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Liebert

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[54] **MACHINE FOR COMPACTING, PELLETIZING AND/OR BRIQUETTING**

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[51] **Int. Cl.** **B30b 3/00,** B30b 3/04

[58] **Field of Search** ..... 100/155, 161–172, 100/DIG. 6, DIG. 7, DIG. 8, DIG. 9; 425/237, 335, 363; 72/234, 245

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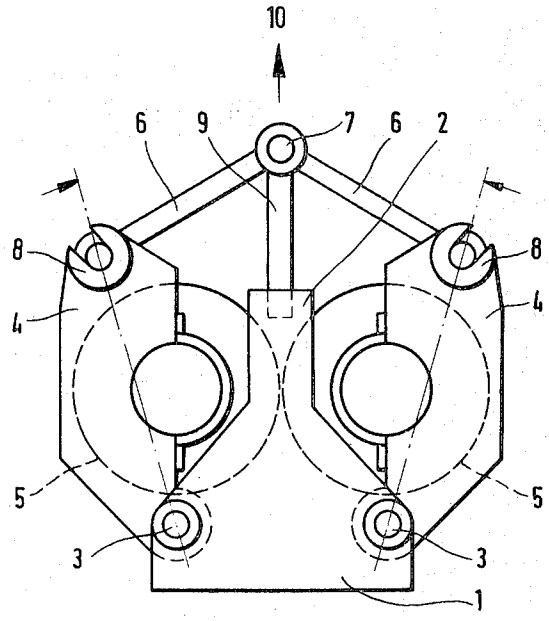
[57] **ABSTRACT**

A compression pressure machine for compacting, pelletizing, or briquetting pulverant, fine grained or structurally voluminous products. The machine includes a frame supporting oppositely disposed lever cradles, these cradles in turn supporting two horizontally juxtaposed compacting rollers. The lever cradles are pivotally connected to the frame, and connecting rods are attached to the lever cradles for movement of the cradle and associated rolls. The connecting rods are operated by means of piston mechanisms associated with the machine frame with extension and retraction of the piston mechanisms serving to move the rolls toward and away from each other. The positions of the lever cradles and associated operating mechanisms provide highly efficient means for achieving the desired forces while also providing an arrangement which is extremely efficient from the standpoint of machine construction and maintenance.

