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[54] **APPARATUS FOR PROCESSING MATERIALS**

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[58] **Field of Search** 241/25, 29, 82.1, 82.4, 241/82.7, 84, 84.2, 161, 162, 163

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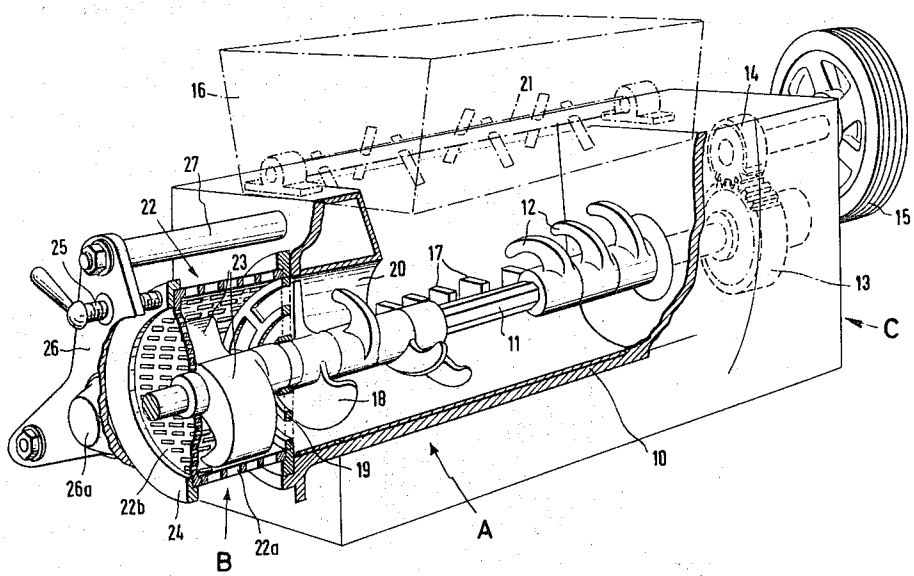
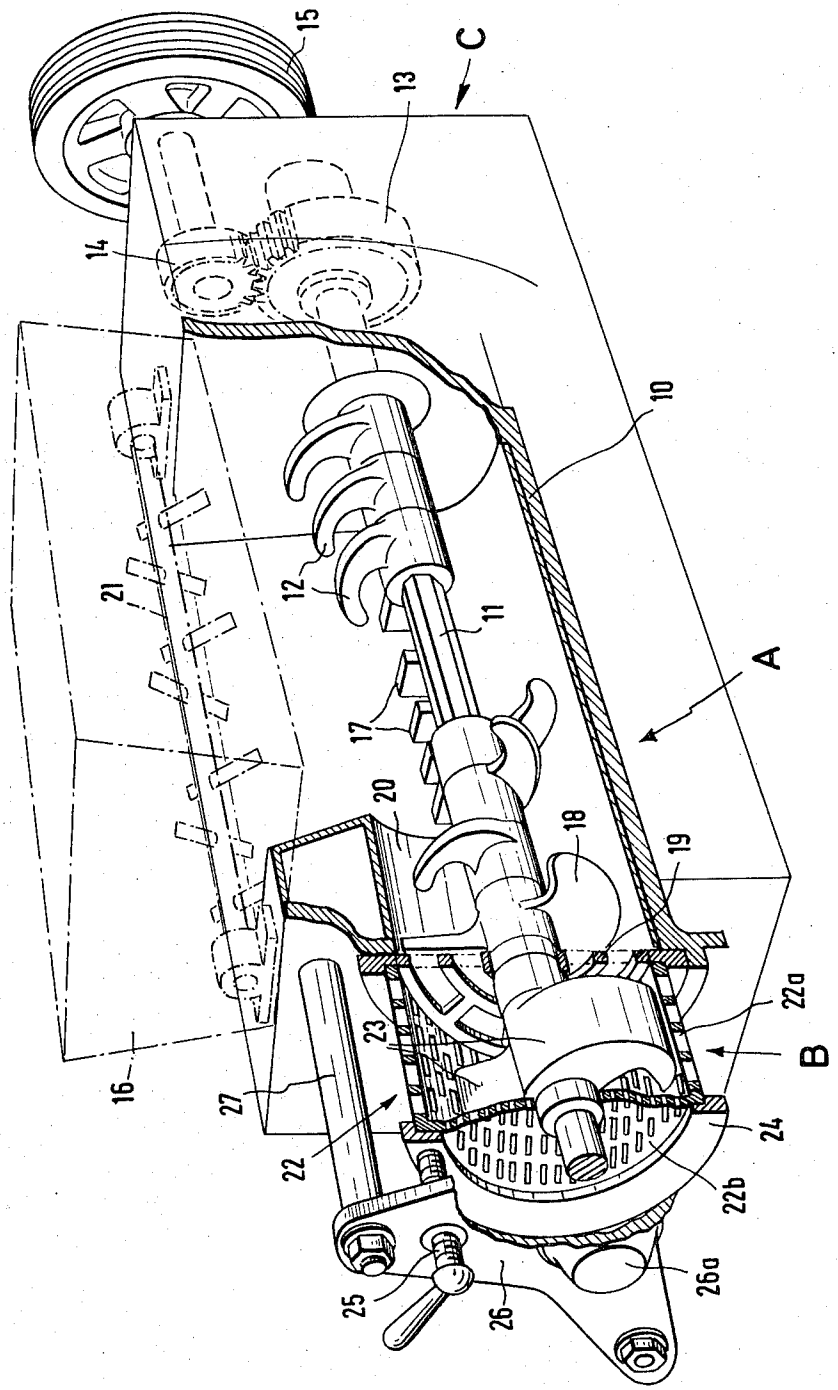
[57] **ABSTRACT**

