Feb. 13, 1962 K. H. CONLEY 3,021,083

HEAVY DUTY CENTRIFUGAL PROCESSING APPARATUS

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Fig. 1

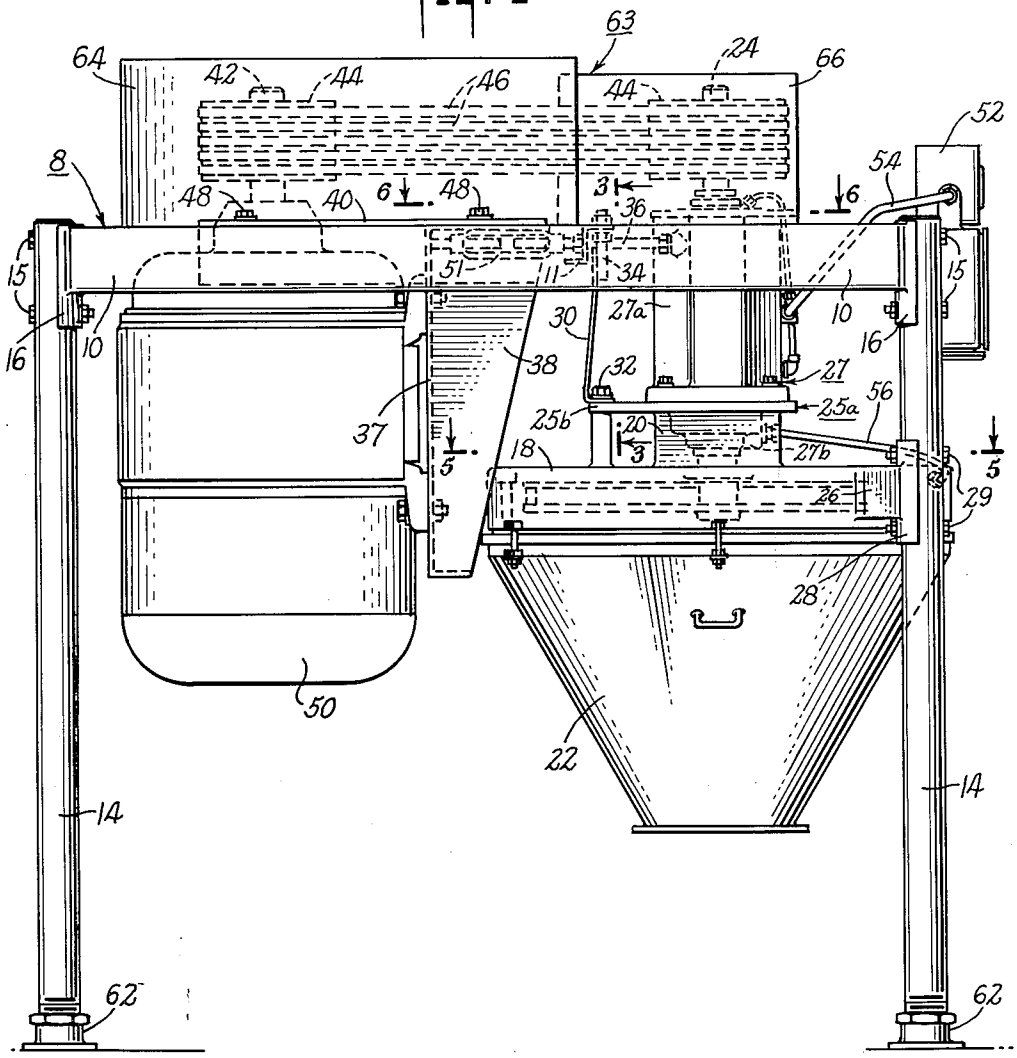
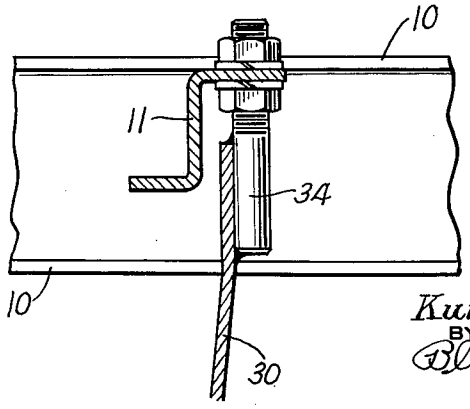


Fig. 4



INVENTOR
Kurt H. Conley
BY
Blair & Spencer
ATTORNEYS

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Fig. 2.

