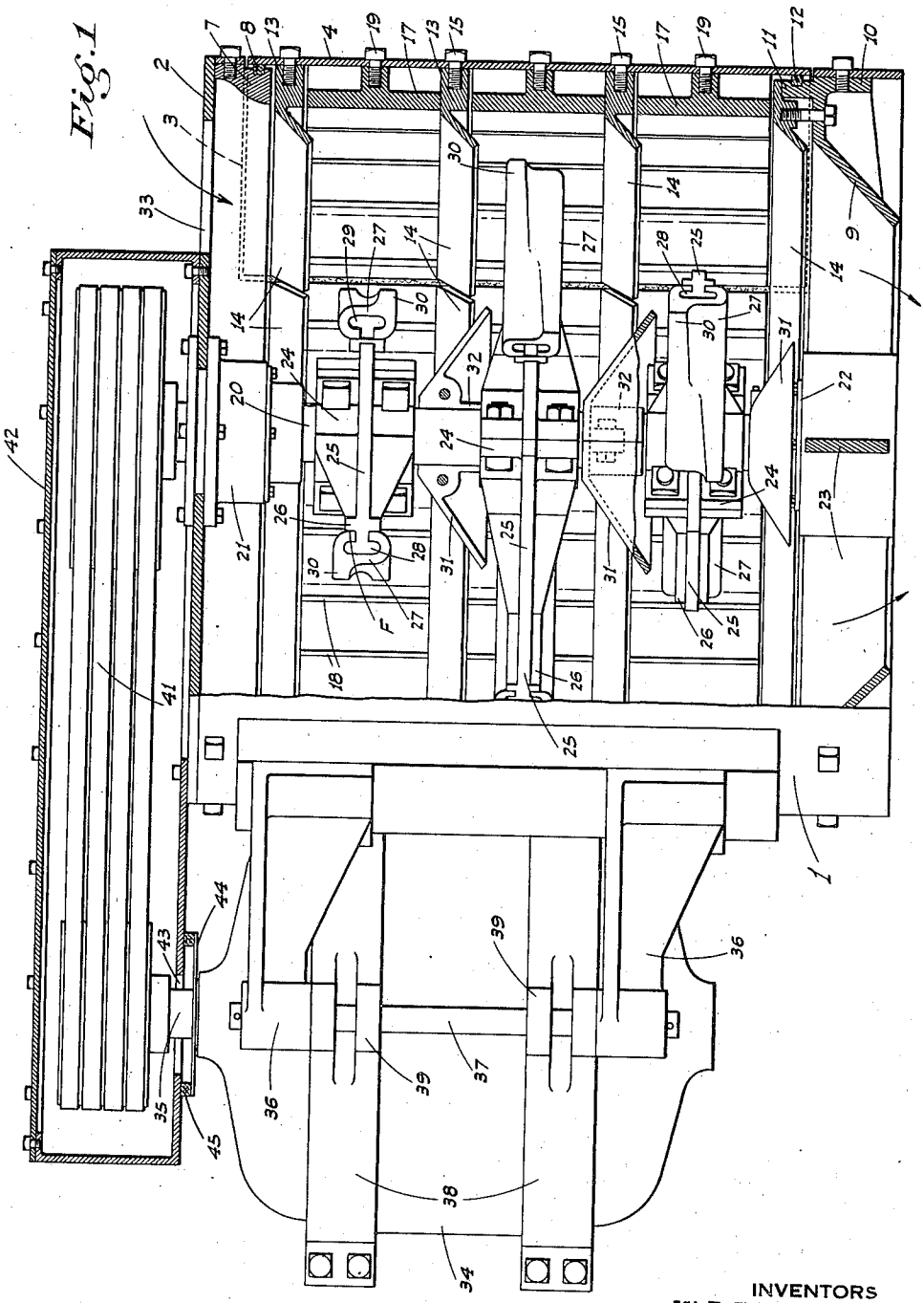
Oct. 10, 1944. W. B. THURMAN ET AL 2,360,086

