig. 1 is a perspective view of a blender according to the invention;

Fig. 2 is a detail perspective view showing portion of the blender;

Fig. 3 is an elevational view of the blender portion shown in Fig. 2;

Fig. 4 is a plan view of the blender portion shown in Fig. 2;

Fig. 5 is an enlarged detail elevational view of portion of the blender;

Fig. 6 is a detail perspective view showing a discharge pipe portion of the blender;

Fig. 7 is an elevational view of the discharge pipe;

Fig. 8 is a side elevational view of the discharge pipe;

Fig. 9 is a plan view of the discharge pipe;

Fig. 10 is a sectional elevational view of the discharge pipe taken along the line X-X of Fig. 7;

Fig. 11 is a cut-away perspective view showing another blender according to a second embodiment of the invention;

Fig. 12 is a detail perspective view showing a discharge pipe for another blender according to a third embodiment of the invention;

Fig. 13 is a plan view of the discharge pipe shown mounted on a mixing chamber of the blender of Fig. 12;

Fig. 14 is a detail perspective sectional view showing the mixing chamber and discharge pipe of the blender of Fig. 12;

Fig. 15 is a detail sectional elevational view showing an alternative construction of material discharge pipe for use with the blenders of the invention;

Fig. 16 is a detail perspective view showing portion of another blender according to a fourth embodiment of the invention; and

Fig. 17 is a detail perspective view showing the blender portion of Fig. 16.

Detailed Description of the Preferred Embodiments

Referring to the drawings, and initially to Figs 1 to 10 thereof, there is illustrated a blender according to the invention, indicated generally by the reference numeral 1. The blender 1 has a frame 2. A number of raw material storage bins 3 are mounted at a top of the frame 2. Suspended on the frame 2 beneath the raw material storage bins 3 is a weigh hopper 4. Mounted beneath the weigh hopper 4 on the frame 2 is a mixing chamber 5 for reception of materials to be blended from the weigh hopper 4. A mixer, in this case provided by a mixing screw 6, is provided at a bottom of the mixing chamber 5 for blending materials within the mixing chamber 5 prior to discharge of blended materials through a material outlet 7 at a bottom of the mixing chamber 5. The material outlet 7 discharges blended material into a material discharge pipe 8 and through an outlet duct 9 having a flanged end 10 for mounting the blender 1 on a processing line such as a plastics extruder. The mixing chamber 5 is mounted on a cantilevered support platform 12 on a base plate 14 of the frame 2 and cooperates with a load cell 15 mounted on the base plate 14 to provide a measurement of the weight of the mixing chamber and materials therein to determine the weight of the materials within the mixing chamber 5.

An inner end 17 of the cantilevered support platform 12 is mounted by pivots 18 to upstanding support rods 19 at an inner end 20 of the base plate 14 for pivoting about a horizontal axis. An opposite free outer end 21 of the cantilevered support platform 12 rests on the load cell 15 which is carried on the base plate 14 of the frame 2 at an outer end 23 of the base plate 14.

The load cell 15 is connected to a controller 22 which continuously determines the weight of blended materials within the mixing chamber 5. The controller can be used to control the process line with which the blender 1 is used, say, for example, a plastics extruder, so that operation of the process line corresponds with the rate of discharge of blended material from the mixing chamber 5 into the process line. Alternatively the controller 22 could regulate the rate of discharge of blended material from the mixing chamber 5 into the process line as required, for example by controlling operation of the mixing screw 6.

The arrangement of the raw material storage bins 3 and weigh hopper 4 is similar to

arrangements already described in EP 2143484 and need not be repeated here. In this case also, the mixing screw 6 comprises opposed screw blades driven by a drive motor 25 which urge material inwardly from each end of the mixing chamber 5 towards the centrally located outlet 7 for circulating material within the mixing chamber 5 for blending the materials within the mixing chamber 5 and also delivering the blended materials to the outlet 7 for delivery through the pipe 8 discharge into the process line. The preferred mixing screw is similar to that previously described in EP 0911130 and essentially comprises a central shaft with a pair of mixing blades of opposite pitch extending outwardly from a central portion of the shaft which is located directly above the outlet 7 of the mixing chamber 5. One end of the screw shaft projects through an end wall of the mixing chamber 5 for engagement with the associated drive motor 25.

It will be noted that the motor 25 is mounted on the cantilevered support platform 12 adjacent the pivots 18, being supported on an upstanding mounting bracket 26 at the inner end of the cantilevered support platform 12. This conveniently provides a robust yet sensitive assembly.

Referring in particular to Figs. 6 to 10, the discharge pipe 8 is shown in more detail. A pair of vertically spaced-apart baffle plates 30, 31 is mounted within a bore 32 of the discharge pipe 8 defining a tortuous path for blended material through the discharge pipe 8. Each baffle plate 30, 31 is mounted on a side wall 34 of the bore 32 and extends outwardly and downwardly from the side wall 34. That is to say they are angled in the direction of flow of the blended material through the discharge pipe 8. The normal action of the mixing screw 6 in the mixing chamber 5 causes downward pressure on blended material exiting the mixing chamber 5 at the outlet 7. The angled baffle plates 30, 31 within the discharge pipe 8 negate the effect of downward pressure on the load cell 15 coming from the cramming effect of the mixing screw 6 whilst still allowing blended material to flow through the discharge pipe 8.

