Dec. 15, 1959 J. KRUG ET AL 2,917,248

PULVERIZING SYSTEM

Filed March 20, 1957

FIG. 3

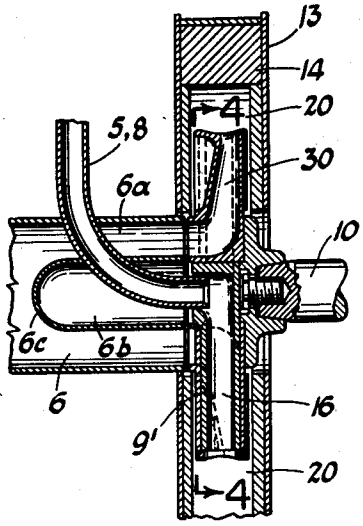
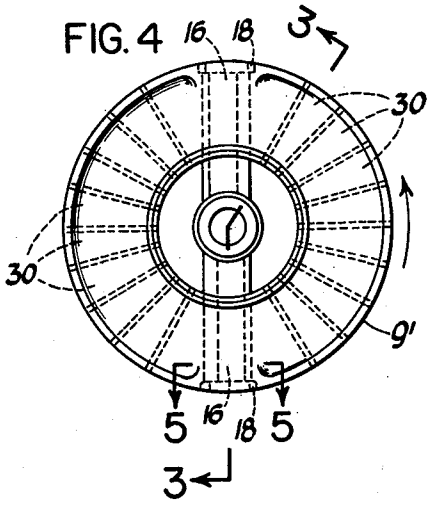


FIG. 4



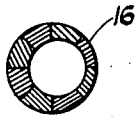


FIG. 5

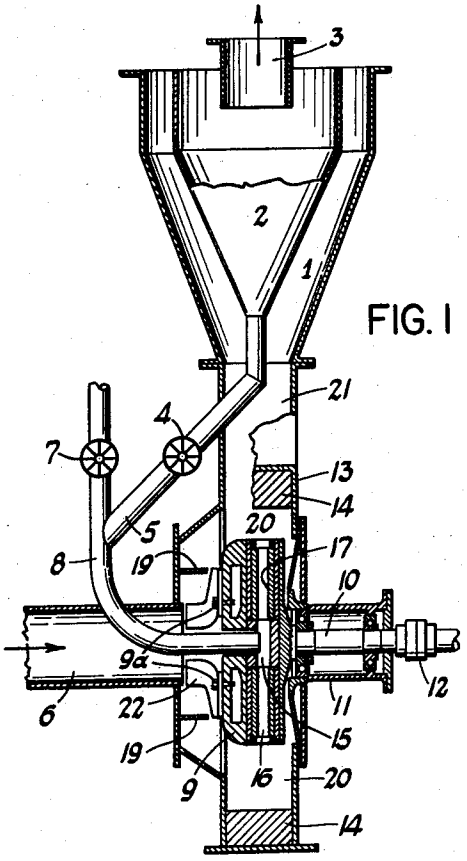
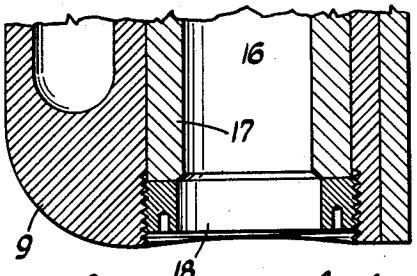


FIG. 1

FIG. 2



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PULVERIZING SYSTEM

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6 Claims. (Cl. 241—275)

This invention relates to a pulverizing apparatus of the centrifugal type and is more particularly concerned with an apparatus for pulverizing coal in which pulverization is accomplished by impingement of the coal on impact means with an impact velocity of such magnitude that sufficient energy is developed to shatter or disintegrate the coal to the required fineness.

Mills are already known, as for instance so-called hammer or beater mills, which depend more on striking the coal a succession of blows in a chamber or container by rotating hammers or a beater wheel than on obtaining an initial velocity of impact sufficient to completely shatter the coal to the desired fineness. The runner or beater wheel of such mills rotates at about 750 to 1000 r.p.m. Pulverizing and crushing is thereby carried out to a large extent through impact upon the hammer or beater. The amount of air or carrier gas required to be passed through the mill and rotating with the coal is such that the requisite initial velocity of the particles to attain disintegration by impact on the surrounding housing, cannot be obtained except at an expenditure of power so great as to be prohibitive. In pulverizers of the hammer mill type the grinding of the coal therefore primarily results in wear of the beater parts, and to a lesser extent, in wear of the surrounding housing necessitating frequent replacement of the beater parts which is time consuming and costly.

