(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 015 992**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **09.02.83**

(51) Int. Cl.³: **B 02 C 1/04**, E 21 F 17/00, E 21 C 27/30

(21) Application number: **79900517.8**

(22) Date of filing: **11.05.79**

(86) International application number:
PCT/US79/00315

(87) International publication number:
WO 79/01060 13.12.79 Gazette 79/25

(54) **LOW PROFILE CRUSHING APPARATUS.**

(30) Priority: **11.05.78 US 904906**

(43) Date of publication of application:
01.10.80 Bulletin 80/20

(45) Publication of the grant of the patent:
09.02.83 Bulletin 83/6

(84) Designated Contracting States:
AT DE FR GB SE

(56) References cited:
DE - C - 1 002 595
US - A - 1 987 761
US - A - 2 127 027
US - A - 2 177 524
US - A - 2 264 915
US - A - 2 566 583
US - A - 2 591 639
US - A - 2 593 353
US - A - 2 873 922
US - A - 3 386 667
US - A - 3 804 345
US - A - 3 946 955

(73) Proprietor: **THE UNITED STATES OF AMERICA represented by the Secretary U.S. Department of Commerce**
National Technical Information Service Office of Government Inventions and Patents 5285 Port Royal Road
Springfield, Virginia 22161 (US)

(72) Inventor: **MILLER, Harold John**
934 Biddle Road
Galion, OH 44833 (US)

(74) Representative: **Jukes, Herbert Lewis**
STANLEY, POPPLEWELL, POOLE European Patent Attorneys 57 Lincoln's Inn Fields
London WC2A 3LS (GB)

EP 0 015 992 B1

Courier Press, Leamington Spa, England.

Low profile crusher apparatus

This invention relates to a low profile crusher apparatus suitable for crushing mine ore or hard rock, or any other suitable material. One preferred example of the crusher apparatus is a portable, low head room or low profile, crusher for primary reduction of ore or hard rock, close to the active working areas in underground mining operations.

Particularly, as applied to underground mining operations, a reliable, efficient, and low profile portable underground, hard rock, crusher has long been needed to improve underground ore handling systems. One of the primary causes of low productivity in underground mines is inefficient ore handling which is currently experienced. Studies sponsored by the United States of America Bureau of Mines (USBM) have documented the long felt need for such a crusher apparatus which would make possible more efficient use of currently operated conveyor systems by bringing haulage close to the face of the mine and eliminate expensive rock handling procedures. It has been estimated that as much as a 50% increase in productivity could be realized if primary reduction crusher apparatus could be employed at an earlier stage to permit smaller beltable material to be available close to the working site. Present crusher apparatus having the required capacity for primary reduction application in this area are not easily transported and require too much head space for economical installation close to working areas, to obtain optimum haulage from the face to dump locations.

Prior art, hard rock crushers which are currently well known in the industry and used in hard rock crushing applications, such as the gyratory, Blake type, overhead eccentric and cone crushers, all have relatively high profiles for comparable capacity ranges to be employed appropriately to solve the ore handling problems facing the industry. One example of a Blake type crusher is disclosed in US—A—2,127,027 as comprising: a main frame; a stationary, vertically inclined, first crusher jaw; a movable, vertically inclined, second crusher jaw, pivoted at the lower end thereof, the upper end of that jaw being connected to a pitman; an eccentric drive connected to said pitman so as to drive said second crusher jaw; and conveyor means mounted adjacent the lower end of said second crusher jaw so as to collect and transport the crushed material.

It has been noted in a United States of America government sponsored study, the Rapidex report under USBM Contract No. J0285003 that an eccentric jaw crusher with overhead feed is unsuitable, and that use of an eccentric jaw crusher which has been turned on its side, for horizontal feed through the crusher chamber, is not suitable owing to the difficulty of conveying the material through the chamber and the need for a chain conveyor disposed near or adjacent the length of the crusher chamber.

Other types of prior crusher apparatus which are of low profile design are not suitable for hard rock applications or do not possess the required size and throughput capacity for practical use in such applications. According to said Rapidex report, a rotary type, jaw crusher has been proposed to attempt to meet the needs mentioned above. However, as compared to the present invention, I believe that such a proposed crusher has serious limitations in the context of the applications described above, which will render such a crusher less satisfactory than a crusher provided in accordance with the present invention.

In the following statements of invention, reference is made by way of example to reference numerals in the drawings accompanying this specification.