Referring in particular to Figs. 8 to 10, it will be noted that inner free ends 36, 37 of the baffle plates 30, 31 overlap. Each baffle plate 30, 31 terminates at a central portion of the bore 32. The baffle plates 30, 31 are vertically spaced-apart within the bore 32 of the discharge pipe 8.

The mixing chamber 5 is mounted by the discharge pipe 8 on the cantilevered support

platform 12 intermediate the ends 17, 21 of the cantilevered support platform 12. A lower end 40 of the discharge pipe 8 projects through a complementary opening 41 in the base plate 14 for discharge into the outlet duct 9 mounted on an underside of the base plate 14. An upper end of the discharge pipe 8 has a flanged head 41 with an annular shoulder 42 on an underside thereof for engagement with the cantilevered support platform 12 and an arcuate top face 43 for snug engagement with a bottom of the mixing chamber 5.

In use, selected raw materials from the raw material storage bins 3 are discharged into the weigh hopper 4 to provide a batch of materials in a preset ratio or recipe which are discharged, as required, into the mixing chamber 5 when the material in the mixing chamber 5 goes below a preset minimum weight. Within the mixing chamber 5 the mixing screw 6 mixes the materials for blending the materials and delivers blended materials to the outlet 7. The load cell 5 element, on which the cantilevered support platform 12 and hence the mixing chamber 5 rests, weighs the contents of the mixing chamber 5 in order to measure the loss in weight of the blended materials within the mixing chamber 5, as the blended materials are discharged through the discharge pipe 8 into the process line. The controller 22 measures the rate of material being consumed by the process line on which the blender 1 is mounted, for example, a plastic extrusion line. In this way, the system provides a measurement of continuous material weight usage (or throughput) of the process which can then be used to allow continuous control of the process to maintain a set throughput.

Conveniently, the loss in weight measurement can be recalibrated by the weigh hopper 4, as the weigh hopper 4 completely empties itself and then tare weighs itself before every batch is filled and thus constitutes an absolute measurement. The loss in weight from the mixing chamber 5 measures only rate of change, as the mixing chamber 5 never actually empties and material continues to be drawn away from same, even when refilling.

Referring now to Fig. 11 there is shown another blender according to the invention indicated generally by the reference numeral 50. This is largely similar to the blender described previously and like parts are assigned the same reference numerals. An upstanding collar 51 is provided on the base plate 14 about the opening 41 through which the material discharge pipe 8 passes.

Referring now to Figs. 12 to 14, there is shown portion of another blender indicated generally by the reference numeral 60. Parts similar to those described previously are assigned the same reference numerals. In this case a baffle 61 is mounted centrally in the discharge pipe 8. The baffle 61 has a centrally mounted vertical plate 62 which bisects the bore 32 of the discharge pipe 8 extending partially downwardly through the bore 32 from a top inlet end of the bore 32. A pair of downwardly and outwardly angled deflector plates 63 is mounted at a lower end of the plate 62, partially obscuring the bore 32 leaving an open annular passageway 65 between the deflector plates 63 and an inside wall of the bore 32 through which material passes.

Referring now to Fig. 15, there is shown an alternative construction of material discharge pipe indicated generally by the reference numeral 70. Such a material discharge pipe 17 might be used with any of the embodiments of the invention if required. In this case instead of providing internal baffles within the material discharge pipe 70, the discharge pipe 70 is cranked intermediate its ends, having an upper portion 71 which extends vertically downwardly from the mixing chamber 5, an intermediate portion 72, angled relative to the upper portion 71 and leading to a lower portion 73 which again is vertically orientated and is offset from the upper portion 71 by a distance which in this case is equal to the diameter of the material discharge pipe 70. The intermediate portion 72 may be provided at any suitable angle, but typically may be in the order of $40^{\circ} - 60^{\circ}$ relative to the upper portion 71 and lower portion 73. This particular arrangement may be more suitable for handling certain materials.

Referring now to Fig. 16 and Fig. 17, there is illustrated portion of another blender indicated generally by the reference numeral 80. Parts similar to those described previously are assigned the same reference numerals. In this case the load cell 15 is mounted to one side of the mixing chamber 5, rather than directly beneath the mixing chamber 5 which is the arrangement shown in Fig. 1. The side-mounted arrangement has the advantage of reducing the overall height of the blender 80. In either arrangement the load cell 15 performs the same function. In all of the embodiments described, it is possible to manually lift the mixing chamber 5 off the load cell 15 so as to zero calibrate the load cell and to check weigh the mixing chamber 5. It will be noted that the load cell 15 is mounted within a housing 82 on the frame 2. An arm 83 mounted on the mixing chamber 5, an actuating arm 84 of the load cell 15 which

projects outwardly through an opening 85 in a side wall 86 of the housing 82. A low friction disc 88 and associated low force foam spring 89 are mounted on the actuating arm 84 at an inside face of the side wall 86 and provides a seal at the opening 85 to provide ingress of dust and the like. An outer side wall of the housing 82 is formed by the frame 2.

It will be appreciated that the blenders of the invention combine proportionally blending materials into a batch weighing hopper which then discharges into a weighed mixing chamber.

Any other suitable mixing elements such as paddles might be used in the mixing chamber for mixing the materials and delivering the materials to the outlet of the mixing chamber. However, an opposed screw centre feed mixing screw of the type described above is the preferred mixing and material feeding element as this promotes an even distribution of material in the mixing chamber to facilitate accurate weighing.

Mounting the mixing chamber on a cantilevered platform provides a robust construction.

The controller is operable to control delivery of material to the weigh hopper and to the mixing chamber.

