March 15, 1949. W. R. MOBLEY 2,464,775

PULVERIZING MILL

Filed April 1, 1944

Fig. 1.

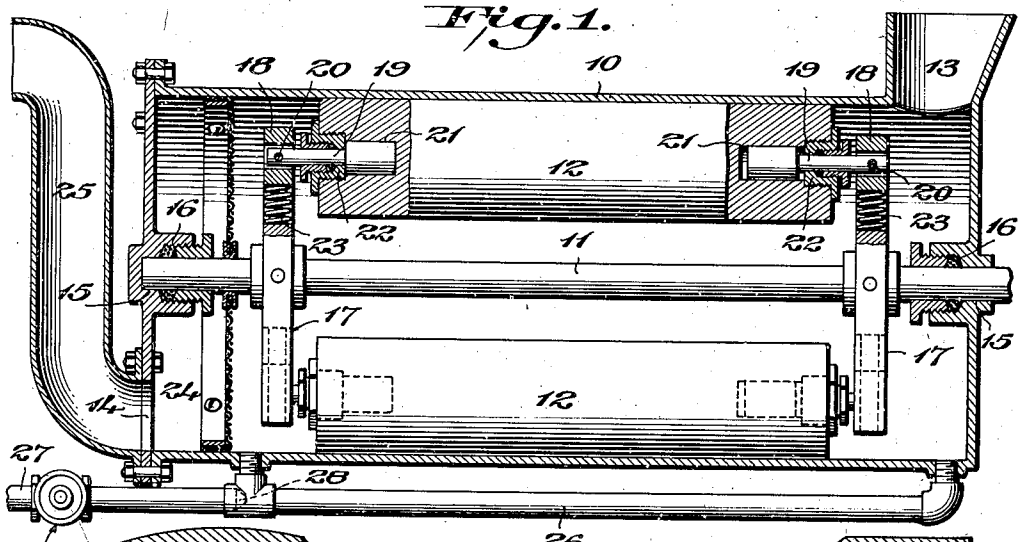


Fig. 2.

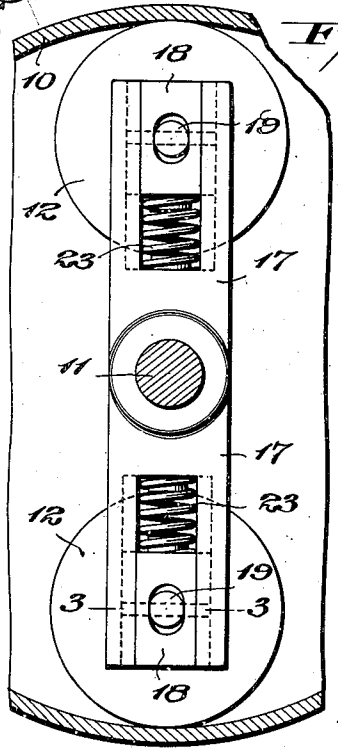


Fig. 4.

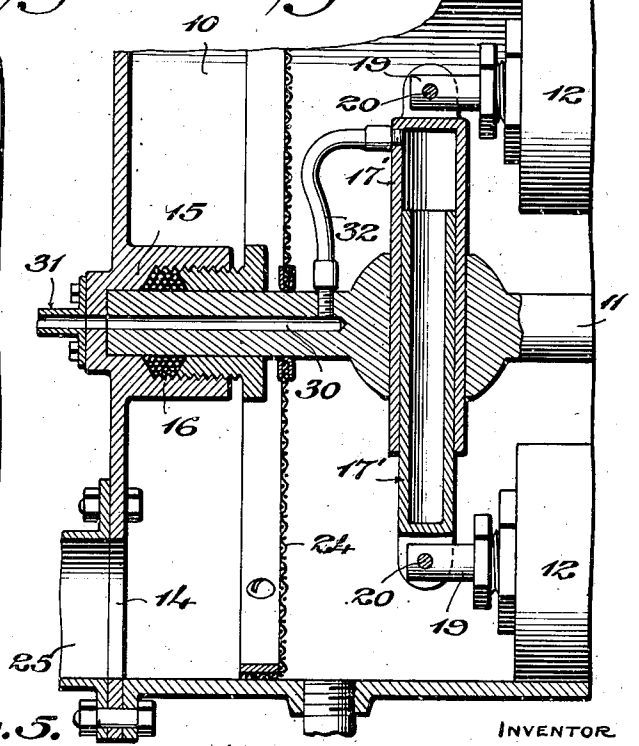


Fig. 3.

