Nov. 3, 1936. W. T. SHALER 2,059,754

VIBRATOR

Filed Oct. 5, 1935 2 Sheets-Sheet 1

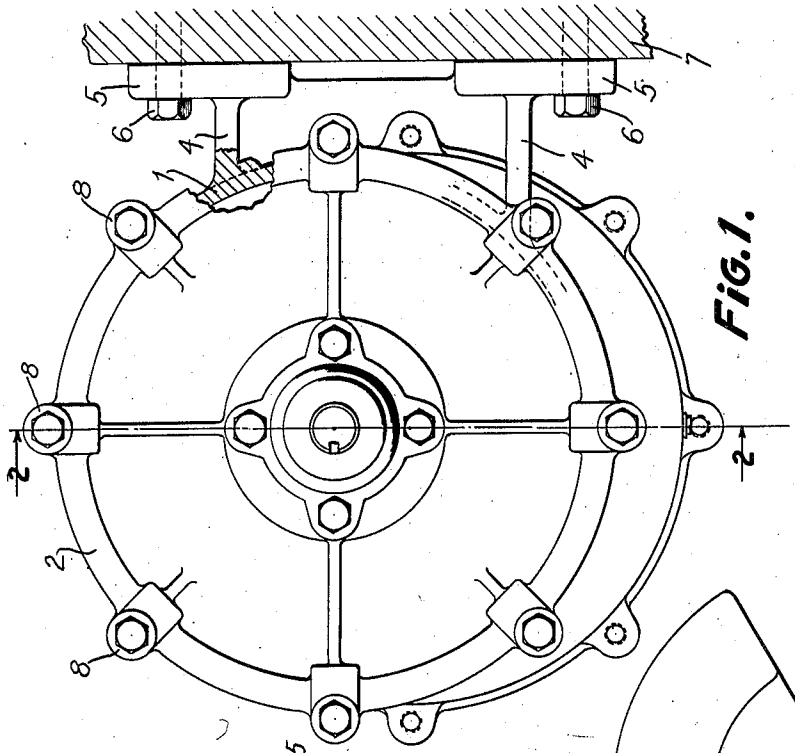


Fig. 1.

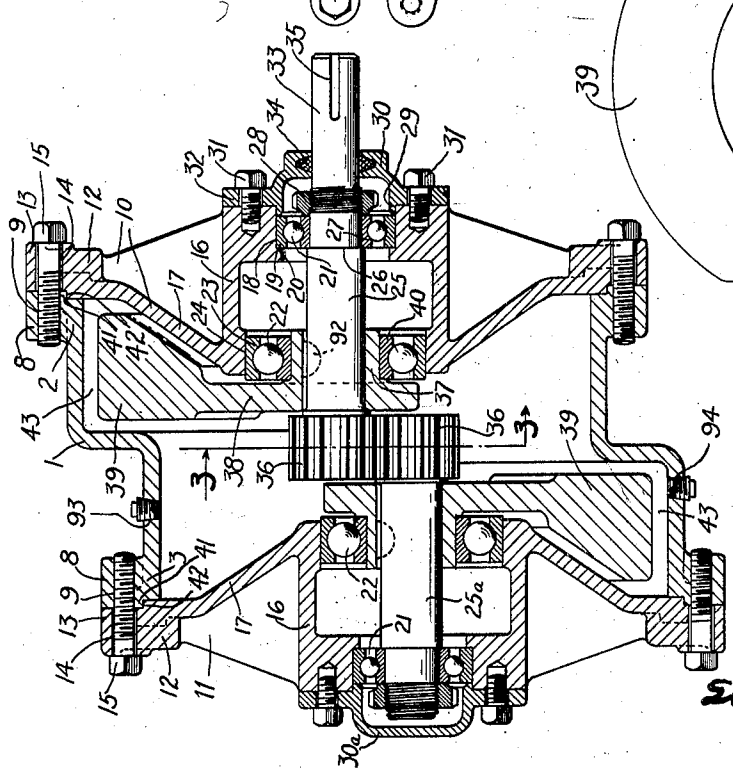


Fig. 2.