The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

CLAIMS

1. A blender, including:

a mixing chamber for reception of materials to be blended,

said mixing chamber having a material outlet,

a mixer for mixing materials within the mixing chamber for blending the materials within the mixing chamber prior to discharge of blended materials through the material outlet of the mixing chamber,

characterised in that the blender includes a weigher for weighing the mixing chamber to determine the weight of materials therein.

2. The blender as claimed in claim 1 wherein the weigher is connected to a controller which is operable to control a process to which the blended materials are being supplied from the blender in use in response to the sensed weight of material being discharged from the mixing chamber.

3. The blender as claimed in claim 1 wherein the controller is operable to regulate the rate of discharge of blended material from the mixing chamber to the process.

4. The blender as claimed in any preceding claim wherein the weigher is operable to continuously weigh the mixing chamber and contents therein.

5. The blender as claimed in any preceding claim wherein the weigher comprises a load cell.

6. The blender as claimed in any preceding claim wherein the mixing chamber is mounted on a cantilevered support platform which engages the load cell to provide a measurement of the weight of the mixing chamber and contents therein.

7. The blender as claimed in any preceding claim wherein the blender comprises a

frame having a base plate, the cantilevered support platform being mounted by pivots to upstanding support rods on the base plate, a free end of the cantilevered support platform resting on the load cell which is carried on the base plate.

8. The blender as claimed in any preceding claim wherein a discharge pipe is provided at the material outlet, said discharge pipe having a baffle to regulate the flow of blended materials through the discharge pipe.

9. The blender as claimed in any preceding claim wherein the baffle comprises at least one baffle plate mounted within a bore of the discharge pipe and partially blocking the bore.

10. The blender as claimed in any preceding claim wherein a plurality of spaced-apart baffle plates is mounted within the bore of the discharge pipe defining a tortuous path for blended material through the discharge pipe.

11. The blender as claimed in any preceding claim wherein the, or each, baffle plate is mounted on a side wall of the bore and extends outwardly and downwardly from the side wall.

12. The blender as claimed in any one of claims 9 to 11 wherein inner free ends of the baffle plates overlap.

13. The blender as claimed in any one of claims 9 to 12 wherein each baffle plate terminates at a central portion of the bore.

14. The blender as claimed in any one of claims 9 to 13 wherein the baffle plates are vertically spaced-apart within the bore of the discharge pipe.

15. The blender as claimed in any preceding claim wherein a pair of spaced-apart baffle plates is mounted within the bore of the discharge pipe.

16. The blender as claimed in any one of claims 8 to 15 wherein the mixing chamber is mounted by the discharge pipe on the cantilevered support platform.

17. The blender as claimed in any one of claims 8 to 16 wherein the discharge pipe

is mounted intermediate the ends of the cantilevered support platform.

18. The blender as claimed in any one of claims 8 to 17 wherein a lower end of the discharge pipe projects through a complementary opening in the base plate for discharge into an outlet duct mounted on an underside of the base plate.

19. The blender as claimed in any preceding claim wherein a mixing screw is rotatable mounted in a trough at a bottom of the mixing chamber, the mixing screw having a central portion located above the material outlet, the mixing screw having a rotatable shaft with a pair of mixing blades of opposite pitch extending outwardly from the central portion of the mixing screw located adjacent the blended material outlet, each mixing blade upon rotation of the shaft delivering material towards the material outlet.

20. The blender as claimed in claim 19 wherein the mixing screw is connected to drive means for rotation of the mixing screw within the mixing chamber for circulating and mixing of materials within the mixing chamber, said drive means comprising a drive motor mounted on the cantilevered support platform adjacent the pivots for the cantilevered support platform .

21. A blender, including:

a mixing chamber for reception of materials to be blended,

said mixing chamber having a material outlet,

a mixer for mixing materials within the mixing chamber for blending the materials within the mixing chamber prior to discharge of blended materials through the material outlet of the mixing chamber,

characterised in that a discharge pipe is provided at the material outlet, said discharge pipe having a baffle to regulate the flow of blended materials through the discharge pipe.

22. The blender as claimed in claim 21 wherein the baffle comprises at least one baffle plate mounted within a bore of the discharge pipe and partially blocking

the bore.

23. The blender as claimed in claim 22 wherein a plurality of spaced-apart baffle plates are mounted within the bore of the discharge pipe defining a tortuous path for blended material through the discharge pipe.

24. The blender as claimed in claims 21 to 23 wherein the, or each, baffle plate is mounted on a side wall of the bore and extends outwardly and downwardly from the side wall.

25. The blender as claimed in any one of claims 21 to 24 wherein inner free ends of the baffle plates overlap.

26. The blender as claimed in any one of claims 21 to 25 wherein each baffle plate terminates at a central portion of the bore of the discharge pipe.

27. The blender as claimed in any one of claims 21 to 26 wherein the baffle plates are vertically spaced-apart within the bore of the discharge pipe.

28. The blender as claimed in any one of claims 21 to 27 wherein a pair of spaced-apart baffle plates is mounted within the bore of the discharge pipe.

29. The blender as claimed in any one of claims 21 to 28 wherein the mixing chamber is mounted by the discharge pipe on the cantilevered support platform.

30. The blender as claimed in any one of claims 21 to 29 wherein the discharge pipe is mounted intermediate the ends of the cantilevered support platform.

31. The blender as claimed in any one of claims 21 to 30 wherein a lower end of the discharge pipe projects through a complementary opening in the base plate for discharge into an outlet duct mounted on an underside of the base plate.