A material processing apparatus includes coarse and fine comminuting sections and a mixing section interposed therebetween. A common drive shaft is provided for the sections. Blade members are mounted on the drive shaft in the coarse and fine comminuting sections for pulverizing incoming material. The mixing section includes a tunnel portion, a screen member, and a helical blade mounted on the drive shaft for mixing incoming materials and pressing them through the screen.

5 Claims, 1 Drawing Figure

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APPARATUS FOR PROCESSING MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to a processing device for crushing, comminuting and preparing materials, such as clay and sandy masses, factory wastes, and compost.

In such a device, incoming materials pass through a coarse comminuting section which is studded with grate bars and which is provided with rotating crushing blades arranged on a driving shaft. The crushing blades rotate and simultaneously pass between the grate bars. Afterwards the materials pass through a fine comminuting section that is provided with a screen basket and wiper blades which squeeze the materials through the screen basket.

OBJECTS AND SUMMARY OF THE INVENTION

It is a primary object of the invention to provide a device of the described type which combines within itself the effects of a pan grinder, a crushing mill and a mixing machine.

It is a further object of the invention to provide a device of the above-mentioned type that is equally well suited for the processing of dry, wet and frozen material, including, for example, freshly mined clay or marl, as well as moist, sticky material.

It is also a primary object of the invention to provide a device which will sufficiently comminute and intensively mix material that is obtained even in large chunks.

According to the invention the above objects, among others, will be achieved through the provision, in an apparatus of the initially mentioned type, of a mixing section, in the form of a tunnel, disposed between the coarse and the fine comminuting sections. The mixing section includes a transverse screen adjoining the fine comminuting section and covering the entire cross sectional surface of the tunnel. A screw conveyer is disposed in the tunnel for mixing material which is crushed in the coarse comminuting section and squeezing this material through the transverse screen into the fine comminuting section. The crushing blades of the coarse comminuting section, the screw conveyer of the mixing tunnel and the wiper blades of the fine comminuting section are seated for rotation on a common drive shaft.

According to a further aspect of the invention, the crushing blades which succeed one another toward the mixing tunnel are disposed on the driving shaft in a manner radially offset with reference to one another. The crushing blades further include angularly disposed material-feeding surfaces which, when the drive shaft is rotated, will feed material toward the mixing tunnel.

The drive shaft is polygonally shaped, preferably octagonally. As a result, a very impact-resistant arrangement is achieved, while enabling identically-formed crushing blades to be easily assembled in a manner wherein they are relatively radially oriented.

The coarse comminuting section preferably further includes an additional break-up roller that particularly serves to scrape and dislodge moist sticky material which is inclined to settle in a feed hopper which directs incoming material to the apparatus.

In a further facet of the invention the screen basket of the fine comminuting section is provided with a front screen for the discharge of material in an axial direction.

The grate bars of the invention, which extend up to the hubs of the crushing blades, are arranged for insertion from the outside into the housing of the coarse comminuting section.

The housing of the coarse comminuting section has been conveniently shaped in the general form of a funnel with a cylindrical, or curved, bottom, whereby the bottom of the coarse comminuting section can be mounted for downward swinging.

The housing of the coarse comminuting section may be further provided with a feed arrangement, disposed in front of and directed into the tunnel, for feeding additive substances, for example, water, sand and dye.

THE DRAWING

In the drawing, an embodiment of the invention has, by way of example, been shown partially in section and in perspective side view.

DETAILED DESCRIPTION OF A PREFERRED FORM OF THE INVENTION

The apparatus according to the invention includes a coarse comminuting section A, a fine comminuting section B and a gear mechanism drive section C. The latter has been separated by an intermediate wall from the coarse comminuting section A.