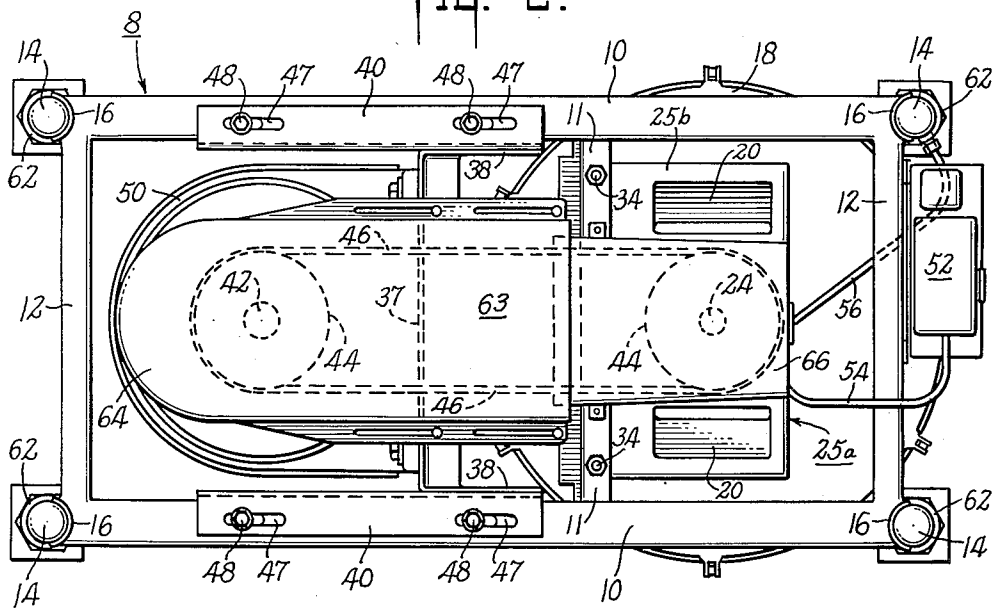
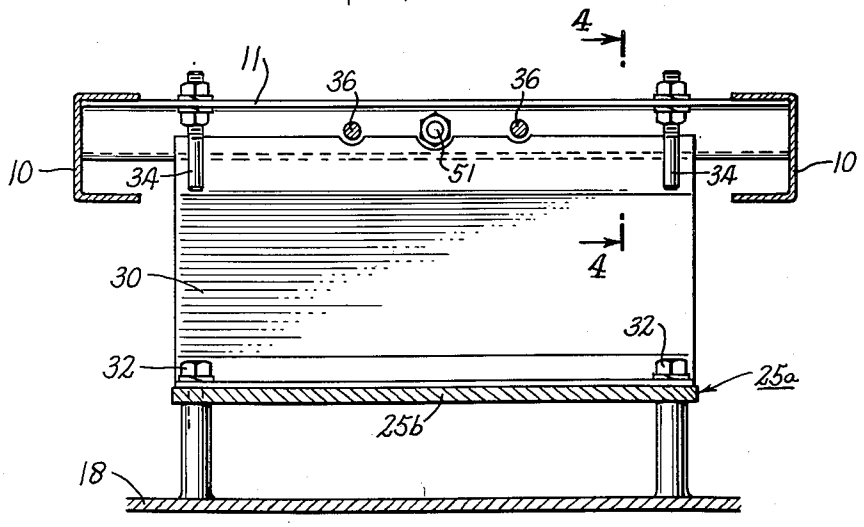