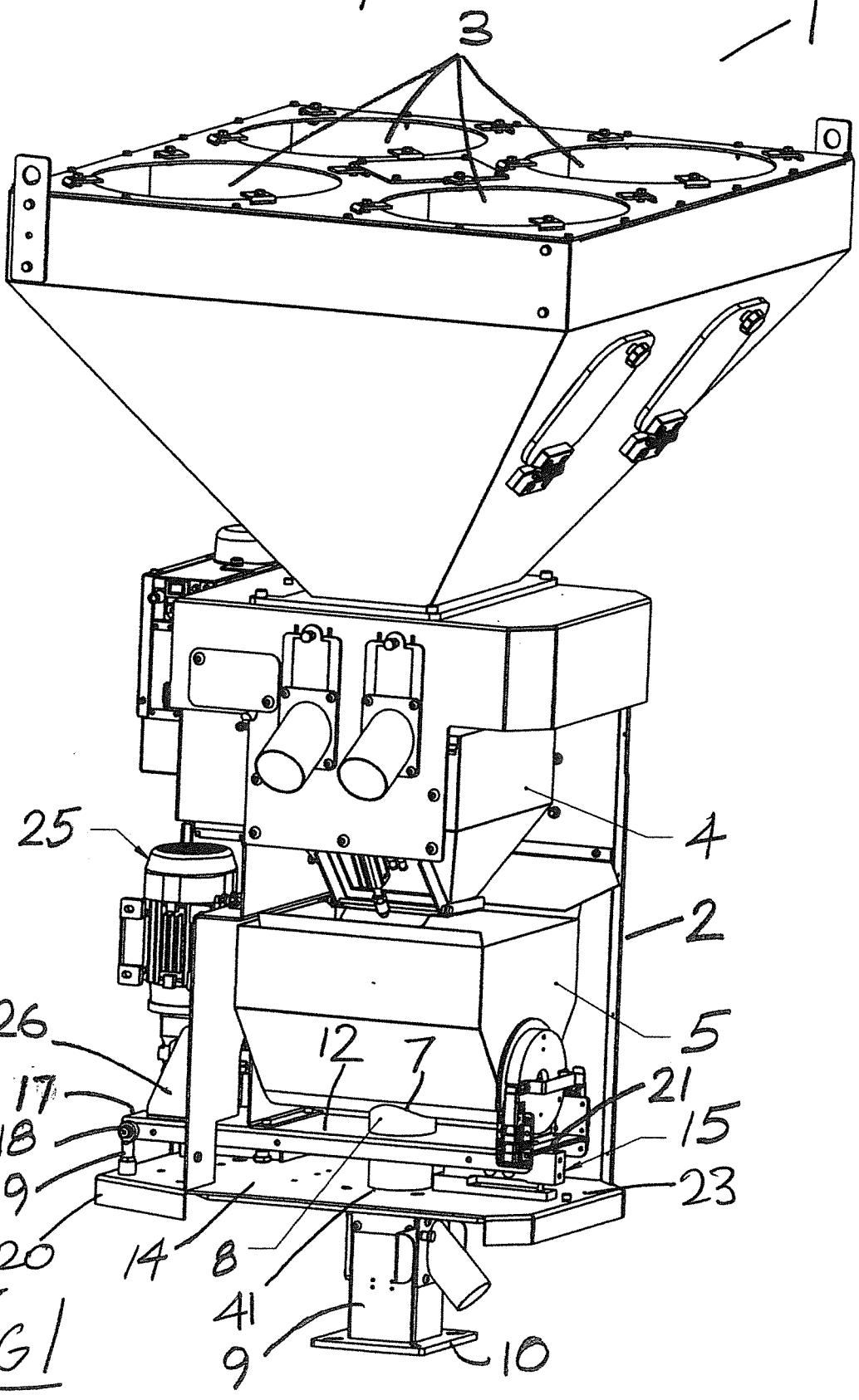

FIG 1

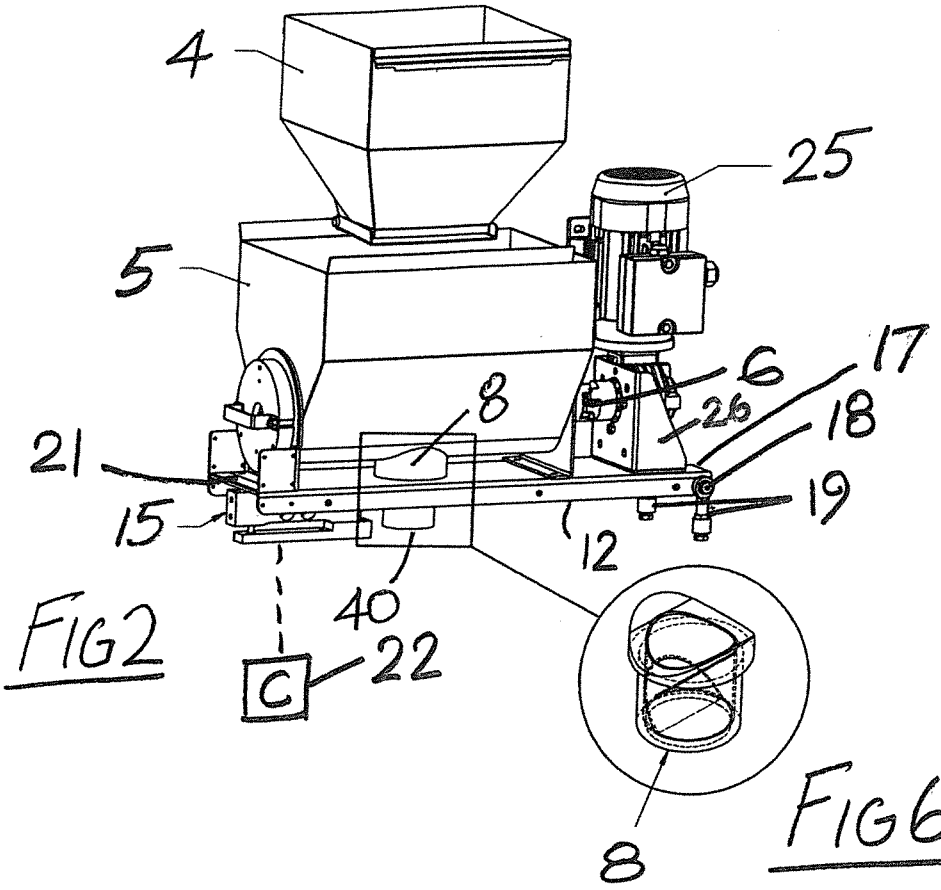

FIG2

FIG6

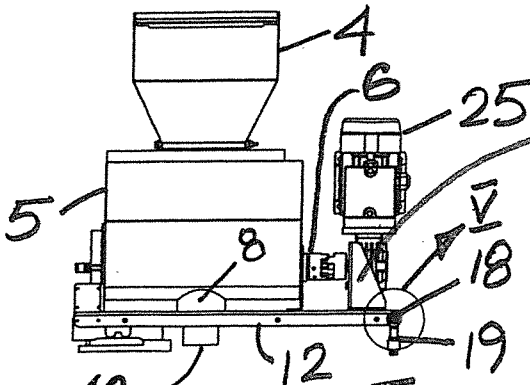