The housing **10** of the apparatus has lateral walls extending convergingly, angularly downwards, i.e., generally in the form of a funnel, which walls extend atop a cylindrical or curved bottom of the housing **10.** The lateral walls thus merge at their lower portion into a curved floor for the coarse comminuting section A. The driving shaft **11** in the area of the coarse comminuting section is octagonally-shaped. This shaft, besides providing a very impact-resistant mounting for a plurality of crushing blades **12,** affords the advantage of enabling simple assemblage and disassemblage of the crushing blades. This mounting arrangement further enables the crushing blades to be easily mounted on the drive shaft in a successively radially offset manner, as is illustrated.

Rotational drive for the shaft is provided by means of a one-step gear mechanism which includes a gear **13** seated on the drive shaft **11** and a power-transmitting pinion **14** that is driven by way of a belt pulley **15.** In order to protect the processing apparatus and particularly the driving motor, a conventional starting and safety clutch, which is not shown, is disposed between belt pulley **15** and pinion **14.** The apparatus is additionally safeguarded against obstructions by way of a safety shear pin built into the driving pulley **15,** which shear pin likewise has not been shown. Thus, should an obstruction prevent the shaft **11** from rotating, the safety clutch will disengage or the shear pin will be severed to protect the apparatus from damage.

A crushing grid is provided in the coarse comminuting section A, and includes a plurality of grate bars **17** which can be inserted, from the outside, into apertures of the housing **10** and are provided with suitable flanges for being screwed onto the outside of the housing.

The crushing blades **12** are arranged to pass between the grate bars **17,** the latter extending inward substantially to the hubs of the crushing blades **12.** The crush-

ing blades **12**, on at least one of their sides, each have a feed surface which is angled with respect to the drive shaft in a manner causing a shifting movement of material toward the discharge end of the coarse comminuting section.

It will be apparent that due to the radially-offset arrangement of the crushing blades **12** and the angularly-arranged feed surfaces, the crushing blades **12**, as a group, have the effect of a continuous screw conveyor.

A short screw conveyer **18** is mounted on an intermediate portion of the driving shaft **11** adjacent the discharge end of the coarse comminuting section A. This conveyer **18** rotates adjacently to a transverse screen **19**, the latter being disposed such that the material to be processed must pass therethrough before entering the fine comminuting section B from the coarse comminuting section A. The transverse screen is thus positioned at the discharge end of said tunnel and occupies the entire transverse width of said tunnel. The screw conveyer **18** is positioned to squeeze the material through the transverse screen **19** into the fine comminuting section B. In order to increase the discharge effect, the screw conveyer **18** may advantageously include two blades, separated from one another, and extending in a spiral fashion.

The screw conveyer **18** and the crushing blades **12** located nearest the discharge end of the coarse comminuting section A are surrounded by a tunnel or enclosure **20** which is of generally reduced size in relation to the cross section of the coarse comminuting section A. The arrangement and size of the tunnel **20** advantageously assures that no large chunks of material can be jammed firmly against the transverse screen **19**, which could tend to obstruct and block-up the apparatus, and further assures that, within the tunnel, a particularly intensive mixing effect will be achieved.

It will be apparent, then, that the combination of the tunnel **20**, the screw conveyer **18**, and the transverse screen **19** define a mixing section which is interposed, and provides communication between, the coarse and the fine comminuting sections A and B. The mixing section excludes large chunks of material which might jam against the screen **19**, and affords a compact, enclosed area which enables an intensive mixing of the material to be accomplished.

The coarse comminuting section A may be provided with an additional break-up roller **21** positioned at the lower end of a feed hopper **16** which may be mounted on the housing **10**. The additional break-up roller **21** is particularly important in the case of processing moist, sticky material that is inclined to settle in the bottom of the feed hopper **16** since it causes such material to be drawn, or fed, into the housing of the coarse comminuting section. In the area of the coarse comminuting section A, housing **10** can be provided with a swinging bottom.

The fine comminuting section B includes a screen basket **22** comprising a cylindrical sifting drum **22***a* and a front screen **22***b* at its extreme end. The screen basket **22** follows, i.e., lies downstream of, the transverse screen **19** of the coarse comminuting section. Rotatable within the screen basket **22** are wiper blades **23** which are attached to an end portion of the driving shaft **11**, opposite the end portion which mounts the crushing blades **12**. The wiper blades **23** force the material through the sifting drum **22***a* and the front screen **22***b*. Preferably, the blades **23** may include segments, not shown, that can be easily replaced and which consist of particularly wear resistant raw material at locations that are prone to wear.