In contradistinction thereto the present invention provides an apparatus wherein the larger portion of the carrier gas entrains the particles at the point of impact, and not before these particles enter the mill. Consequently only a small amount of carrier gas or air is introduced with the material into the passages of the impeller or runner, to be hurled from the periphery of the runner. This makes it economically feasible to build up a tremendous centrifugal force by rotational speeds of several thousand r.p.m., thereby ejecting the particles at an extremely high initial velocity against the impact surface of the surrounding circular impact ring or abutment. The wear and tear of the grinding parts is therefore to a large extent concentrated on the abutment surface surrounding the runner rather than on the outer surfaces of the runner parts. As is well known worn parts of the impact ring can be easily exchanged and replaced in contrast to replacement of the beater wheel parts. Abrasion of the outer surface of the impeller due to collision with the particles is slight in the herein disclosed apparatus and can be kept within bearable limits.

On the other hand, the wearing down of the walls of the tubular passages of the impeller through which the material passes from the axially located material inlet to the peripherally located outlet, is met, according to the invention, by equipping these passages with liners which are supported and locked in place in such a manner that they can easily be removed and replaced. Because, according to the invention, none or only a minor portion of the air is admitted with the fuel to the passages, the runner may be combined with a blast fan either of integral or separate construction for supplying all or the remaining larger portion of carrier air. This fan may be coaxially arranged with the impeller and may be driven either by the same or by separate driving means.

It is accordingly the main object of the invention to provide an impact mill that gives superior performance by virtue of possessing greater economy with respect to wearing of surfaces and with respect to requirements of driving power.

Another object of the invention is to provide a mill having feeding passages or ducts which are equipped with replaceable liners having locking means.

A further object of the invention is to provide a liner for the material feeding passages, the wall thickness of part of the liner protecting the trailing side of the duct (with respect to rotation) being heavier than the part protecting the leading side of the duct.

An additional object of the invention is to provide duct liners which are sub-divided into longitudinal sections so that only those sections need to be replaced which suffer excess wear.

A still further object of the invention is to provide an impact pulverizer wherein the major portion of the carrier air is discharged through impeller ducts and nozzles other than those through which the material is ejected.

We accomplish the foregoing, together with such other objects as may hereinafter appear or are incident to our invention, by means of a construction and method, the preferred embodiments of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a sectional elevation of the mill, including a section through the material feeding ducts.

Fig. 2 is an enlarged partial section of the material feeding duct of Fig. 1 and showing the replaceable liner and liner support.

Fig. 3 is a vertical section through a mill having an impeller equipped with two oppositely arranged material feeding ducts and other ducts arranged therebetween for discharging the carrier air or gas, when taken on line 3—3 of Fig. 4.

Fig. 4 is an elevational view of the impeller wheel, taken on line 4—4 of Fig. 3.

Fig. 5 is a cross section through the material feeding duct taken on line 5—5 of Fig. 4 and showing a liner having unequal wall thickness and being composed of longitudinal sections.

Referring now to Fig. 1 carrier air or gases as well as the material to be pulverized are introduced into the mill axially. The carrier gas with the ground material entrained therein flows upwardly and enters a cyclone separator **1**, having an inner material collecting chamber **2** in which the heavier particles are collected before being returned to the mill. The finer particles together with the carrier gas are discharged through an outlet duct **3** to a point of use, not shown. A rotary valve or rotary feeder **4** is provided in the duct **5** through which the coarse particles flow on their way to the mill. These coarse particles join with the material to be pulverized which is fed to the mill by gravity and by way of feeder **7** and duct **8** and separately from the carrier air which enters the mill by way of duct **6**.

The mill is provided with a runner or impeller wheel **9** the shaft of which is supported by a bearing **11**, and is driven through coupling **12** by power means not shown. The runner **9** rotates within a housing **13** which is provided with a circular abutment or impact ring **14** comprising readily replaceable sections. Duct **8** through which the material is fed to the mill projects into a central opening **15** of the impeller wheel **9** which is provided with one or several radially disposed passages **16**. These passages are lined with interchangeable tubular liners **17**. The replacement of liners **17** can readily be

effected through a sealable opening (not shown) in the mill housing 13, after a portion of the abutment 14 has been removed. As shown in Fig. 2 the liner 17 is retained in working position by a threaded locking ring 18. This ring is easily accessible through the aforesaid opening in the mill housing, thereby facilitating removal and replacement of tubular liner 17.

In accordance with the invention the impeller 9 rotates at several thousand revolutions per minute. Consequently the material particles travelling through passages 16 are accelerated to a very high velocity and are hurled against the surface of impact ring 14, with sufficient force to cause immediate disintegration of the particles to the desired fineness.