Fig. 3



INVENTOR
Kurt H. Conley
BY
Blair & Spencer
ATTORNEYS

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Fig. 5

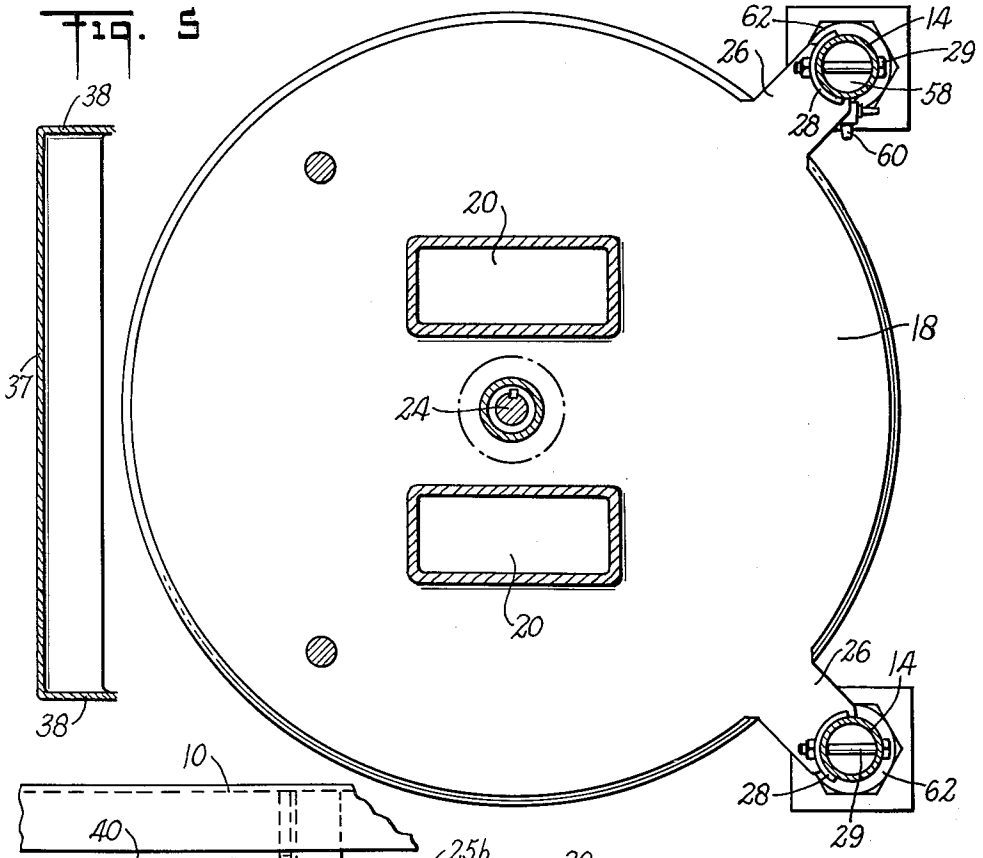
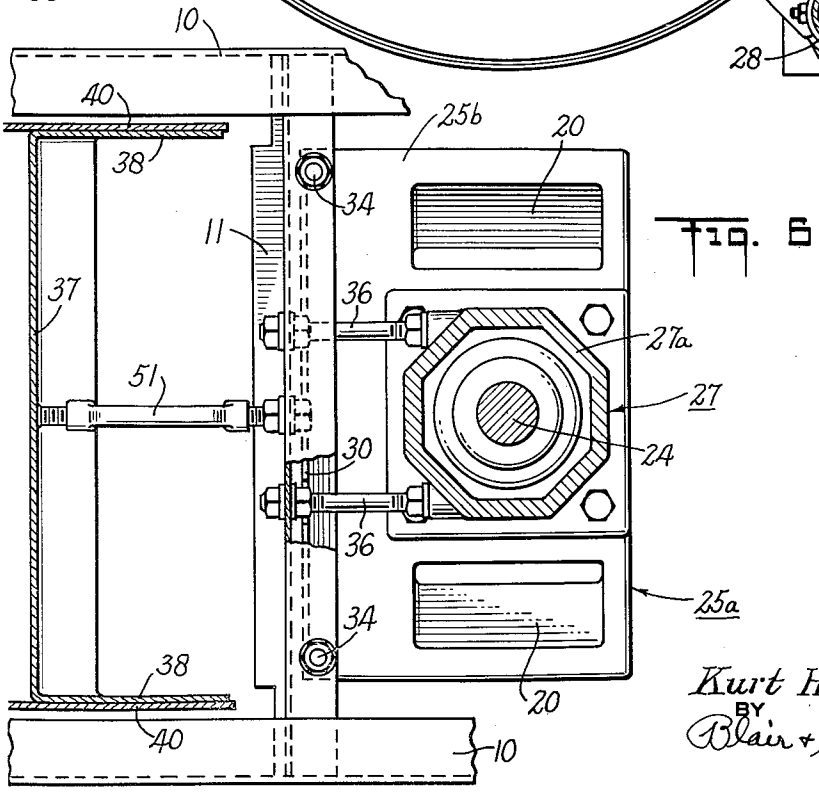