FIG3

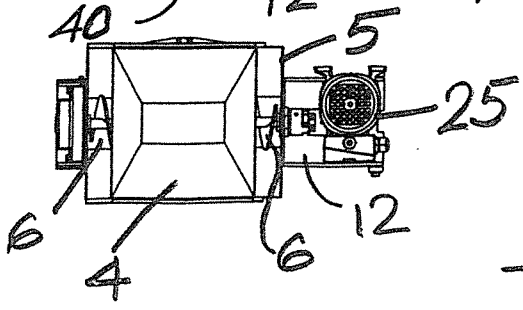

FIG4

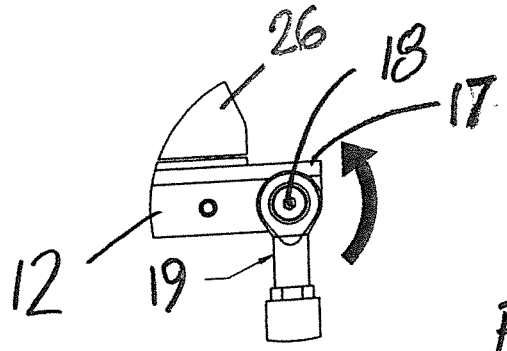

FIG 5

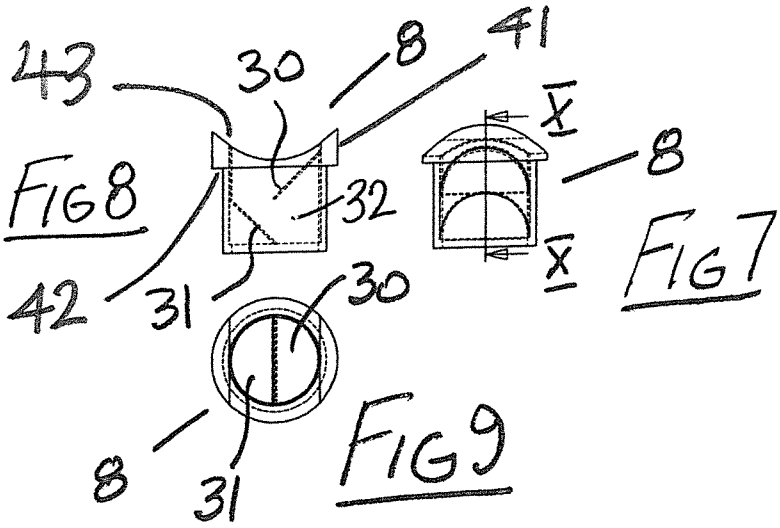