The screen basket **22** is forced against the transverse screen **19** by means of a lock ring **24** and a plurality of pressure screws **25**, only one of which being shown. The pressure screws **25** can be screwed through a base plate **26** that is attached by holding bolts **27** to the frame of the apparatus. The base plate **26** also contains the front bearing **26***a* for the drive shaft **11**.

Thus, the transverse screen **19** and the screen basket **22** are both held in position through the force which is exerted on the screen basket by means of the pressure screws **25**, acting through the lock ring **24**.

OPERATION

As material is fed into coarse comminuting section A through the hopper **16**, and the drive mechanism is activated, fairly large chunks, as well as small chunks, of material are precrushed by the crushing blades **12** and are simultaneously conveyed toward the fine comminuting section B due to the orientation of the crushing blades. In front of the transverse screen **19**, the material is seized by the screw conveyer **18** and is pushed through the transverse screen **19**. As a result of this and the good mixing effect which occurs in the tunnel by the downstream crushing blades **12** and the screw conveyer **18**, a further comminution of the material takes place in the tunnel **20**. The material precrushed in this way, and after entry into the fine comminuting section B, is pushed radially forward, or outward, in the fine comminuting section B by the wiper blades **23** and also axially outwardly of the screen basket through the front screen **22***b*. Through this pushing or pressing out, the ejected material will comprise a very large portion, i.e., a high concentration, of finely comminuted substances.

The instant apparatus is also suited for the production of pellets. In this case, rotating cutting knives could be mounted and arranged for transversing movement across the openings in the screen basket.

In certain cases, the fine comminuting section may be omitted. In this case there will be the discharge of relatively coarse material through the screen **19**. Alternatively, with the bottom of the coarse comminuting section A swung downwards, the discharge takes place through the bottom of the coarse comminuting section A.

MAJOR ADVANTAGES AND SCOPE OF THE INVENTION

The invention provides a material processing apparatus in which a mixing section is interposed between coarse and fine comminuting sections. The transverse screen **19** of the mixing section affords an increased comminuting effect since all of the material passing from the coarse to the fine comminuting section will be pressed through this screen by a screw conveyer.

The screen itself is protected against obstruction by large chunks of material by means of the tunnel member **20** which surrounds the screen.

The tunnel member **20** further defines an enclosure in which rotating bladed members cooperate to impart a high degree of mixing to material passing therethrough.

The instant apparatus is further adapted for the efficient processing of even wet, sticky material due to the provision of the rotatable break-up roller **21** which assists in the feeding of such material into the coarse comminuting section.

The present invention provides a compact and efficient arrangement of elements which cooperate in a manner to impart a high degree of comminution and mixing of materials.

Although the invention has been described in connection with a preferred embodiment thereof, it will be appreciated by those skilled in the art that additions, modifications, substitutions and deletions not specifically described may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A material processing apparatus comprising: a coarse comminuting section, a fine comminuting section, a mixing section, and a common, power-rotatable drive shaft for said sections, wherein:

said coarse comminuting section includes:

a plurality of stationary grate bars, and

a plurality of crushing blades mounted for rotation on a portion of said rotatable drive shaft,

at least some of said crushing blades being positioned to pass between said grate bars during rotation thereof;

said fine comminuting section being in downstream communication with said coarse comminuting section and comprising:

a screen basket,

a plurality of wiper blades mounted for rotation on the other end portion of said rotatable drive shaft and being rotatable within said screen basket to press material received from said coarse comminuting section through openings in said screen basket;

said mixing section providing said communication between said coarse and said fine comminuting sections, said mixing section including:

a tunnel means extending between said coarse comminuting section and said fine comminuting section, a screw conveyor mounted for rotation on an intermediate portion of said rotatable drive shaft, and

a transverse screen positioned at the discharge end of said tunnel means adjacent said fine comminuting section and extending across the entire transverse area of said tunnel means;

said screw conveyer being operatively positioned adjacent said transverse screen to mix crushed materials received from said coarse comminuting section and to press such crushed materials through said transverse screen into said fine comminuting section.

2. A material processing apparatus according to claim **1** wherein said driving shaft is polygonally-shaped.

3. A material processing apparatus according to claim **1** wherein said coarse comminuting section further includes:

a break-up roller positioned adjacent an inlet feed opening of said coarse comminuting section to cause a dislodging of moist, sticky material being fed into said coarse comminuting section.

4. A material processing apparatus according to claim **1** wherein said screen basket includes:

a front screen member affording axial discharge of material from said fine comminuting section.

5. A material processing apparatus according to claim **1** wherein:

said coarse comminuting section is generally funnel-shaped with a generally cylindrically-curved floor.

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