Fig. 6



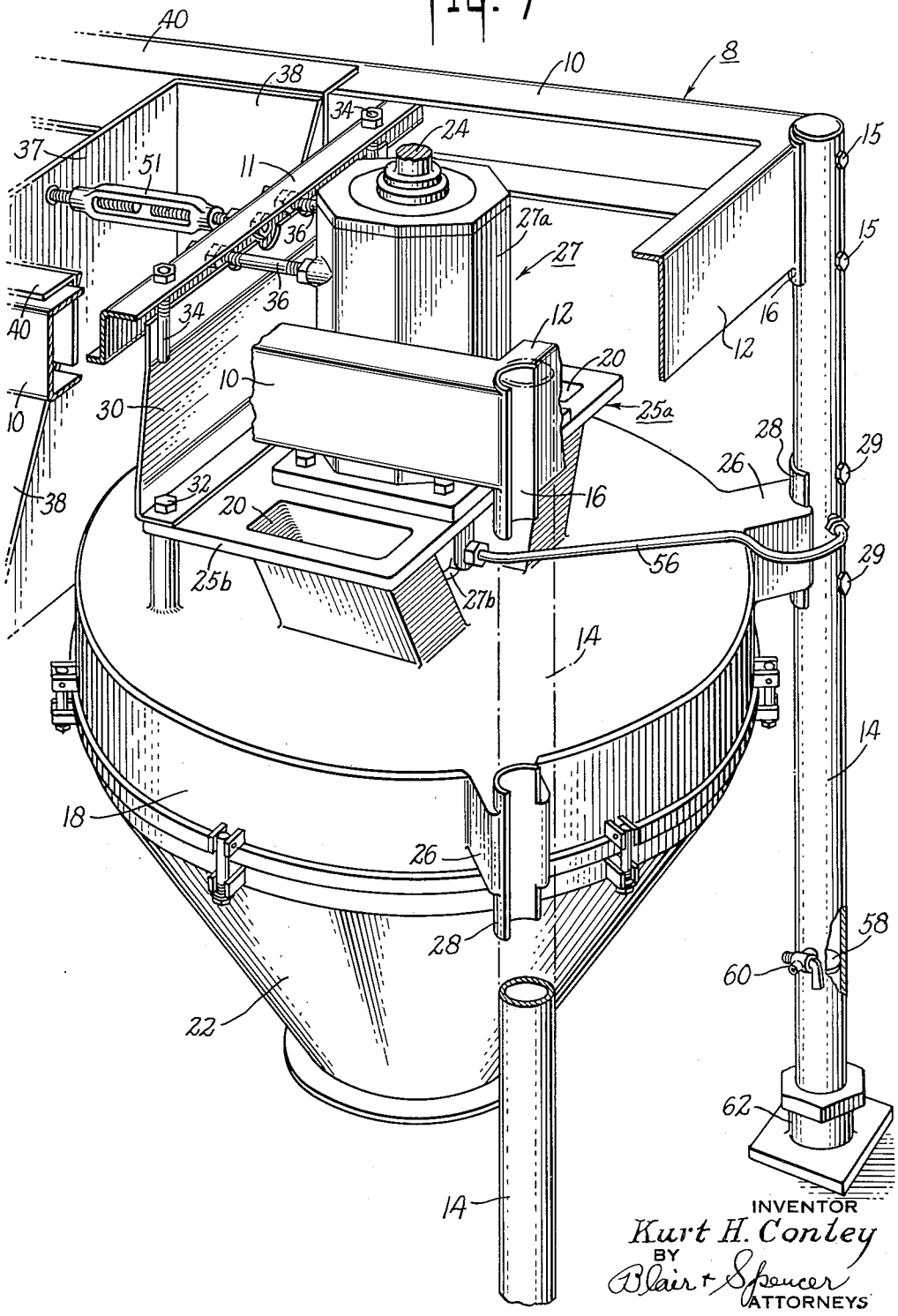
INVENTOR
Kurt H. Conley
BY
Blair & Spencer
ATTORNEYS

Feb. 13, 1962 K. H. CONLEY 3,021,083

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Fig. 7



INVENTOR
Kurt H. Conley
BY
Blair & Spencer
ATTORNEYS

United States Patent Office 3,021,083 Patented Feb. 13, 1962

3,021,083 HEAVY DUTY CENTRIFUGAL PROCESSING APPARATUS

Kurt H. Conley, Hamden, Conn., assignor, by mesne assignments, to Entoleter, Inc., a corporation of Delaware

Filed June 25, 1958, Ser. No. 744,602
10 Claims. (Cl. 241—275)

My invention relates to apparatus for impacting granular materials, such as grains, roots, tapioca, plastics, and chemicals, to reduce their particle size, to mix or blend them, or to extract ingredients or fractions therefrom. More specifically, it relates to apparatus particularly useful in centrifugal impact milling apparatus of the type described herein for use throughout a variety of processing procedures such as milling grain, blending, mixing, cleaning, etc.