FIG 8

FIG 7

FIG 9

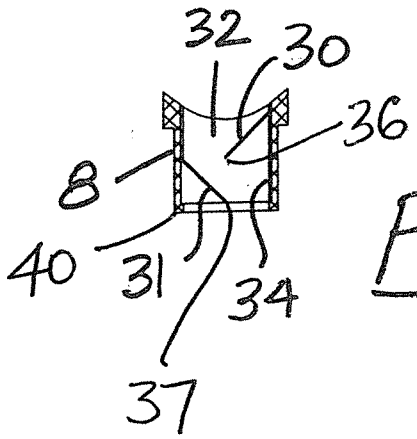

FIG 10

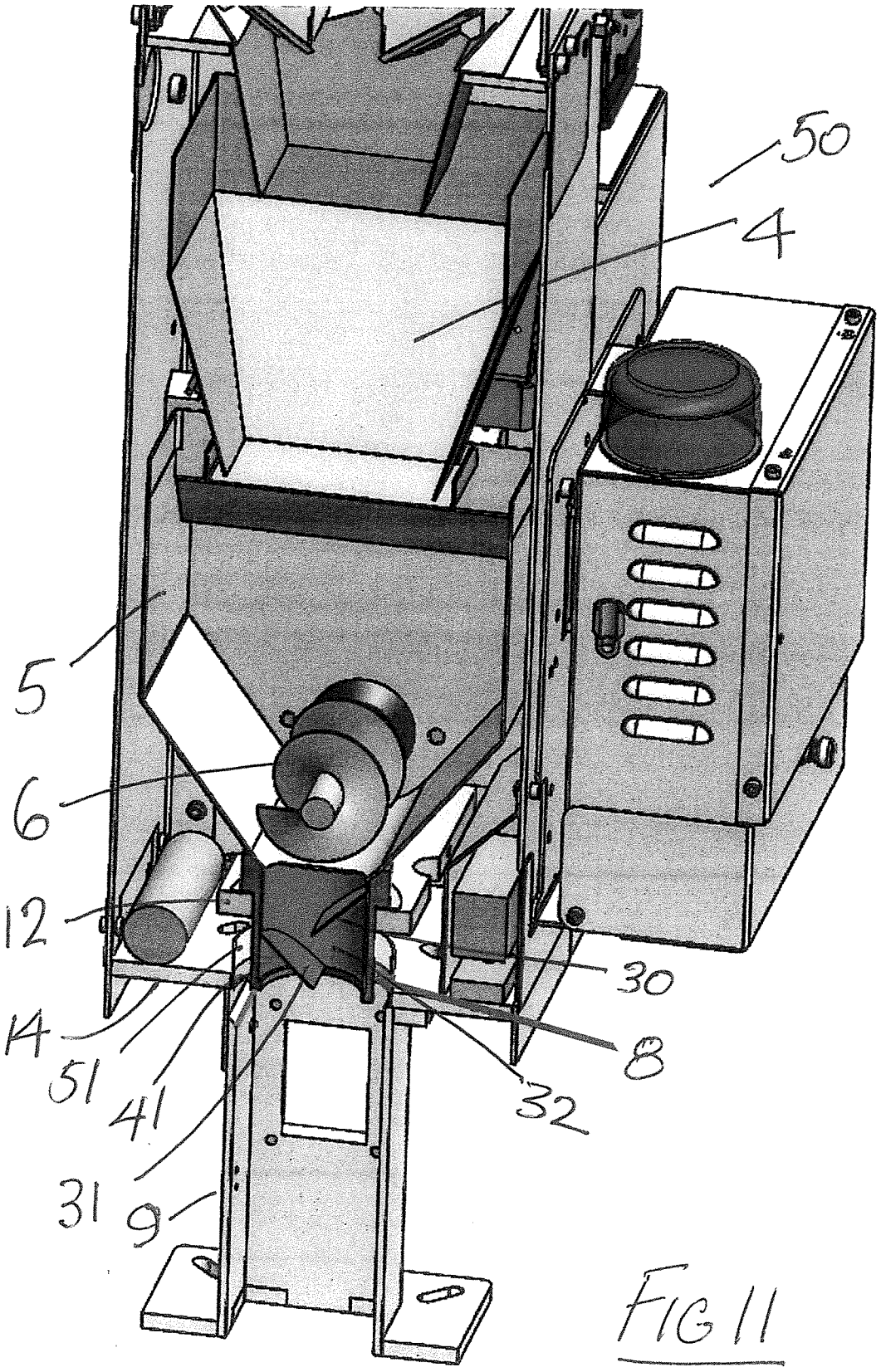

FIG 11