REDUCTION MILL

Filed Jan. 19, 1943 2 Sheets-Sheet 1

Fig. 1



INVENTORS
W. B. Thurman
E. A. Glynn
BY
ATTORNEYS

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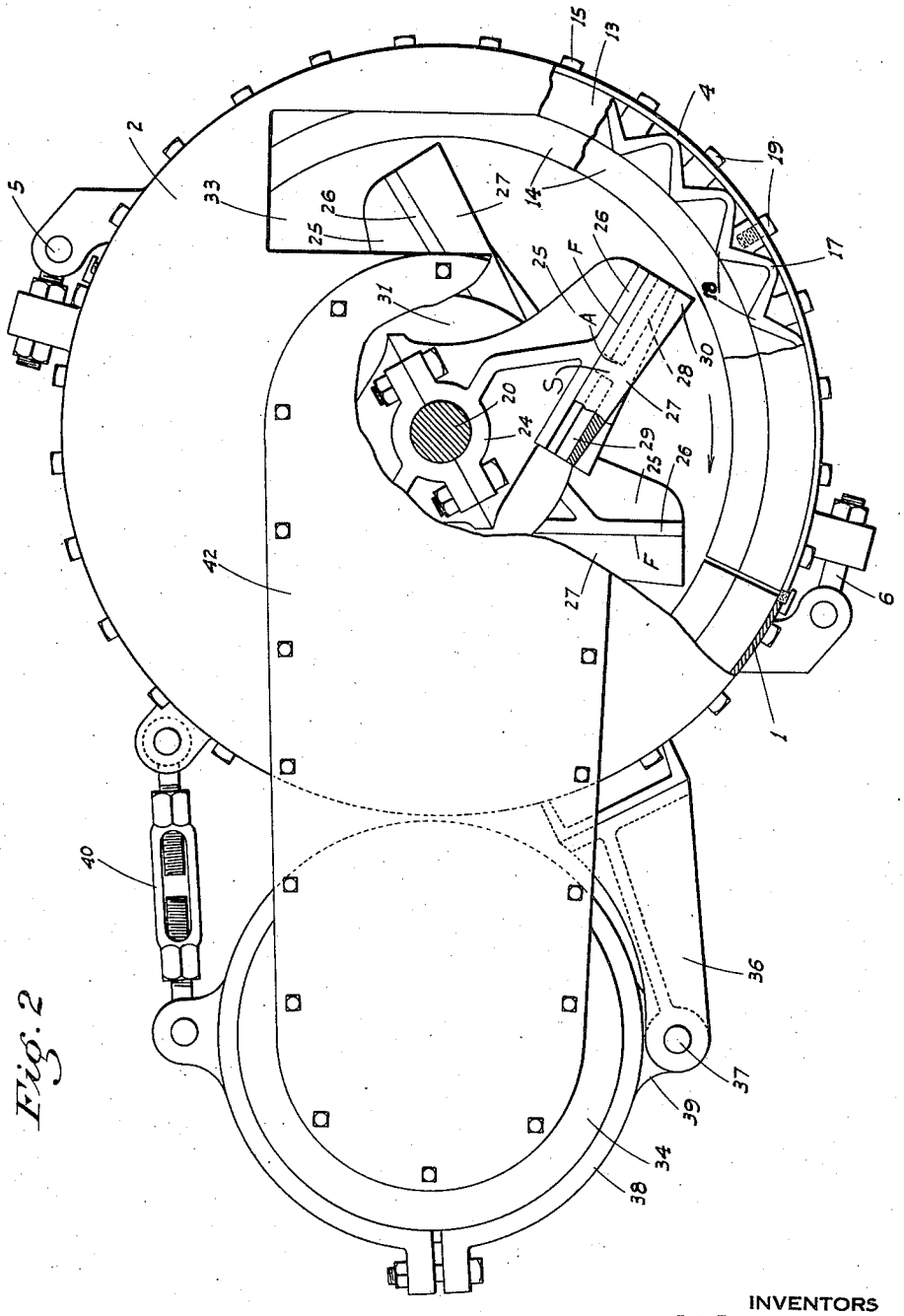

Fig. 2

INVENTORS
W. B. Thurman
E. A. Glynn

BY Webster & Webster
ATTORNEYS

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REDUCTION MILL

William B. Thurman and Edwin A. Glynn, Lodi, Calif., assignors to Super Mold Corporation of California, Lodi, Calif.

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2 Claims. (Cl. 83—11)

This invention relates in general to an improved reduction mill, and in particular is directed to an impact mill for reducing ore to a desired screen size for subsequent processing and the recovery of precious metals therefrom.

One of the objects of the present invention is to provide an ore reduction mill which includes an assembly of axially alined rotary impact units mounted on a driven vertical shaft, and a cylindrical housing surrounding said shaft and assembly in concentric, adjacent but clearance relation to the latter; said housing being faced on the interior with ore disintegrating plates, and additionally said housing is formed with a relatively large side opening door whereby parts of the mill within said housing may be removed, repaired, or replaced with relative ease and without necessity of disassembling the mill.

Another object of the invention is to provide a reduction mill which includes rotary impact units of unique construction; each of said units comprising a hub, legs radiating from said hub, and removable impact shoes mounted on the outer ends of said legs.