According to a first aspect of the present invention, there is provided a low profile crusher apparatus suitable for crushing mine or hard rock, comprising:

a main frame (20);

a first crusher jaw (39) mounted on said frame and in a vertically inclined position;

a second crusher jaw (60) mounted on a support (62) and disposed below and spaced from said first crusher jaw (39), this spacing being in a vertically inclined position so as to define a crusher chamber (84) between said first and second crusher jaws, said support (62) being mounted on said frame;

eccentric drive means (66, 68) mounted on said frame, for causing repetitive movement of said second crusher jaw (60) relative to said first crusher jaw (39); means (28, 30) for feeding material into said crusher chamber (84) and for collecting and transporting material passing through said crusher chamber;

said apparatus being characterized in that:

(a) a supporting toggle arrangement (64) is mounted on said main frame (20) so as to be separate from said eccentric drive means (66, 68) and be connected to said support (62), for supporting the upper end of said second crusher jaw (60); and in that

(b) said eccentric drive means (66, 68) is connected to the upper and lower ends of said support (62) of said second crusher jaw (60).

In one preferred embodiment of said crusher apparatus of the present invention that apparatus is characterized in that said feeder and collector means (28, 30) comprises: feeder means (28) mounted adjacent said crusher chamber (84), for feeding material into an upper portion of said crusher chamber; and collector means (30) mounted adjacent the lower end of said crusher chamber (84), for collecting and transporting material passing through said crusher chamber.

Preferably, said preferred embodiment is characterized in that the uppermost portion of said second crusher jaw (60) is disposed lower than the uppermost portion of said first crusher jaw (39) so as to define an inlet (82) of crusher chamber (84); and the upper portion of said feeder means (28) is disposed at a height not substantially higher than the uppermost portion of said first crusher jaw (39).

According to a second aspect of the present invention, there is provided a method of crushing hard material with crusher apparatus, said method being characterized by the use of a crusher apparatus according to said first aspect of the present invention. Preferably, said material to be crushed comprises mine ore and/or hard rock.

In low profile crusher apparatus according to said first aspect of the present invention, unlike prior art, eccentric crushers, the crusher jaws (39, 60) are vertically inclined to form an inclined crusher chamber (84) which slopes downwardly from inlet to outlet thereof, with the lower jaw (60) being movable to impart crushing action between it and a stationary upper jaw (39). This arrangement of jaws (39, 60) in combination with features a) and b) of claim 1 provides a powerful and most efficient crushing of material while maintaining very adequate feeding of the material through the crusher chamber. Additionally, the arrangement of the crusher jaws in this manner permits the attendant eccentric shaft, drive means (66, 68), and support means (62, 64) to be positioned in a lower profile manner on the main frame (20), as well as reduce the height at which feeder (28) feeds the inlet of the crusher chamber (84) so as to permit the feeding and collecting system (28, 30) to be mounted at a lower position on the main frame (20).

Thus, the present invention enables a portable, low head room, crusher to be provided which has significantly reduced profile compared to prior art apparatus suitable for use in underground mine applications, and has a crusher chamber capacity comparably equal to prior art crushers which require significantly greater head room than required by apparatus according to said first aspect of the present invention. A crusher of the present invention can be more easily and efficiently transported from site to site compared to prior art, hard rock crushers. Furthermore, a crusher of the present invention is of comparable ease to manufacture and maintain relative to prior art, hard rock crushers. A crusher of the present invention can be advantageously utilized more closer to the working areas of undergound mines, for greatly improving ore handling and production in those mines. It will be appreciated that the disposition of the lower crusher jaw (60) and the eccentric drive means (66, 68) not only contributes to providing lower head room but also ensures efficient transport of crushed material from the inlet of the crusher chamber (84) to the outlet thereof.

The present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a side elevational view of one preferred embodiment of crusher apparatus of the present invention, the embodiment being shown with associated feed and discharge conveyor systems;

Figure 2 is a partial side elevational view of the apparatus shown in Figure 1, in which view the eccentric driven crusher jaw means and crusher chamber are shown apart from the associated main frame and accessory equipment; and

Figure 3 is a top plan view of substantially that portion of the apparatus shown in Figure 2.

In Figure 1, a portable, low profile, crusher apparatus includes a main frame 20, which is supported for movement by several pairs of conventional wheel means 22, 24. A crusher portion 26 is centrally located on the main frame 20 so as to be adjacent a conventional feed conveyor system 28 and above a discharge conveyor system 30. These feed and discharge conveyor systems are of conventional nature, and a variety of standard types thereof could be employed within the context of the present invention. A typical scalping mechanism is usually included to remove fine or the like before entry to the crusher chamber 84. An eccentrically mounted shaft means 32 is connected to a pair of fly wheels such as at 34, which in turn is driven via a belt drive 36 connected to a conventional motor 38. Each of these components can be mounted on the main frame 20 in any conventional suitable manner.