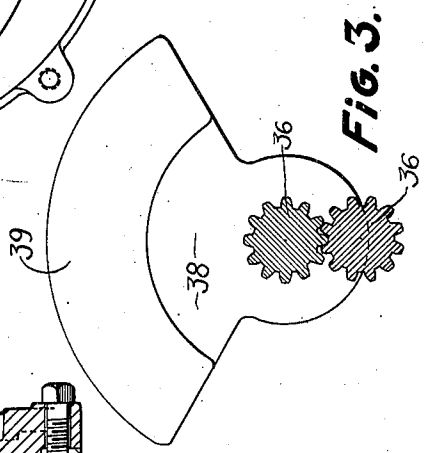


Fig. 3.

INVENTOR.
William T. Shaler.

Clough and Canfield
ATTORNEY.

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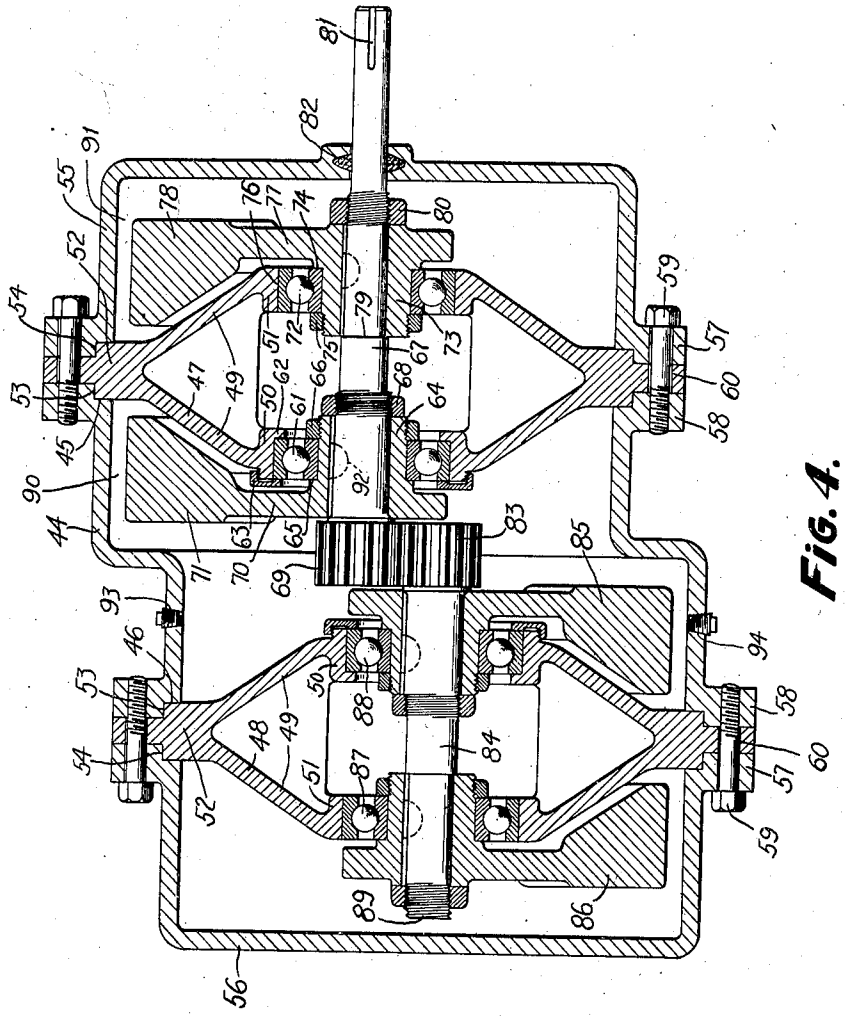


Fig. 4.

INVENTOR.
William T. Shaler.
BY Slough and Canfield
ATTORNEY.

Patented Nov. 3, 1936 2,059,754

UNITED STATES PATENT OFFICE

2,059,754

VIBRATOR

William T. Shaler, Silver Creek, N. Y.