A further object is to provide rotary impact units as in the preceding paragraph in which the impact shoes are elongated and extend generally transversely of the direction of travel or rotary movement; said shoes being double-ended and reversibly mounted so that when the initially outer ends of said shoes become worn, the shoes may be reversed and the other end thereof disposed outermost for subsequent operation of the mill.

An additional object is to provide a reduction mill which includes a novel adjustable mounting for the electric motor which drives such mill; said mounting being arranged to position the motor in compact relation to the mill housing without interfering with the aforementioned access door in said housing.

A further object of the invention is to provide a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects we accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation, partly in section, of the improved reduction mill.

Figure 2 is a plan view of the mill with the top of the housing partially broken away.

Referring now more particularly to the characters of reference on the drawings, the numeral 1 indicates a cylindrical housing disposed with its axis vertical, said housing including a circular top 2. The housing 1 may be rigidly supported in any suitable manner.

The housing 1 is formed at the side with a door opening 3 which is substantially half-circle in circumferential extent and at the top and bottom edges terminates adjacent but short of corresponding ends of the housing. The portion of the housing within and normally closing said opening is a separate, circumferentially arcuate door 4 which is hinged to a fixed portion of the housing, as at 5, for horizontal swinging movement between open and closed positions; the door when closed being secured in said position by a releasable locking bolt assembly, indicated at 6, which connects between the free end of the door and adjacent portion of the housing.

The housing at the top and on the inside is fitted with a rigid ring 7 whose inner surface slopes inwardly and downwardly as a deflector; said ring depending below the top edge of the door opening 3 and forming a stop for the upper portion of the door 4. A seal 8 is secured on said depending portion of the ring and against which seal the door engages.

The bottom of the housing is open and is fitted with an annular, downwardly and inwardly sloping chute 9 which includes an attachment flange 10 secured within the housing adjacent its lower end. A door stop 11 is formed integral with and projects upwardly from the flange 10 in symmetrical relation to door 4; said stop including a seal 12 against which the lower portion of said door engages.

At vertically spaced points between the ring 7 and the annular chute 9 the housing is fitted with horizontal rings 13, each of which includes an annular, downwardly and inwardly sloping skirt or ore deflector 14, said deflectors being relatively short radially of the mill. The rings 14 are attached to the housing by means of bolts 15, except the lowermost one of said rings which is attached to the mounting of chute 9 by means of bolts 16.

Between the rings 13 the housing 1 is faced with annular ore disintegrating plates 17 whose inner surface is deeply corrugated, the corrugations 18 extending vertically. The disintegrator plates 17 are attached to the sides of the housing

by bolts 19. The portions of the rings 13, deflectors 14, and corrugated disintegrator plates 17 which are attached to the door 4 are arcuate sections of said parts separate from the remainder, whereby they swing out with said door.

A vertical shaft 20 disposed centrally in the housing is journaled at its upper end in a dust-sealed bearing 21 mounted on the top 2; the shaft projecting upwardly to a termination above said top. At its lower end the shaft is journaled in a bearing 22 supported by a spider 23 fixed in the annular chute 9.

In horizontal planes substantially equi-distant between the upper and lower edges of adjacent ore disintegrator plates 17, the shaft is fitted with corresponding rotary impact units. Each of these units comprises a split hub 24 clamped on the shaft 20, and a pair of legs 25 radiating from said hub in opposite directions. At its outer end each leg 25 is formed with a horizontal impact shoe-supporting foot 26 which has a vertical but horizontal elongated face F; said face extending lengthwise generally transversely of the direction of travel, as indicated by the arrow in Fig. 2, and with the inner end of said foot leading the outer end thereof.

A horizontal impact shoe 27 of substantially the same length as the foot is removably and reversibly secured against the face of the latter by the following arrangement. A single tongue 28, of T shape in cross section, projects forwardly from the face F of foot 26 and extends from the radially outermost end of said foot along the same to a point slightly short of the center of said foot. As there is no tongue projecting from the radially innermost half of the foot, the inner end of tongue 28 forms an abutment A. Each shoe 27 is formed with a pair of longitudinally alined sockets 29 opening to opposite ends of the shoe and separated at adjacent ends by a stop S; the sockets 29 being of the same length and formed to matchingly and selectively receive the tongue 28 in frictional engagement. The inner end or abutment A of tongue 28 seats against the corresponding end of stop S when the shoe is in place and limits inward movement thereof to correct position on foot 26. Thus, as is apparent, the shoe may be attached to the foot 26 with the tongue 28 seated in either socket 29, and consequently either end of said shoe outermost; centrifugal force holding the shoe on the foot. In other words, the shoe 27 is reversible, whereby when the initially outer end thereof is badly worn, the shoe may be reversed and the initially inner end then disposed outermost for continued operation of the mill. As shown, the shoe 27 is increased in thickness horizontally from the center towards its ends along or adjacent the side which is uppermost when the corresponding end of the shoe is outermost. This feature is shown at 30.