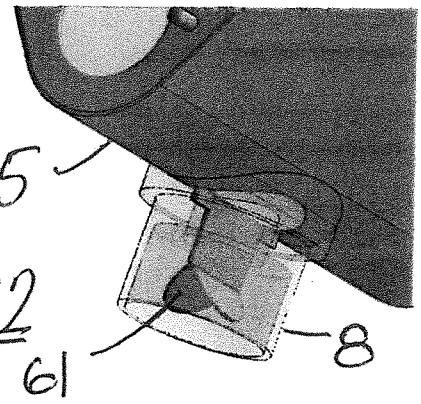

FIG 12

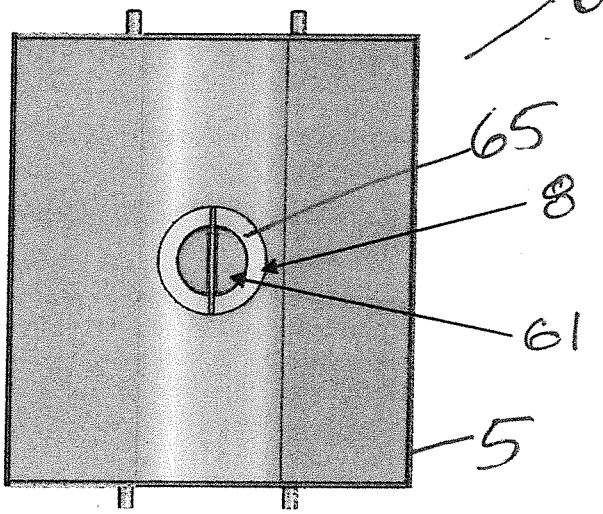

FIG 13

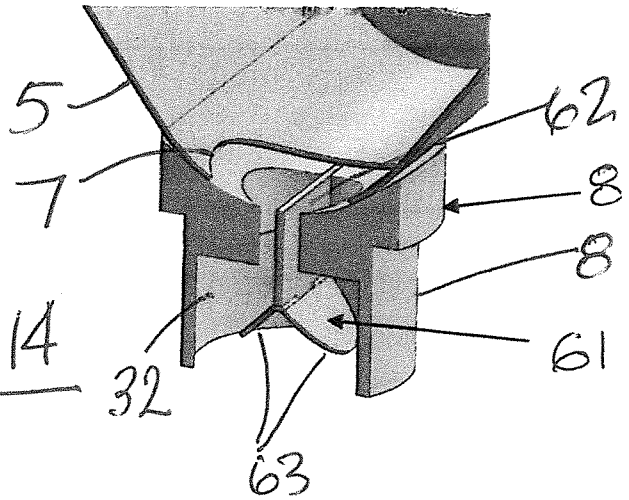

FIG 14