Application October 5, 1935, Serial No. 43,747

12 Claims. (Cl. 74—61)

This invention relates to devices for producing vibratory motion suitable for vibrating or shaking other apparatus such as material handling screens, sieves, agitators, conveyors, etc., and relates particularly to devices of this class in which the vibratory movement is derived from the unbalanced rotary motion of a weight or weights.

Devices of this general class have been proposed in which a pair of shafts are mounted in suitable bearings, each shaft carrying an unbalanced weight and the two shafts caused to rotate in opposite directions by intermeshed gears on the respective shafts.

Illustrative of such prior devices is that illustrated and described in my Patent No. 1,999,213, issued April 30, 1935, for improvements in sieve shakers.

It is an object of this invention to provide an improved device of this class which may be manufactured with economy and assembled conveniently; and which will have improved durability in use.

A further object is to provide a device of the class referred to which can be readily assembled from economically manufactured units, at the minimum of cost.

Another object is to provide a device of the class referred to which will have sufficient rigidity to maintain essential alignment of parts therein and which will be durable under the varied usage to which such devices are subjected.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of an embodiment of my invention;

Fig. 2 is a sectional view taken from the plane 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken from the plane 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 2 but illustrating a modification.

Referring to the drawings, I have illustrated generally at 1, a housing member which in the particular embodiment illustrated is in the form of a tube having annular open opposite end portions 2 and 3. Intermediate of the end portions, a bracket 4 is rigidly secured to the housing member, or formed integrally therewith, and extends laterally therefrom and is provided with feet 5—5 provided with suitable perforations or slots therein whereby, by means of bolts 6—6, the feet 5—5 may be rigidly secured to an apparatus to be vibrated, illustrated generally at 7.

The opposite end portions 2 and 3 of the housing member are in the form of annular rings upon which at peripherally spaced points are provided bosses or lugs 8—8 having threaded holes 9—9 therein. Upon each end portion 2 and 3 is mounted a frame member 10 and 11 having at the periphery thereof an annular ring 12 provided with a plurality of spaced lugs 13 having bores 14 therein aligned with the threaded holes 9—9, and bolts 15—15 are projected through the bores and threaded into the holes to rigidly mount the frame members 10 and 11 upon the ends of the tubular housing member 1.

The two frame members 10 and 11 are preferably made identically alike. Each frame member comprises a central tubular portion 16 connected to the ring 12 by a frusto-conical, inwardly tapering, portion 17. The tubular portion 16 is bored at 18 to receive the outer raceway 19 of a ball bearing and has a shoulder 20 against which the raceway abuts axially. Spaced inwardly axially from the ball bearing 21 just described, is another ball bearing 22, the outer raceway 23 of which fits in a cylindrical bore 24 in the tubular portion 16 of the frame element. The raceway 23 is preferably free from axial abutment in either direction and therefore floats in the bore 24.

A shaft 25 is provided having a shoulder 26 thereon against which the inner raceway 27 of the ball bearing 21 is clamped by a nut 28 threaded on the shaft. The outer raceway 19 is clamped against the shoulder 20 by an annular sleeve portion 29 of a bearing closure cap 30, the sleeve portion 29 fitting in the bore 18 and being held against the raceway 19 by a plurality of bolts 31 projected through perforations in a flange 32 of the cap 30 and screwed into the end of the tubular portion 16. The shaft 25 has a reduced portion 33, upon which the nut 28 is threaded, projected outwardly through the cap 30 and packing 34 disposed in a suitable groove in the cap element serves to seal the shaft against ingress of foreign matter and egress of lubrication which may be provided within the housing.

The end portion 33 of the shaft is provided with a keyway 35 by which a pulley or other means for supplying rotating power thereto may be secured to the shaft. The opposite end of the shaft has thereon a gear 36 preferably formed integrally with the shaft 25 by being cut thereon. Inwardly of the gear 36, the shaft is press-fitted into a tubular shank 37 formed on a head 38

supporting at a suitable distance radially from the shaft a sector-form weight **39**, the weight **39**, head **38** and shank **37** being preferably formed all in a single piece, for example as from a metal casting. The shank **37** is press-fitted into the inner raceway **40** of the ball bearing **22**.

Preferably also, the shank **37** is keyed to the shaft **25** by a key **92** to insure that the shaft will not slip within the shank and that the rigidity of the press-fit connection of the shank and shaft will be maintained.