Access to the above described rotary impact units for the purpose of reversing the shoes 27 or replacing the same is had through the door 4, and can be quickly accomplished with a minimum of effort.

Between the rotary impact units, and above the bearings 22, the mill includes frusto-conical deflectors 31 which have split hubs 32 secured on the corresponding portion of the vertical shaft 20; the lower edge of deflectors 31 being spaced some distance horizontally from and disposed in a vertical plane slightly below the lower edge of the corresponding annular deflectors 14. A feed opening 33 is cut in the top 2 of the housing in offset relation to the shaft 1; ore as fed through said opening and passing through the mill being deflected onto the rotary impact units by deflectors 14 and deflectors 31. The rotary impact units, the shoes of different ones of which are disposed in circumferentially staggered relation, and which shoes substantially span the space between corresponding deflectors 14 and 31, strike the falling ore, and with high impact drive it against the disintegration plates 17, producing an effective reduction in screen size of said ore. The assembly of rotary impact units is rotated at relatively high speed by shaft 20, which is driven in the following manner.

A heavy-duty electric motor 34 is disposed to one side of the housing 1 with the drive shaft 35 of the motor vertical and projecting above the horizontal plane of top 2. Rigid brackets 36 project horizontally outwardly from the housing 1 in vertically spaced relation and to a termination adjacent the motor 34, said brackets supporting a vertical post 37 which extends therebetween. Split bands 38 clampingly engage about the motor at spaced points and said bands each include ears 39 which surround the post 37 in relatively turnable relation; said ears being engaged between the outer end portions of the brackets whereby to prevent of vertical displacement of the motor, while supporting said motor for horizontal adjustment about the post as an axis.

A turnbuckle adjustment link 40 is pivotally connected in generally tangential relation between one of the split bands 38 and an adjacent portion of the housing 1; said link connecting with said band on the side opposite the brackets 36, whereby upon adjustment of the link the motor is swung in a horizontal plane relative to the housing. An endless multiple belt drive unit 41 connects the upper ends of the shaft 20 and 35, connecting the motor in driving relation to the rotary impact units.

A dust-proof belt guard and case 42 is mounted on the top 2 of the housing and surrounds the drive unit 41. The motor shaft 35 projects through an elongated opening 43 in the bottom of case 42 whereby to permit of unobstructed horizontal adjustment of the motor by means of link 14, and for the purpose of imparting the desired tension on the drive unit 41. In order to prevent dust from gaining access to case 42 a disc 44 is fixed on the upper end of the motor 34, and an annular seal 45 is secured to said disc and slidably engages the bottom of the case about opening 43.

From the foregoing description it will be readily seen that we have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described our invention, what we claim as new and useful and desire to secure by Letters Patent is:

1. A reduction mill including a vertical cylindrical housing, a driven axial shaft in said housing, a plurality of rotary impact units mounted on the shaft in vertically spaced relation, corresponding disintegrator plates mounted in the housing in spaced but adjacent and surrounding relation to said rotary impact units, annular de-

flectors mounted in the housing between the disintegrator plates, and other annular deflectors mounted on the shaft between said units; the deflectors mounted on the housing sloping downwardly and radially inwardly, and the deflectors mounted on the shaft sloping downwardly and radially outwardly, the innermost edges of the deflectors on the housing being in a plane radially outwardly of the adjacent edges of the deflectors on the shaft.

2. A reduction mill comprising a vertically disposed cylindrical housing, a driven axial shaft in said housing, a plurality of rotary impact units fixed on the shaft in vertically spaced relation, annular disintegrator plates mounted in the housing in corresponding and concentric but spaced relation to said rotary impact units, annular deflectors mounted in the housing between said plates, said deflectors sloping downwardly and inwardly, and corresponding frusto-conical deflectors mounted on the shaft between said rotary impact units, said frusto-conical deflectors sloping downwardly and outwardly; the adjacent edges of said annular deflectors and corresponding ones of said frusto-conical deflectors being disposed in horizontally spaced relation, the space between said edges being substantially spanned by said rotary impact units.

WILLIAM B. THURMAN.
EDWIN A. GLYNN.