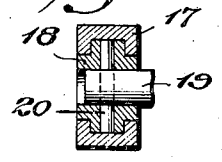
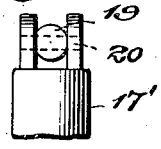


Fig. 5.



INVENTOR.

William R. Mobley,

By Carroll Bailey

HIS Attorney

Patented Mar. 15, 1949

2,464,775

UNITED STATES PATENT OFFICE

2,464,775

PULVERIZING MILL

William R. Mobley, Miami, Fla., assignor of one-half to Joseph H. Adams, Miami, Fla.

Application April 1, 1944, Serial No. 529,099

5 Claims. (Cl. 241—131)

1

This invention relates to mills, and has particular reference to improvements in mills for either dry or wet pulverization of various different materials such, for example, as ore, coal and the like.

Generally speaking, the object of the invention is to provide a simple, practical material pulverizing mill which is thoroughly reliable and highly efficient in operation.

With the foregoing general object in view, the invention consists in a mill embodying the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings, wherein like characters of reference denote corresponding parts in the different views:

Figure 1 is a central, vertical, longitudinal section through a mill constructed in accordance with one practical embodiment of the invention.

Figure 2 is a fragmentary cross section on an enlarged scale through the mill shown in Fig. 1.

Figure 3 is a detail section on the line 3—3 of Fig. 2.

Figure 4 is a fragmentary view similar to Fig. 1 illustrating an alternative embodiment of the invention; and

Figure 5 is a detail elevation of a part of the Fig. 4 construction.

Referring to the drawings in detail, it will be observed that a mill constructed in accordance with the invention comprises, generally speaking, a casing 10 to contain the material to be pulverized, a rotatable power shaft 11 extending into said casing, and rollers 12 mounted on said shaft for rotation therewith, for inward and outward movement relative thereto and for rotation about their own axes to cooperate with the casing to effect pulverization of the material.

The casing 10 preferably is of cylindrical form as shown. It may, however, be of tapered or conical form. In either case it may be of any suitable diameter and length and may include any suitable provision for the inlet or supply thereto of the material to be pulverized and for the discharge or removal therefrom of the pulverized material. In this connection and as illustrated in the drawings, said casing may be provided at its top and near one end thereof with an inlet opening 13 and at its bottom and in or near the other end thereof with an outlet opening 14.

The power shaft 11 extends longitudinally of the casing 10, preferably coaxially therewith, and

2

may be journaled in any suitable manner as, for example, in suitable bearings 15 in the end walls of the casing. Moreover, said shaft may be driven in any suitable manner and suitable packings 16 may be associated therewith and with the bearings 15 to exclude from the latter abrading or damaging material such as the material being pulverized.

Suitably fixed on the shaft 11 for rotation therewith and located at points spaced apart therealong are pairs of arms 17 which extend radially or transversely relative to said shaft, while between each pair of said arms is mounted one of the rollers 12 which may be of cylindrical form as shown or of tapered or any other desired form.

There may be any desired number of pairs of the arms 17 and of the rollers 12 and they may be angularly spaced about the shaft 11 as desired. Preferably, however, they are spaced equal distances apart angularly. In any event, the rollers extend longitudinally of the casing 10 and each roller is suitably supported at its ends upon its related pair of arms 17 for orbital rotation with and about the shaft 11, for rotation about its own axis, and for inward and outward movement relative to the casing 10. In this connection and according to the construction illustrated in Figs. 1 to 3 of the drawings, the outer end portions of the arms 17 are bifurcated, blocks 18 are slidably mounted in the said bifurcated outer end portions of said arms for sliding movement along said arms, and stub shafts 19 are pivoted at their outer ends to said blocks, as indicated at 20, and extend inwardly into axial bores 21 in the ends of the rollers 12 and have said rollers journaled thereon. The rollers thus are mounted upon the arms 17 for the movements mentioned.