8 Claims, 3 Drawing Figures



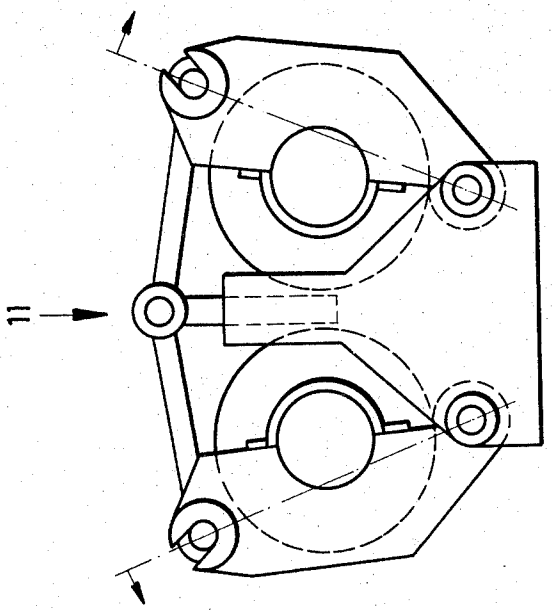


FIG. 2

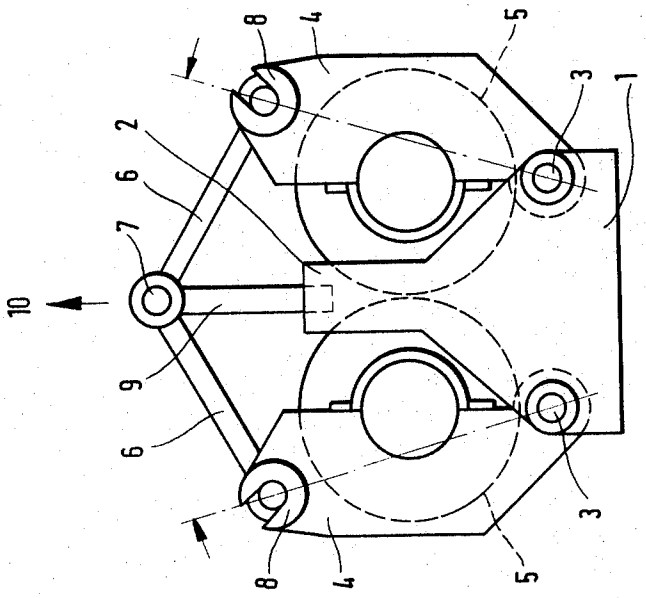


FIG. 1

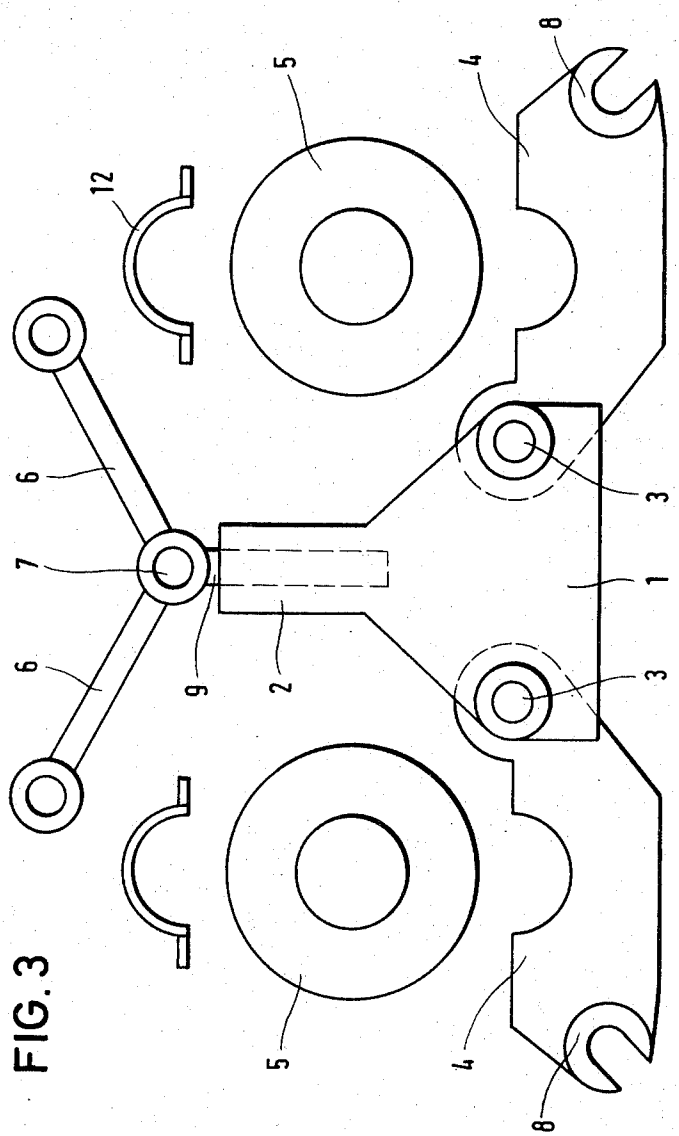


FIG. 3

MACHINE FOR COMPACTING, PELLETIZING AND/OR BRIQUETTING

The invention relates to a compression-pressure machine for compacting, pelletizing or briquetting pulverant, fine grained or structurally voluminous products. The construction generally comprises a machine frame and two horizontally juxtaposed compacting rollers positioned in lever cradles which in turn are articulated pivotably at one end to the machine frame. Press-on devices for pressing both compacting rollers toward each other and for thereby applying pressure to the material between the rolls are directly associated with the machine frame.