Centrifugal impact mills, driven at high speeds by electric motors through flexible belt drives or by direct drives, present problems of sturdy and reliable support. The high operating stresses produced in the frame by such factors as uneven flow and varying weight of materials passing through the centrifugal impact mill create severe torsional stresses which are transmitted to its supporting structure. This supporting structure must therefore be sufficiently sturdy to withstand these operating stresses while yet being economical in manufacture. When these centrifugal impact mills are driven by separate motors through a flexible belt drive, this drive will not operate efficiently unless the shafts of the motor and the mill are aligned substantially parallel. The belt tension must also be adjustable and these features of adjustability must be incorporated in a supporting structure sufficiently sturdy to withstand attendant operating stresses.

One of the objects of this invention is to provide centrifugal impacting apparatus having an economical lightweight supporting frame capable of withstanding the high stresses resulting during the operation of the impact mill.

Another object of the invention is to provide centrifugal impacting apparatus of the above character having a supporting frame for an impact mill and a driving motor, and adapted to support the impact mill with reinforcement from the supporting legs, thus giving the combined structure greater rigidity.

A further object is to provide a supporting frame of the above character for a centrifugal impact mill and a driving motor, which is torque resistant, being adapted to resist torsional stresses induced by uneven distribution of the material treated at high rotational speeds in the impact mill.

Still another object is to provide a supporting frame of the above character for a centrifugal impact mill and driving motor joined by a flexible belt drive, providing for substantially parallel alignment of the pulley shafts of the motor and the impact mill.

An additional object is to provide a supporting frame of the above character for a centrifugal impact mill and driving motor joined by a flexible belt drive providing for adjustment of the tension of the flexible belt drive.

Another object is to provide a supporting frame of the above character for a centrifugal impact mill and driving motor joined by a flexible belt drive providing protective covering for the driving belts and pulleys for all adjusted positions of the apparatus.

A further object of the invention is to provide a supporting frame of the above character having a lubricant sump integrally incorporated therein.

Other objects of the invention will be in part obvious and in part pointed out hereinafter.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention:

FIGURE 1 is a side elevation of a machine having the preferred embodiment of this invention incorporated therein, with a portion of the frame cut away to show details of certain adjustable features;

FIGURE 2 is a top plan view of the machine;

FIGURE 3 is a fragmentary vertical transverse sectional view taken at line 3—3 in FIGURE 1;

FIGURE 4 is a fragmentary vertical longitudinal sectional view taken at line 4—4 in FIGURE 3;

FIGURE 5 is a fragmentary horizontal sectional view taken at line 5—5 in FIGURE 1;

FIGURE 6 is a fragmentary horizontal sectional view taken at line 6—6 in FIGURE 1; and

FIGURE 7 is a perspective view, partially cut away, of the frame and associated parts of the machine illustrated in the other figures of the drawings.

The invention accordingly comprises the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

The invention includes a combination of a power driven centrifugal impact mill, supporting frame and legs. The mill is supported by the main frame, being joined to the adjacent legs by anchor brackets. The mill is also adjustably supported by a mill support plate joining it to a crosspiece on the frame and torsional stresses are transmitted by additional torque resisting members from the mill to the mill support plate or crosspiece. Thus, a motor is supported by a motor bracket slidably depending from the frame, and a flexible belt drive interconnects the motor and mill. In the preferred embodiment of the invention, an adjustable turnbuckle joins the crosspiece or the mill support plate to the motor bracket and permits the distance between the motor shaft and the mill shaft to be varied, thus adjusting the belt tension. Adjustment of the mill support plate with respect to the crosspiece and frame also permits alignment of the motor and mill shafts to make them substantially parallel to and in alignment with each other. The desirable features of adjustability of shaft alignment and belt tension, to produce the most efficient operation of the flexible belt drive, are thus combined with light-weight, economical construction and structural rigidity. The objects and advantages of the invention are achieved in an entirely novel way by the combination and co-action of the various elements, hereafter described in detail.