The inner ends of the stub shafts 19 preferably are enlarged and are retained in the bores 21 by plugs 22 threaded in the ends of the rollers 12. Moreover, at one end of each roller the plug 22 serves to hold the headed end of the related stub shaft against the wall defining the inner end of the bore 21, whereby each roller is held against longitudinal movement and thereby is constrained to travel a fixed orbital path. On the other hand, at the other end of each roller the length of the bore 21 between its inner end and the plug 22 is greater than the length of the headed end of the related stub shaft 19. Consequently, each roller is free to assume various different inclined positions relative to the casing 10 and the shaft 11 due to the blocks 18 of

each pair being slidable independently of each other along their arms 17 and to the pivotal connections 20 of the stub shafts 19 with said blocks, which pivotal connections are at right angles to the arms 17 and the rollers 12 as shown. In other words, each roller is free to swing inwardly or outwardly at either end about the pivotal connection 20 between the stub shaft 19 and the block 18 at its other end.

Suitable springs such, for example, as expansion coil springs 23 interposed between the blocks 18 and the walls defining the inner ends of the bifurcations of the arms 17, preferably are provided to urge the rollers 12 constantly outwardly. However, whether springs such as the springs 23 are employed for the purpose stated, the rollers 12 will be urged outwardly by centrifugal force as they are rotated or swung orbitally about the shaft 11 in response to rotation of said shaft.

Preferably, but not necessarily, a suitable screen 24 is mounted in the casing 10, transversely thereof, at a point between the outlet opening 14 and the adjacent ends of the rollers 12 to insure that all of the pulverized material discharged from the casing 10 through said outlet opening shall be of predetermined fineness. In this connection, the material being pulverized may be in a dry condition, in which event the provision of any means to prevent loss of water from the casing 10 through the outlet opening 14 is unnecessary. On the other hand, should it be desirable to have the material in a wet condition during its pulverization, the casing 10 may be supplied with water or other liquid in any suitable manner and an outlet duct 25 may be provided to lead upwardly from the outlet opening 14 to any suitable elevation to trap water or other liquid at any desired level in the casing 10.

The material to be pulverized is supplied to the casing 10 through the inlet opening 13 or in any other desired manner either continuously or otherwise, gravitates or otherwise is caused to travel through said casing to the outlet opening 14, and during its travel through said casing is pulverized by being crushed between the rollers 12 and the side walls of the casing, outward crushing pressure of the rollers against the material being produced by centrifugal force as the rollers are rotated orbitally by and about the shaft 11. In this connection is may be desirable at times to transfer the material from the discharge end portion of the casing 10 to the inlet end portion thereof for the purpose of subjecting it a second time or repeatedly to the crushing and pulverizing action of the rollers 12, and the invention includes simple, effective means for this purpose. More particularly, said means may comprise, as shown, a pipe 26 connecting the outlet end portion of the casing 10 at the bottom thereof with the inlet end portion thereof either at the bottom thereof or at any other suitable point, and a pipe 27 for supply of water or other liquid or fluid under pressure from any suitable source to said pipe 26 in a manner and in a direction to effect flow of the material through said pipe 26 from the outlet to the inlet end portion of the casing 10. The pipe 27 may be connected to the pipe 26 at or near the point of connection of said pipe 26 with the outlet end portion of the casing 10 and may discharge into said pipe 26 toward the inlet end of the casing 10 through a nozzle 28, thus to insure that the supplied pressure liquid or fluid shall operate effectively to perform its stated function. The pipe 27 may be provided with a valve 29 so that pressure fluid may be supplied at will to the pipe 26.

The purpose of mounting the rollers 12 so that they may assume inclined positions relative to the shaft 11 and the casing 10 is, of course, to permit them to accommodate themselves to lumps of material encountered at different points along their lengths as the pulverizing action progresses.

According to the form of the invention illustrated in Figs. 4 and 5 of the drawings, the construction and mode of operation of the mill is the same as in the form thereof illustrated in Figs. 1 to 3, except as regards the arms designated generally as 17' and which correspond to the arms 17 of the Figs. 1 to 3 construction. In other words, according to the Figs. 4 and 5 construction, each arm 17' is in the form of a hollow member open at its inner end and closed at its outer end and at each end of the casing these arms are telescopically engaged with one another and the outer or larger arm is mounted for longitudinal sliding movement in a transverse opening in the shaft 11. Thus, said arms are movable inwardly and outwardly independently of each other and thereby serve the same purpose as the blocks 18 slidably engaged with the arms 17 of the Figs. 1 to 3 construction since the roller-supporting stub shafts 19 are pivoted to the outer ends of said arms 17' in the same manner as the stub shafts of the Figs. 1 to 3 construction are pivoted to the blocks 18.