An essential principal component of each compression pressure machine is the machine frame and/or the machine carriage in which two horizontally operating juxtaposed compacting rollers are positioned horizontally or bilaterally. The provision of the oppositely disposed rolls is particularly called for in the case of compression pressure machines of high capacity for industrial production. At least one compacting roller is usually movably mounted in the pressing direction, so that the width of the operating gap and/or the roller gap can be varied between both rollers. This is done for reasons of safety, for example, so that in case of overload, one roller can move away in relation to the other one. In addition, the relative movement is desired to permit adjustment of the thickness of the pressed products discharged from the roller gap.

The compression means generating the pressing force acting in the roller gap bear down on the one hand at the machine frame, and on the other hand at the operating rollers, particularly at the ends of their shafts.

Designs of machine frames according to the prior art are typically H-, U- and rectangular frames, usually disposed in a horizontal arrangement. The pressure-producing members, particularly the pistons or piston rods of hydraulic compression apparatuses, are fastened to the vertical machine frame, either integrally formed parts or connected to it separately, e.g., by means of bridge bolts arranged on the outside. The pressure-producing members act inwardly in the direction of the horizontal central plane passing through both longitudinal axes of the rollers. Consequently, they must muster the entire pressing force required and transfer it as reactive force of the same magnitude to the connecting members or directly to the machine frame. Since the frame is thus exposed to these forces, the frame and the connecting and pressure-producing members must have high structural strength.

Replacement of the compacting rollers which frequently becomes necessary, is carried out in the rectangular frames of typical machines from the front, and this is most cumbersome. In the U- or H-shaped machine frame, first the vertical bridge bolts including all pressure-producing members always must be dismounted, so that the compacting rollers can be pulled out laterally, that is in transverse direction. The bearing jaws are removed transversely of the compacting rollers.

Compression pressure machines are known whose compact rollers are positioned in lever cradles. The centers of gravity of the latter are located below the points of attack of the pressure-producing members and/or the compression devices are located above the roller shafts. Such arrangements result in a diminished lever effect and consequently a reduction of the traction or pressure energy to be mustered for the pressing force of the compacting rollers results. Because the pressure-producing members of the compression devices in the compression pressure machines of the prior art always act from the outside toward the inside on the lever cradles, additional supporting and fastening are necessary, which results in increased construction costs and space requirements.

Another disadvantage of all hydraulically supported or pressed-on compression pressure machines of the prior art resides in the fact that, under the product pressure, the roller gap varies between the compacting rollers. Thus, the rollers move in the pressing direction, in relation to the vertical central plane between both rollers, asymmetrically and in an undefined manner. In this respect it is immaterial whether both compacting rollers or only one is provided with a pressure-producing member and/or a compression means. The gap variation leads to a considerably reduced sealing effect of the roller sealing members and thus to an increased build-up of dust around the equipment. Where both compacting rollers are movably positioned, axis parallelity can be accomplished only at considerably hydraulic expense.

It is a general object of this invention to provide an improved apparatus for achieving the compacting, pelletizing and briquetting of pulverant, fine-grained or structurally voluminous products.

It is a more specific object of this invention to provide a mechanism of the type described which can achieve the application of the desired forces with a relatively low energy input requirement.

It is a still further object of this invention to provide an arrangement of the type described which is relatively straightforward in design whereby the construction can be economically manufactured, and whereby the maintenace of the construction, particularly from the standpoint of roll replacement, can be carried out on an efficient basis.

These and other objects of this invention will appear hereinafter, and for purposes of illustration but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a schematic side elevation of a construction characterized by the features of this invention;

FIG. 2 is a schematic side elevation of the construction illustrated with the compacting rolls in the open position; and,

FIG. 3 is a schematic side elevation of the construction illustrating the position assumed by the machine elements during disassembly.