By the construction above described, the shaft **25** is supported at spaced points therealong by the two ball bearings **21** and **22**; and the shaft is prevented from endwise movement by having the inner raceway **27** of the ball bearing **21** rigidly secured to the shaft and by having the outer raceway **19** rigidly secured to the frame **16**. When the shaft **25** rotates in the operation of the device to be described, the weight **39** being unbalanced about the shaft **25**, exerts lateral thrust on the shaft **25** which is taken up by the relatively larger ball bearing **22**; and the gear **36**, weight **39** and shaft **25** all rotate in unison.

The above description is directed to the parts at the right-hand portion of Fig. 2 in connection with the frame member **10**, said parts being assembled therewith as a unit in the production of the device. The frame member **11**, in the left-hand part of Fig. 2, is assembled also at an assembly unit with a like set of parts which may be identical with the units just described except for the following exceptions. The shaft **25***a* outwardly of the ball bearing **21** terminates inwardly of the cap **30***a*, the cap **30***a* covering the end of the shaft **25***a* and being substantially the same as the cap **30** above described except that it is not perforated and does not have the seal of said cap.

The frame members **10** and **11** are disposed so as to offset the shafts **25** and **25***a* so as to intermesh the gears **36—36** of the two shafts respectively. To provide this offset relationship and at the same time to permit the frame members **10** and **11** to be identical, the opposite end portions **2** and **3** of the housing member **1** are offset relative to each other, as plainly shown in Figs. 1 and 2.

In order to insure proper meshing of the gears **36—36**, the end portions **2** and **3** of the housing member **1** are each provided with an annular shoulder **41** and the frame members **10** and **11** are provided with corresponding annular shoulders **42—42** formed to telescope with the shoulder **41**. This mutually intermeshing shoulder construction not only disposes the axes of the two frame members **10** and **11** in the proper offset or parallel spaced relation, but also positions the two frame members **10** and **11** the desired exact distance apart in the axial direction, so that the gears **36—36** are sure to properly mesh.

As will now be apparent, when power applied to the shaft end portion **33** rotates the same, to rotate the shaft **25**, the shaft **25***a* will likewise be rotated at the same speed through the gears **36—36** which preferably are of the same number of teeth, and the weights **39—39** rotate in opposite directions, causing the device as a whole to vibrate and transmitting said vibration through the bracket **4** and feet **5** to the apparatus **7** to be vibrated thereby.

It will be observed that the frusto-conical form of the intermediate portion **17** of the frames **10** and **11** provides, outwardly radially of the shaft, an enlarged annular chamber **43** in which the enlarged sector-form weight **39** may rotate, thus providing the maximum of space for the weight with the minimum of over-all length of the device.

In the modification shown in Fig. 4, the mass of the rotating weights is divided into two parts, two weights rotating with each shaft to distribute the load of the unbalanced rotating weight on both bearings. In this form, a central generally tubular frame member **44** is provided which may be similar to or like the frame member **1** of the first described form having annular shoulders **45** and **46** at the opposite annular open ends thereof. Frame members **47** and **48** are provided, preferably identical in structure, having double frusto-conical opposed web or disc portions **49—49** joined to axially spaced tubular central portions **50** and **51** and joined peripherally in an annular ring **52** having annular shoulders **53—53** formed to telescope into the shoulders **45** and **46** of the main frame or housing **44** and having also, axially opposite, annular shoulders **54—54** formed to telescope with corresponding shoulders on cup-form cover elements **55** and **56**.

The cover elements **55** and **56** have peripherally thereof a plurality of bored lugs **57—57** and the tubular housing element **44** has a corresponding plurality of lugs **58—58** peripherally thereof. Bolts **59—59** are projected through the bores of the lugs **57** and through aligned bores **60** in the peripheral portions of the frame elements **52—52** and threaded into the lugs **58** to clamp the frame elements **47** and **48** upon opposite ends of the tubular housing member **44** and at the same time to clamp the cover elements **55** and **56** on the frame elements.