The apparatus embodying the preferred form of the invention, as can best be seen in FIGURES 1, 2 and 7, comprises a centrifugal impact mill, a motor and associated supporting structure. A rectangular frame, generally indicated at 8 (FIGURE 2), comprises side members 10 and end members 12, which may be angle or channel members. Supporting legs 14, which may be hollow pipe segments of substantial diameter and thickness, are joined by bolts 15 or other suitable securing means to the corners of the frame, in which sockets 16 are formed to accommodate the legs 14. Crosspiece 11 (FIGURES 2 and 3) spans the rectangular frame, being welded to the two side members 10, and is Z-shaped in cross-section (FIGURES 1 and 4), as shown, to provide increased rigidity in a manner to be more fully described hereinafter.

A rotor housing 18 of the mill surrounds the rotor and impacting target elements of the mill, and can be seen in FIGURES 1, 2, 3 and 7. Granular material, fed to the impact mill through chutes 20 (FIGURES 1, 2 and 7) flanking bearing housing 27 and leading into rotor housing 18, is flung outward by the rotor and impacted

by apparatus forming no separate part of this invention; the milled material then falls into hopper 22 (FIGURE 1) and then is directed to later stages of the process involved. The rotor of the mill which is not shown but which is rotatably mounted in housing 18 is turned by mill shaft 24 mounted in suitable bearings housed within a bearing housing 27 suitably interfitted with rotor housing 18 and comprising an upper section 27*a* and a lower section 27*b* (FIGURE 7). A plurality of flexible belts 46 (FIGURES 1 and 2) join the two sheaves 44 which are mounted on motor shaft 42 and mill shaft 24.

As shown in FIGURES 1, 5 and 7, rotor housing 18 is joined to each of the adjacent legs 14 by socket members or anchor brackets 26, which are provided with suitable sockets 28 shaped to interfit with these legs and secured thereto by bolts 29. The rotor housing and associated parts are further supported by mill support plate 30 and connected thereto by bolts 32, as shown in FIGURES 1, 3 and 7. A bearing housing supporting structure 25*a* is joined to rotor housing 18, and, as seen in FIGURES 1, 4 and 7, includes a horizontal plate portion 25*b* bolted to plate 30 by bolts 32; and the upper section 27*a* of bearing housing 27 is bolted to plate portion 25*b*, the lower portion 27*b* extending downwardly therethrough as seen in FIGURE 7. Accordingly, bearing housing 27, connected to the rotor housing 18, and frame 8 via plate 30 all coact to strengthen the machine for high speed operation. This mill support plate 30 is suspended from crosspiece 11 by adjustable elements such as threaded studs 34 welded to mill support plate 30, and nuts are threaded on these studs to permit vertical and lateral adjustment of the position of the impact mill by way of plate 30, as shown in FIGURES 3 and 4. This allows for alignment of shafts 24 and 42 as desirable for most efficient operation of the flexible belt drive.

Reinforcing members or torque braces 36 join mill support plate 30 and also bearing housing 27 near its upper end, further resisting torsional loads caused by uneven distribution and weight of material passing through the impact mill. The torque braces, best seen in FIGURES 1, 6 and 7, also resist any tendency of the flexible belt drive to displace bearing housing 27 when high belt tension is employed.

It will be seen that anchor brackets 26 in combination with torque braces 36, mill support plate 30, legs 14 and the rectangular frame 8 provide a sturdy but lightweight supporting structure anchoring the impact mill firmly in position against the severe fluctuating operating stresses produced by the passage of material through the impact mill.

The motor bracket, as best shown in FIGURES 6 and 7, incorporates a vertical plate 37 with stiffening side flanges 38 welded to and depending from movable slides 40, which rest lengthwise on side members 10. An electric motor 50 with upwardly projecting drive shaft 42 is mounted on vertical plate 37, all designed to align motor drive shaft 42 and driven mill shaft 24. Sheaves 44, which may be multi-grooved, as shown in FIGURE 1, are mounted on shafts 42 and 24, and one or more flexible belts 46 passing therearound provide a flexible driving means joining the motor and the impact mill. As shown in FIGURE 2, slides 40 are provided with slots 47 accommodating bolts 48, fitted in side channel members 10, permitting the motor bracket to be moved freely along members 10 to adjust the distance between shafts 24 and 42, and the resulting tension in flexible belts 46. A convenient and positive means for adjusting this belt tension is a turnbuckle 51 joining motor bracket palte 37 to crosspiece 11, thereby providing easy adjustment of these parts.