Generally, this invention is directed to the problem of obviating the aforementioned disadvantages of the compression pressing machines of prior art and to create in addition an embodiment for which the manufacturing and production costs are simplified and reduced. Moreover, the invention provides operating characteristics which are improved under changing loads.

For the solution of this problem, the invention provides in a compression pressure machine a machine frame and two horizontally juxtaposed compacting rollers. These rollers are supported in lever cradles which in turn are articulated pivotably at one end to the machine frame. Devices for pressing the compacting rollers against each other are associated with the machine

frame and are connected to the compacting rollers through the lever cradles. The pressing devices are positioned to direct the pressing force in the vertical central axis between the ends of the shafts of the compacting rollers by means of an upwardly movable pressure rod. The force is directed laterally and downwardly by means of inclined traction bars connected to the lever cradles. These bars are pivotally articulated at one end to the upper end of the pressure bar and at their opposite end to a cradle.

The sides of the machine frame preferably have the shape of an inverted T. It is then preferable to design each compression device as a hydraulic or hydraulic-pneumatic piston-cylinder unit, with the cylinder of each press-on device being placed in or at the vertical beam of each T-shaped lateral part of the machine frame, or comprising an integral part of the vertical beam. When using hydraulic-pneumatic piston-cylinder units, it is expedient to provide two separate operating circuits for the operating medium, one of them containing a hydraulic fluid, the other one, air. The pneumatic circuit may then be so designed that it becomes effective only as an overload safety device.

It is necessary to periodically replace the operating rollers of such equipment, which requires disassembling, including disassembly of the compression devices. In order to simplify this, a further improvement of the invention provides that the free ends of the traction bars are suspended at their outer end in open, claw-like slots of the pivotable lever cradles. For that purpose, the traction bars may be designed at their outer ends as load hooks by which they can be suspended in the lever cradles. They also may be provided with transverse pins extending parallel with the roller shafts, by means of which an engagement into corresponding slots or perforations at the lever cradles can be accomplished, or by any other suitable means which permits rapid disassembly.

The lever cradles in turn are so designed that following the loosening of the connection with the traction bars they can be pivoted outwardly into a horizontal position. In addition, the design of the bearings of the compacting rollers in such that the disassembly of the compacting rollers in an upward direction is possible once the lever cradles have been pivoted into the horizontal position. This offers the advantage that the usually heavy rollers can be lifted upwardly out of the lever cradles with the aid of cranes or the like.

The compression pressure machine according to the invention offers the advantage that a considerable reduction of energy input is possible for generating the forces for the compacting roller compression, so that the pressure-producing components can be less massive when compared with conventional machine design. Moreover, variations in the roller gap is achieved in a strictly axis-symmetrical manner. Axis parallelity for the compacting rollers is made possible with simple hydraulic means. A change of the compacting rollers with the hinged-off cradles can be accomplished by simply unhooking the traction bars from the cradles. The arrangement avoids the necessity of machining the surfaces of many parts which must be done in a very precise manner and by the application of drilling and lathing or turning operations. Manufacturing costs are thus reduced considerably.

The principal components of the compression pressure machine according to the invention are a machine frame 1 shaped like an inverted T. A vertical beam 2 forming a hydraulic cylinder comprises part of this frame. Two compacting rollers 5 mounted horizontally and in parallel with each other, are positioned, respectively, in cradle levers 4. These levers are articulated at their lower ends to the horizontal part of the machine frame 1 by means of bearings 3. A piston with a pressure bar 9 is guided horizontally in the vertically disposed hydraulic cylinder.

Traction bars 6 are articulated in each case at their upper ends in bearings 7, these bars being slightly tilted downwardly as shown in FIG. 2. Each bar is suspended at its other free end in jaw-like slots 8 at the upper ends of the cradle levers 4. This positioning in the slots is located above the compacting rollers 5 and outside their longitudinal axes. The two traction bars or traction anchors 6 of equal length combine to form a bendable traction anchor.