In the tubular central portion of the frame element **47** is telescoped the outer raceway of a bearing shown generally at **61**, the raceway abutting a shoulder **62** on the tubular portion **50** and being held thereagainst by a ring-form nut **63** threaded on the tubular portion **50**.

The inner raceway of the bearing **61** is telescoped on a hub **64**, being clamped against a shoulder **65** on the hub by a nut **66**. The hub **64** in turn is clamped on a shaft **67** between a nut **68** and a gear **69** on the shaft. The hub **64** is connected by an arm **70** to a sector-form weight **71** similarly to that illustrated in Fig. 3 for the first described form.

Axially spaced from the bearing **61** is another bearing **72**, the inner raceway of which is clamped on a hub **73** between a shoulder **74** on the hub and a nut **75** threaded thereon. The outer raceway of the bearing **72** floats axially in a suitable bore **76** in the tubular portion **51**. The hub **73** is connected by an arm **77** with a sector-form weight **78**.

By the bearing construction above described, it will be apparent that the bearing **61** is locked against axial movement in the tubular portion **50** of the end frame **47** to position the shaft **67** and the gear **69** axially. Any inaccuracies are taken up by the floating condition of the bearing **72** at the bore **76**. In this form as will also be apparent, the balanced weight is divided into two parts, **71** and **78**, the thrust of each part on the shaft being absorbed by the bearings **61** and **72** respectively.

The hub **73** is retained on the shaft **67** by abutting at one end upon a shoulder **79** and at the other being clamped under a nut **80** on the

shaft. Outwardly beyond the nut 80 the shaft has a keyway 81 for the purposes referred to above. The cover element 55 may have an annular packing 82 therein to seal the projecting end of the shaft, passing therethrough.

A gear 83 on a shaft 84 meshes with the gear 69, the shaft 84 being parallel to the shaft 67, and having a pair of weights 85 and 86 rotatable with the shaft end bearings 87 and 88 in the end frame 48, the construction of these parts and the assembled relation thereof being preferably identical with that of the parts above described except that the shaft 84 terminates as at 89 inwardly of the cover element 56, being covered and enclosed thereby and the cover element 56 is therefore not provided with the packing 82 as is the cover element 55.

In this form it will be observed that the frusto-conical shape of the end frame 47 provides annular chambers 90 and 91 in which the weights 71 and 78 revolve, the weights partly overlapping the frusto-conical portions 49 of the end frame 47, axially considered. Thus, in this form as in the first described, the maximum of weight is provided, for the minimum of axial extent. In this form also, the annular shoulder arrangement above described in connection with the reference characters 45, 53 and 54 insures that the two end frames 47 and 48 will be disposed with their axes spaced apart and parallel to insure that the gears 69 and 83 will properly mesh with each other. In this form also, except for the two shafts 67 and 84, the end frame members 47 and 48 and the parts assembled therewith may be identical.

No means is shown to attach the form of Fig. 4 to an apparatus to be vibrated but it will be understood in connection with the more complete description of the form of Figs. 1 and 2 that a bracket and feet such as provided at 4 and 5 for the form of Fig. 1 may likewise be provided for the form of Fig. 4.

In both of the forms described, it will be observed that the shaft and weights and intermeshing gears are supported rigidly from the opposite ends of the tubular housing and that no interior ribs, bearings or other supports joined to portions of the housing intermediate its ends are necessary to rigidly maintain the shaft in alignment and the gears in considerable engagement.

Also, in both forms it will be observed that there are no partitions or intermediate housing members in the main housing structure and therefore the entire device within its enclosing housing may be readily and thoroughly lubricated by the "splash" method, from a quantity of lubricant in the housing, which may be put in through a screw-plugged orifice at 93 or drained out at a similar orifice at 94.

My invention is not limited to the exact details of construction shown and described. Modifications and changes may be made therein without departing from the spirit of my invention or sacrificing its advantages and within the scope of the appended claims.

I claim:

1. In a vibratory motion producing device, of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a main frame, a pair of frame members detachably secured in spaced relation on the frame, each comprising assembled therewith and supported solely thereby a pair of axially aligned bearings and one of the shafts rotatably supported on each pair of bearings, the bearings disposing the gears to mutually intermesh, and means for securing the frame upon an apparatus to be vibrated.