If desired, suitable springs may be employed in association with the arms 17' to urge them outwardly and thus urge the rollers 12 outwardly. Preferably, however, means is provided for the introduction of fluid under pressure into the arms 17' for the purpose of forcibly urging them outwardly so that the rollers 12 may be caused, independently of centrifugal force, to exert any desired pressure upon the material being pulverized. In this connection the shaft 11 may be provided at each end thereof with an axial duct 30, a fluid pressure supply pipe 31 may be connected in any suitable manner with each duct 30, and said ducts may be connected with one or the other of each telescoped pair of the arms 17' by a flexible tube 32.

While only the telescoped pair of arms 17' at the discharge end portion of the mill have been illustrated in Fig. 4, it will be understood that the arms at the other or inlet end of the mill are of the same construction.

As will be manifest, the rollers 12, by their combined orbital movements and rotation on their own axes in conjunction with their outward pressure against the material interposed between the same and the side wall of the casing 10, act effectively and in a highly efficient manner to promote rapid pulverization of material introduced into the mill.

Without further description it is believed that the construction and operation of the present mill will be clearly understood and its advantages appreciated. It is desired to point out, however, that while only certain specific constructions have been illustrated and described, these may be varied in many respects within the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A pulverizing mill comprising a substantially cylindrical casing to contain the material to be pulverized, a rotatable power shaft in said casing extending longitudinally with respect thereto, pairs of bearing elements spaced apart

longitudinally of said shaft and mounted thereon for rotation therewith and for movements independently of each other toward and away from the same, stub shafts pivoted to said bearing elements, and substantially cylindrical rollers in said casing extending longitudinally relative thereto and journalled at their ends on said stub shafts for rotation about their own axes so as to cooperate with said casing to pulverize material contained therein, one stub shaft of each pair cooperating with its roller to hold the latter against longitudinal movement and the other stub shaft of each pair having the related end of its related roller slidable longitudinally relative thereto to permit the rollers to assume positions inclined with respect to said power shaft and said casing.

2. A pulverizing mill comprising a casing to contain the material to be pulverized, a rotatable power shaft in said casing, a hollow member extending transversely relative to said shaft and mounted thereon for endwise sliding movement relative thereto, a member mounted in said hollow member for endwise movement relative thereto, said members being rotatable with said shaft, and rolling bodies mounted on the outer ends of said members for cooperation with said casing to pulverize material contained therein.

3. A pulverizing mill comprising a casing to contain the material to be pulverized, a rotatable power shaft in said casing, a hollow member extending transversely relative to shaft and mounted thereon for endwise sliding movement relative thereto, a member mounted in said hollow member for endwise movement relative thereto, said members being rotatable with said shaft, rolling bodies mounted on the outer ends of said members for cooperation with said casing to pulverize material contained therein, and means for the supply of a fluid under pressure into said hollow member for moving said members outwardly relative to each other and thus urging said rolling bodies toward said casing for material pulverizing cooperation therewith.

4. A pulverizing mill comprising a substantially cylindrical casing to contain the material to be pulverized, a rotatable power shaft in said casing extending longitudinally with respect thereto, pairs of hollow members spaced apart

longitudinally along said shaft and extending transversely relative thereto and mounted thereon for endwise movement relative thereto, other pairs of hollow members mounted in said first mentioned members for endwise movement relative thereto, a roller extending between the outer ends of each pair of said members and rotatably mounted thereon for material pulverizing cooperation with said casing, said members being closed at their outer ends and open at their inner ends, and means for the supply of a fluid under pressure into said hollow members for moving the same outwardly relative to each other and thus urging said rollers toward said casing for material pulverizing cooperation therewith.

5. A pulverizing mill comprising a substantially cylindrical casing to contain the material to be pulverized, a rotatable power shaft in said casing extending longitudinally with respect thereto, pairs of bearing elements spaced apart longitudinally of said shaft and mounted thereon for rotation therewith and for movement independently of each other toward and away from the same, stub shafts pivoted to said bearing elements, and substantially cylindrical rollers in said casing extending longitudinally relative thereto and journaled at their ends on said stub shafts for rotation about their own axes so as to cooperate with said casing to pulverize material contained therein, at least one of the stub shafts of each pair having the related end of its related roller slidable longitudinally with respect thereto to permit the rollers to assume inclined positions with respect to said power shaft and said casing.

WILLIAM R. MOBLEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
937,203	Benjamin	Oct. 19, 1909
1,450,290	Hardinge	Apr. 3, 1923
1,635,527	Barthelmess	July 12, 1927
1,679,241	David	July 21, 1928
2,133,449	Haug	Oct. 18, 1938