The distance of both open jaw-like slots 8 in relation to each other is reduced by extension of the piston bar 9 in the direction of the arrow 10. This extension of the bar which is connected to both traction bars 6 in an articulated manner, causes the compacting rollers 5 to move together due to the pressure resulting from the lever effect imparted by levers 4 as the levers pivot about bearings 3. Conversely, this distance is increased by retracting the piston bar 9 in the direction of the arrow 11, which positively increases the roller gap.

The compression apparatus represented in FIGS. 1 and 2 is preferably provided on both sides of the rollers in the case of larger compression pressure machines.

FIG. 3 illustrates the compression pressure machine in the open or partially disassembled condition. As shown, both lever cradles 4 are pivotable horizontally toward the outside after the ends of the traction bars 6 are unhooked from slots 8. The compacting rollers 5 are shown separated from the supporting bearings provided in the lever cradles 4. Bearing bowls 12 can be easily separated from the lever cradles in order to lift the compacting rollers 5 upwardly after they have been disengaged from their drive shafts. The drive mechanisms for compacting rollers 5 as well as other known portions of the construction may be of any conventional type.

It will be appreciated that the construction described herein is of a relatively straightforward design in that the machine frame portions which are located on opposite sides of the machine are uncomplicated in design. The use of these machine frame portions for supporting the lever cradles provides an efficient arrangement from the standpoint of simplified machine design while also providing an ideal structure from a force transmission standpoint. Similarly, the use of the vertical beam 2 as the cylinder or as a housing for the cylinder provides an efficient arrangement from both a design and operating standpoint. The connection of the piston 9 to the connecting rods 6 is a simple design arrangement as is the connection of the opposite ends of these rods with the lever cradles. The efficiency of force transmission achieved is, however, of primary importance. Finally, all of these arrangements provide a structure which greatly simplifies the changing of rolls and other maintenance operations.

It will be understood that various changes and modifications may be made in the above described invention which provide the characteristics of the invention with-

out departing from the spirit thereof particularly as defined in the following claims.

That which is claimed is:

1. A compression pressure machine for compacting, pelletizing and briquetting pulverant, fine-grained or structurally voluminous products, comprising a machine frame, lever cradles articulated pivotably at one end thereof to the machine frame, a pair of horizontally juxtaposed compacting rollers supported by said lever cradles, and a compression device including means for transmitting force along a vertical central axis located between the ends of the shafts of the compacting rollers, means for reciprocally operating said force transmitting means, a pair of traction bars pivotally connected to the opposite ends of the lever cradles, said force transmitting means being connected to said traction bars whereby application of said force pivots said lever cradles and thereby determines the gap between said compacting rollers and the pressure applied by the rollers.

2. A compression pressure machine according to claim 1, wherein the machine frame comprises a pair of oppositely disposed side members having the shape of an inverted T.

3. A compression pressure machine according to claim 2 wherein said compression device comprises a piston-cylinder unit.

4. A compression pressure machine according to claim 3 wherein the cylinder of the compression device is located in the vertical beam of each T-shaped machine frame member.

5. A compression pressure machine according to claim 1 wherein the ends of the traction bars are removably supported in slots defined by said lever cradles.

6. A compression pressure machine according to claim 5 wherein the ends of the traction bars define hooks readily disengageable from the lever cradles.

7. A compression pressure machine according to claim 6 wherein the lever cradles are pivotable outwardly into a horizontal position when disengaged from the traction bars.

8. A compression pressure machine according to claim 7 including bearing members for the compacting rollers, said bearing members being mounted on the lever cradles and being movable upwardly away from the lever cradles when the cradles are in the horizontal position to thereby permit disassembly of the compacting rollers from the lever cradles.

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