A fluid lubricant system, such as an oil mist lubrication system 52 of the "Alemite" type shown in FIGURES 1 and 2, delivers lubricant via tubing 54 to bearing housing 27. Used lubricant is carried from the lower section 27*b* of bearing housing 27 by tubing 56 to the interior of at least one of the legs 14, as shown in FIGURES 1, 2 and 7. This leg may be provided with an internal plug 58 forming the floor of a lubricant sump, from which used lubricant can be drained through a drain valve 60 (FIGURE 7). Adjustable bases 62 are provided at the foot of each supporting leg 14. These may be threaded or otherwise adjustably joined to each supporting leg, and they permit the leveling and adjustment of the apparatus to compensate for irregularities of the supporting floor.

A telescoping drive cover generally indicated at 63 (FIGURES 1 and 2) is formed by open-ended belt cover 64 surrounding motor shaft 42, its associated sheave and a part of the driving belts 46, and by open-ended sheave cover 66, surrounding the remainder of the belts 46, mill shaft 24 and its associated sheave. The open ends of the belt cover and the sheave cover are designed to interfit telescopically, providing covering for the flexible belt drive and sheaves for all adjusted positions of the slidable motor bracket. Accordingly, belt cover 64 is preferably mounted on the motor bracket, while sheave cover 66 is preferably mounted on crosspiece 11 or on the upper part of the impact mill.

The various objects and advantages of the invention are thus achieved by the cooperation of the various elements described above. In particular, anchor brackets 26, mill support plate 30 and the various associated elements provide a lightweight but rigid support for the impact mill. Torque braces 36 further strengthen this supporting structure and reinforce it advantageously. The adjustable elements joining mill support plate 30 to crosspiece 11 provide alignment adjustment of the mill and motor shafts for most efficient operation of the flexible belt drive, and the adjustable motor bracket and associated elements permit adjustment of belt tension without reducing the rigidity and structural integrity of the supporting structure as a whole.

In addition to the static loads created by the weight of the mill and motor, severe and fluctuating dynamic loads are created by the impacting operation when unevenly distributed raw material is fed through chutes 20 to the impacting elements rotating at high speeds within rotor housing 18. These loads create torsional moments acting in various vertical planes as well as in the horizontal plane of rotor housing 18, since they are primarily resisted by the bearings housed in bearing housing 27, by belts 46 passing around sheave 44 on mill shaft 24, and by rotor housing 18.

These dynamic loads and torsional moments are transmitted by the various associated supporting members to the supporting frame, and these supporting members cooperate in counteracting displacement, vibration and distortions induced by the various loads. Thus, torsional moments in horizontal planes are resisted by anchor brackets 26 and legs 14 in cooperation with mill support plate 30, torque braces 36 and crosspiece 11; torsional moments in transverse vertical planes are resisted by the stiffening support provided by mill support plate 30 in combination with the cooperative support provided by anchor brackets 26; and torsional loads in longitudinal vertical planes are counteracted by torque braces 36 and anchor brackets 26 in cooperation with mill support plate 30.

Additionally, there are the resultants of these various torsional stresses which are at angles to the vertical and horizontal planes in directions depending on the particular impact forces resulting from variable, irregular loads encountered in machine operation. Due to such reinforcing parts as plate 30, braces 36, housing 18, brackets 26 and other associated parts, no matter what direction and intensity of such torsional stresses the cooperative strength of these various parts is such as to withstand them with facility; yet due largely to their strategic location with respect to the stresses to be withstood, they do so in a manner leading to easy and economical manufacture.

The essential features of adjustability are thus combined with sturdy cooperative supporting action by all of these elements, and a lightweight and economical structure is provided which is particularly well adapted to resist the severe dynamic loads induced by the centrifugal impacting operation.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. In centrifugal impacting apparatus comprising, in combination, a frame, a horizontal bracing member running crosswise of said frame and secured thereto, a plurality of supporting legs for said frame, a rotor housing depending from said frame and adjacent some of said legs, a rotor rotatably mounted in said housing, a bearing housing mounted on said rotor housing, a vertically-disposed plate secured at one end to said rotor housing and to at least two points on said bracing member, a horizontally-disposed reinforcing member joining said bearing housing to said bracing member in horizontally adjustable relationship, and means securing said rotor housing to at least two of said supporting legs at points spaced below said frame, whereby torsional stress in said housings is resisted by said frame and supporting legs.