2. In a vibratory motion producing device of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a main frame, a frame member, a pair of axially spaced bearings supported on the frame member, adapted to rotatably support a shaft, mutually engageable means on the main frame and frame member to accurately predeterminedly position the frame member on the main frame, and means to detachably secure the frame member on the main frame in said position.

3. In a vibratory motion producing device of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a generally tubular housing member having opposite annular end portions, a pair of frame members each having an annular peripheral portion fitting the annular end portion of the housing member to relatively predeterminedly position the frame members, means detachably securing the frame members on the housing member in said positions; the frame members each rotatably supporting a shaft and disposing the gear to intermesh.

4. In a vibratory motion producing device of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a generally tubular housing member having opposite annular end portions, a pair of generally circular frame members having each an annular peripheral portion fitting an annular end portion of the housing member to relatively predeterminedly position the frame members with their central axes parallel and spaced apart, means detachably securing the frame members on the housing member in said positions, the frame members each rotatably supporting a shaft, and disposing the two shafts parallel and with their respective gears intermeshing.

5. In a vibratory motion producing device, a frame member comprising a portion in the form of a frusto-conical disc and having a tubular central portion, a shaft supported on bearings in the central portion, an arm connected to the shaft and carrying a weight outwardly radially thereof, overlapping by a portion thereof the frusto-conical disc portion.

6. In a vibratory motion producing device, a main frame, a frame member comprising a portion in the form of a frusto-conical disc and having a tubular central portion, a shaft supported on bearings in the central portion, an arm connected to the shaft and carrying a weight outwardly radially thereof, overlapping by a portion thereof the frusto-conical disc portion, and means disposed peripherally of the frusto-conical disc for securing it detachably to the main frame.

7. In a vibratory motion producing device, a generally tubular main frame, a frame member comprising a portion in the form of a frusto-conical disc having peripherally thereof means for securing it to an end of the main frame, and

having a central tubular portion, a shaft supported on bearings in the tubular portion, an arm connected to the shaft and carrying a weight outwardly radially thereof and overlapping by a portion thereof the frusto-conical portion of the disc, and means to detachably secure the said peripheral portions of the disc to the tubular housing.

8. In a vibratory motion producing device of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a tubular main frame open at opposite ends, end members secured to the open end portions, each end member rotatably supporting independently of the tubular frame one of the shafts, and disposing the two gears in intermeshing relation within the tubular frame.

9. In a vibratory motion producing device of the type comprising a pair of rotatable shafts having mutually intermeshing gears and each supporting a weight at one side of the rotary axis of the shaft and the shaft adapted to be rotatably driven, a tubular main frame open at opposite end portions, disc-form end members secured to the ends of the frame by peripheral portions thereof and substantially closing the open end portions, each end member rotatably supporting, independently of the tubular main frame, one of the shafts, and the annular end portions of the frame being off-set out of coaxial relation, and thereby disposing the gears in parallel axial relation to intermesh in the tubular housing.

10. In a vibratory motion producing device, a frame member comprising a portion in the form of a frusto-conical disc, a shaft supported on bearing means at the central portion of the disc, an arm connected to the shaft and carrying a weight outwardly radially thereof overlapping by a portion thereof the frusto-conical disc portion.

11. In a vibratory motion producing device, a frame member comprising a portion in the form of a pair of frusto-conical oppositely tapering discs, a shaft supported on bearing means substantially at the central portion of the discs, a pair of arms connected to the shaft each carrying a weight outwardly radially thereof and each weight overlapping by a portion thereof a frusto-conical disc portion.

12. In a vibratory motion producing device, a main frame, a frame member comprising a portion in the form of a pair of oppositely tapering frusto-conical discs, and having means at the central portion of the discs for supporting a pair of axially spaced bearings, a shaft supported on the bearings, a pair of arms connected to the shaft each carrying a weight outwardly radially thereof each weight overlapping by a portion thereof one of the frusto-conical discs, and means disposed peripherally of the frusto-conical discs for securing them detachably to the main frame.

WILLIAM T. SHALER.