The conveying air being delivered to the mill through conduit 6 is directed by guiding ring 19 into the grinding chamber 20. This chamber may be given a spiral shape of a form well known in the art, and having an outlet leading into separator chamber 21. The carrier air may be delivered to the mill under pressure from a source not shown or it may be passed through the mill and classifier 1 under suction by a suction fan (not shown) and disposed for this purpose in duct 3. Also the carrier air can be conveyed through the mill by an impeller wheel of special construction. For this purpose the impeller wheel would be provided with a series of fan blades 22 radially disposed about the axis of rotation and arranged between guiding rings 19, said blades being fastened to the impeller 9 by means such as bolts 9*a*, and revolving therewith.

In accordance with our invention the air is not mixed with the material prior to entrance thereof into the mill. To the contrary the mill air only comes in contact with the ground material at the point and time of impact with the circular abutment while the air is passing through the grinding space 20 transversely to the flight path of the particles from the impeller nozzles. Substantial savings in driving power will thus be achieved and the impeller can be rotated at extreme speeds without prohibitive consumption of power.

In the impact mill illustratively shown in Figs. 3 and 4 a runner or impact wheel 9′ is shown which is provided with passages 16 for feeding and accelerating the material and also with passages 30 for feeding the air to the grinding space 20 at relatively lower velocities. This air enters ducts 30 by way of an annular space 6*a* formed by a centrally located cylindrical filler piece 6*b* having a rounded frontal closure 6*c*. Preferably passages 30 are arranged on both sides of two passages 16 as shown in Fig. 4. The tubular liner inserted in passages 16 is here shown as having walls of unequal thickness as illustrated in Fig. 5. In addition, this liner can be made in longitudinal sections which permit individual replacement of those sections which are subject to greatest wear. These liners are, of course, arranged in such a manner that the heavier walled portions are located on the trailing side of the passage with respect to direction of rotation, that side over which the material flows on its way through the passage. Also, these separate sections may be of different materials being resistant to abrasion to various degrees.

While we have illustrated and described preferred embodiments of my invention it is understood that these are merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. We therefore do not wish to be limited to the precise details set forth but desire to avail ourselves of such changes as fall within the purview of our invention.

We claim:

1. A pulverizing apparatus of the centrifugal type having circular abutment means and an impeller rotating within said abutment means for hurling the material to be pulverized thereagainst, means for rotating said impeller at high rotational velocity about a central axis, duct means integral with said impeller and extending from the axial portion of said impeller to the periphery thereof, means for axially feeding said material to said duct means, means forming outlet openings in the peripheral ends of said duct means for discharging said material at high velocity by centrifugal force against said abutment means to cause disintegration thereof by impact, a removable liner for lining the inner surface of said duct means, said liner having a greater wear resisting capacity on the trailing side thereof than on the leading side, and locking means for locking said liner in working position.

2. A pulverizing apparatus as defined in claim 1 in which said liner is subdivided circumferentially into longitudinal separate sections.

3. A pulverizing apparatus as defined in claim 1 wherein said liner is subdivided into longitudinal separate sections of material, the section located on the trailing side of said liner having a greater resistance to abrasion than the section located on the leading side thereof.

4. A pulverizing apparatus of the centrifugal type having circular abutment means and an impeller rotating within said abutment means for hurling the material to be pulverized thereagainst; means for rotating said impeller at high rotational velocity about a central axis; first duct means integral with said impeller and extending from the axial portion of said impeller to the periphery thereof; means for axially feeding said material to said first duct means; means forming outlet openings in the peripheral ends of said first duct means for discharging said material at high velocity by centrifugal force against said abutment means to cause disintegration thereof by impact; other duct means integral with said impeller and extending from an inlet portion adjacently surrounding said axial portion of said impeller to an outlet at the periphery thereof and alternatively spaced with said first duct means about the periphery of said impeller; and means for feeding carrier gas to said other duct means via said inlet portion and discharging said gas through the peripheral outlet end of said other duct means.

5. A pulverizing apparatus of the centrifugal type having circular abutment means and an impeller rotating within said abutment means for hurling the material to be pulverized thereagainst; means for rotating said impeller at high rotational velocity about a central axis; duct means integral with said impeller and extending from the axial portion of said impeller to the periphery thereof, said duct means having a leading side and a trailing side with respect to direction of rotation; means for axially feeding said material to said duct means, said material, due to centrifugal force, tending to slide over the surface of the trailing side of said duct means; means forming outlet openings in the peripheral ends of said duct means for discharging said material at high velocity by centrifugal force against said abutment means to cause disintegration thereof by impact; and a removable liner for lining the inner surface of said duct means, said liner having a heavier wall thickness on the trailing side and a thinner wall thickness on the leading side of said duct means.

6. In a puverizing apparatus as specified in claim 5, locking means for locking said liner in working position.

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