2. In rotary processing equipment, in combination, a frame provided with a horizontal bracing member running crosswise of said frame and secured thereto, a plurality of supporting legs secured to said frame, a rotor housing depending from said frame and adjacent some of said legs, a rotor adapted to be power driven within said housing, a shaft connected to said rotor, a bearing assembly rotatably supporting said shaft, a horizontal plate joining said bearing assembly to said housing, a vertical support plate adjustable in a vertical direction and fixed at one end to said horizontal plate and to said housing and at its other end secured adjustably to said bracing member, and means securing said housing to two of said supporting legs, whereby said shaft may be positionally adjusted relative to said frame.

3. The rotary processing equipment as defined in claim 2 wherein there is a horizontally-adjustable reinforcing member connecting said bearing assembly to said bracing member.

4. In rotary processing equipment, in combination, a generally rectangular frame including a spanning beam, a supporting leg joined to each corner of said frame, a rotor housing depending from said frame and adjacent two of said legs, a bearing assembly mounted on said housing, a rotor mounted on a shaft and rotatably supported within said housing by said bearing assembly, a vertical support plate securing said housing to said frame, horizontal reinforcing members securing said bearing assembly to said spanning beam and constructed to resist torque generated by said rotor, and means securing said housing to said two of said supporting legs at points spaced below said frame, whereby torsional stress created in said housing and bearing assembly is resisted by said frame and supporting legs.

5. In rotary processing equipment, in combination, a frame, said frame including two pairs of spaced parallel beams which are L-shaped in cross section, a reinforcing beam L-shaped in cross section and running crosswise of a pair of said parallel beams and secured thereto, a plurality of supporting legs secured to said frame, a rotor housing having an upper surface, said housing being spaced from said frame and adjacent two of said legs, a rotor adapted to be power driven and rotatably supported within said housing, a support plate secured to said reinforcing beam and to the upper surface of said housing, and bracket members connecting said housing to some of said supporting legs at points spaced below said frame, whereby torsional stress created in said housing is resisted by said frame and supporting legs.

6. In rotary processing equipment, in combination, a rectangular frame, said frame including longitudinal and transverse beams which are L-shaped in cross section, a reinforcing member L-shaped in cross section mounted between said transverse beams and secured to said longitudinal beams, a plurality of supporting legs secured to said frame, a rotor housing depending from said reinforcing member and adjacent two of said legs, a bearing assembly mounted on said housing, a shaft adapted to be power driven, said shaft being rotatably supported by said bearing assembly, a rotor within said housing and connected to said shaft, a support plate connecting said housing and said reinforcing member, bracing elements securing said bearing assembly to said reinforcing member in torque-resisting relationship, and bracket members securing said housing to at least two of said supporting legs at points spaced below said frame, whereby torsional stress created within said rotor housing and bearing assembly is resisted by said frame and supporting legs.

7. Rotary processing equipment as defined in claim 6 in which said support plate is connected to said reinforcing member by threaded members, whereby the vertical position of said shaft may be adjusted relative to said frame.

8. The rotary processing equipment as defined in claim 6 wherein said bracing elements are threaded horizontal elements and are horizontally adjustable whereby the position of said shaft may be adjusted relative to said frame.

9. In centrifugal impacting apparatus, comprising, in combination: a frame, a plurality of supporting legs for said frame, a rotor housing positioned adjacent two of said legs, a power driven rotor rotatably mounted within said housing, said housing having an upper and a lower portion, a vertical support plate secured to said housing and adjustably secured to at least two points on said frame and constructed to be in torque-resisting relationship therewith, and means connecting said upper housing portion fixedly to at least two of said supporting legs at points spaced below said frame whereby torsional stress created in said housing is resisted by said frame and said supporting legs, said lower portion being suspended from said upper portion and demountable therefrom to permit access to the interior of said rotor housing.

10. The invention according to claim 9 wherein said means connecting said upper housing portion to said legs includes two integral extensions formed in said upper portion and having inner-contoured portions matching the contours of the surfaces of said two legs.

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