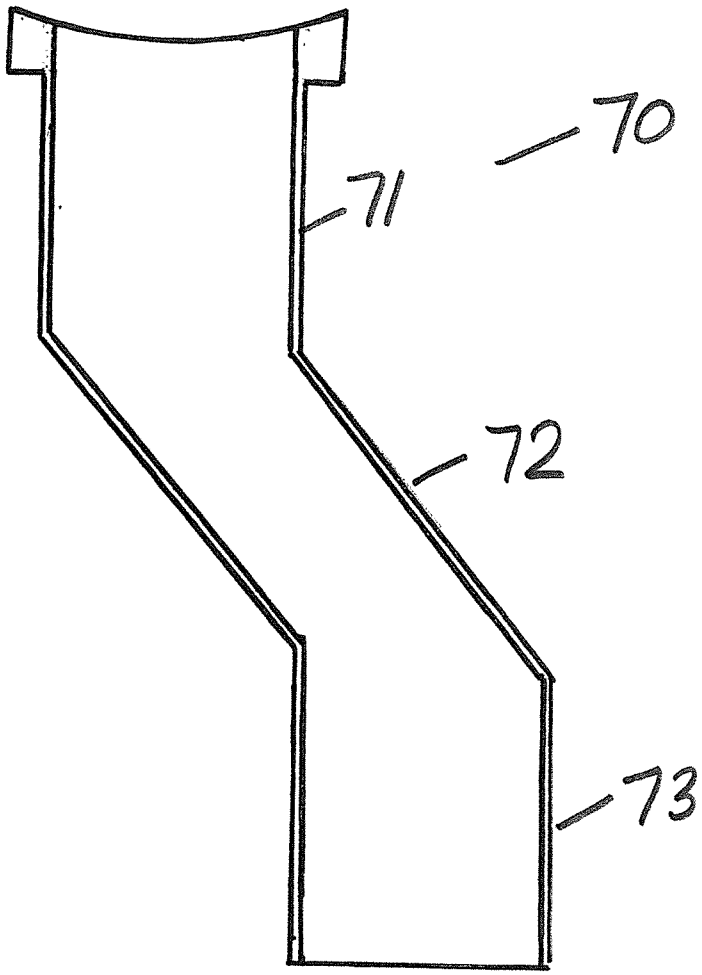

FIG15

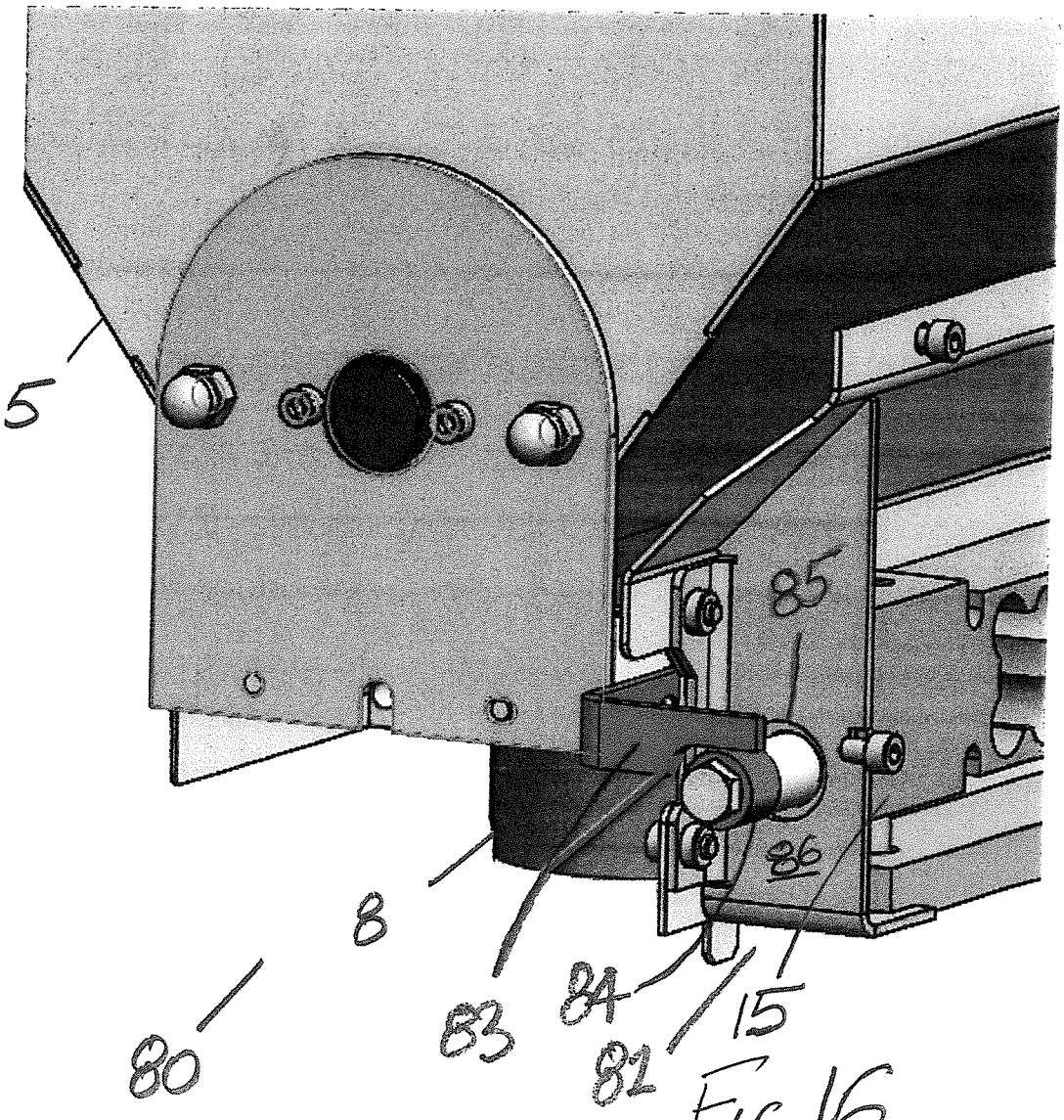

FIG16

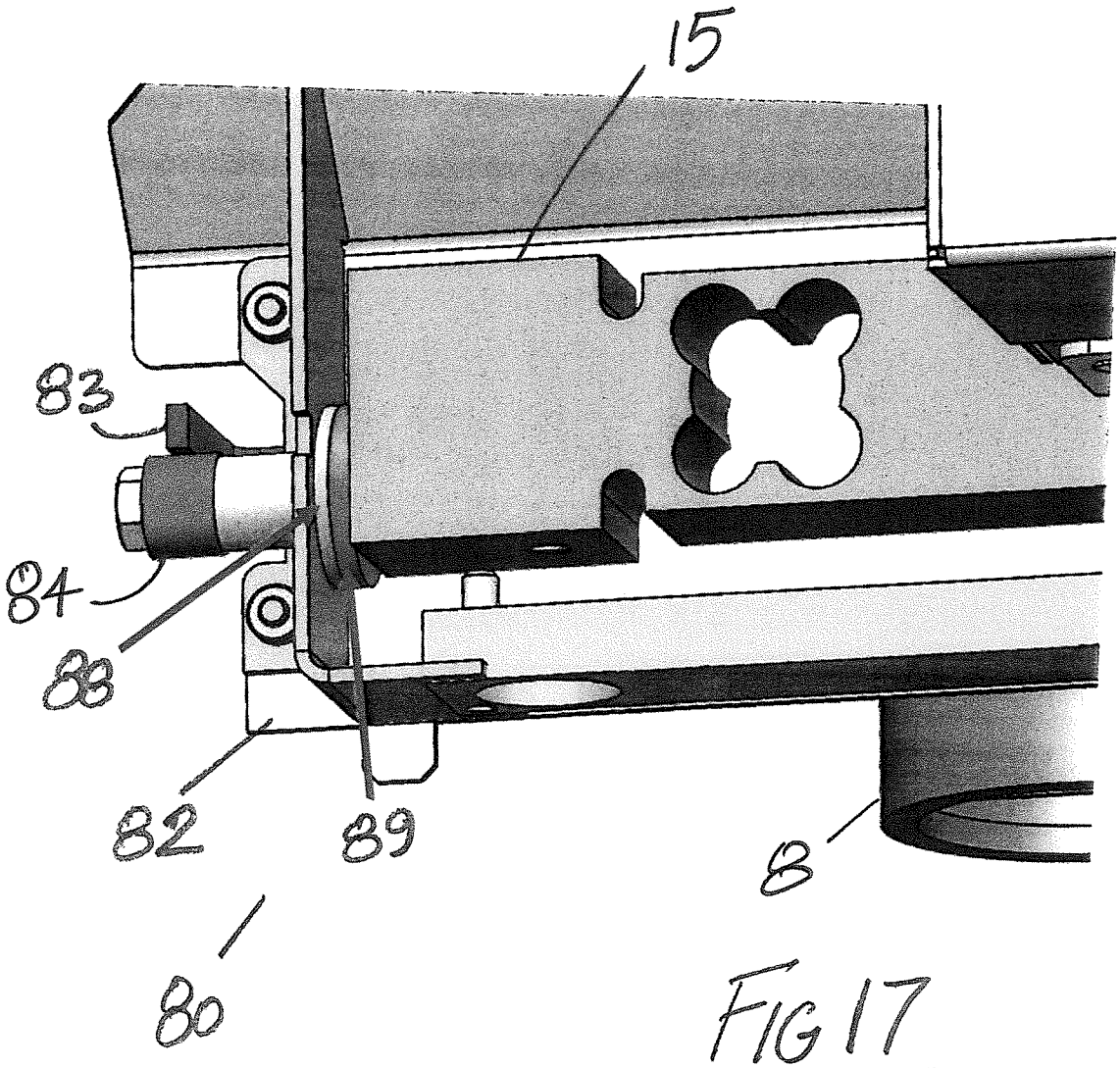

FIG 17