Referring to Figures 2 and 3, the crusher portion 26 is shown in greater detail and includes a stationary first jaw 39, together with supporting frame 40 mounted for pivoted movement at its upper end via a shaft 42, which in turn is supported at each end to main frame 20 in a conventional manner. A replaceable jaw liner 44 comprising highly wear resistant material (e.g. manganese) is releasably fixed to supporting frame 40 by means of threaded wedgelike member 46. The lower end of stationary jaw 39 is releasably fixed in position by a toggle arrangement 48 provided with a series of shims 50. The toggle arrangement 48 is easily used to adjust the position of frame 40 pivoted about shaft 42 so as to vary the discharge opening between the jaws 39, 60. Toggle arrangement 48 is held in place by means of rods 52 pivotally mounted to flanges 54 carried by supporting frame 40, and provided with threaded ends 56 respectively carrying a nut 58 and extended through suitable respective holes in main frame 20. By manipulation of nuts 58 and shims 50, the jaw 39 can be pivoted and locked into a new position. The jaw 39 is inclined relative to the horizontal, and slopes downwardly from the feed inlet 82

of the crusher chamber 84 to the outlet 85 thereof.

A moveable jaw 60 has a supporting frame or pitman 62. The upper end of pitman 62 is supported by a toggle arrangement 64 located beneath the feeder end. The upper and lower ends of pitman 62 are attached to a tubelike support 66 provided with eccentric bearings 68 mounted on eccentric shaft 32. A pair of bearings 70 are mounted on the main frame 20 and connected to eccentric shaft 32. Each end of the shaft 32 is mounted to a fly wheel 34 provided with counter weights to offset the unbalanced weight of pitman 62. One of fly wheels 34 is connected to a conventional electric motor 38 via belt drive 36 to provide rotary power to eccentric shaft 32. The pitman 62 includes side plates 74 and the extended collar-like portion 76 which is connected to tubelike support 66, such that the eccentric motion of shaft 32 is imparted to pitman 62, and a replaceable jaw liner 77 is mounted thereon by a removable threaded wedgelike member 78. It is desirable to provide detachable wear plates 80 respectively to each of the side plates 74 of pitman 62, because of abuse normally encountered in the crusher chamber 84 during operation. The jaw 60 is disposed in an inclined position with the upper end thereof adjacent the feed inlet 82 of crusher chamber 84 defined between the respective jaws 39, 60 and the pitman's side plates 74.

The lower end of crusher chamber 84 includes a discharge outlet 85 for the processed material which falls to the discharge conveyor 30.

The toggle arrangement 64 supporting pitman 62 includes an adjustable and replaceable toggle seat 65 mounted on a cross member 67 fixed to the main frame 20. Another replaceable toggle seat 69 is provided at the top end of pitman 62 where it is connected to pitman 62. It may be desirable to provide for positive retention of toggle arrangement 64 in seat 69 by means of a releasably mounted spring or the like to prevent inadvertent unseating of toggle arrangement 64 during adverse operation conditions. By adjustment of the position of toggle arrangement 64, the motion of the feed end of crusher jaw 60 can be varied according to the most desirable action for a given crushing application.

Both toggle arrangements 48, 64 serve as safety mechanism because they can be designed to break should uncrushable material enter crusher chamber 84. Thus, because toggle arrangements 48, 64 are easily replaceable and relatively inexpensive, their breakability provides a safety factor for preventing more serious damage to the other components which represent more difficult and expensive repair or replacement.

The crusher apparatus shown in the drawings can be used for crushing mine ore and/or hard rock, in e.g. underground mining operations.

Claims

1. Low profile crusher apparatus suitable for crushing mine ore or hard rock, comprising:

a main frame (20);

a first crusher jaw (39) mounted on said frame and in a vertically inclined position;

a second crusher jaw (60) mounted on a support (62) and disposed below and spaced from said first crusher jaw (39), this spacing being in a vertically inclined position so as to define a crusher chamber (84) between said first and second crusher jaws, said support (62) being mounted on said frame;

eccentric drive means (66, 68) mounted on said frame, for causing repetitive movement of said second crusher jaw (60) relative to said first crusher jaw (39);

means (28, 30) for feeding material into said crusher chamber (84) and for collecting and transporting material passing through said crusher chamber;

said apparatus being characterized in that:

(a) a supporting toggle arrangement (64) is mounted on said main frame (20) so as to be separate from said eccentric drive means (66, 68) and be connected to said support (62), for supporting the upper end of said second crusher jaw (60); and in that

(b) said eccentric drive means (66, 68) is connected to the upper and lower ends of said support (62) of said second crusher jaw (60).

2. Apparatus as claimed in claim 1, characterized in that said feeder and collector means (28, 30) comprises: feeder means (28) mounted adjacent said crusher chamber (84), for feeding material into an upper portion of said crusher chamber; and collector means (30) mounted adjacent the lower end of said crusher chamber (84), for collecting and transporting material passing through said crusher chamber.

3. Apparatus as claimed in claim 2, characterized in that the uppermost portion of said second crusher jaw (60) is disposed lower than the uppermost portion of said first crusher jaw (39) so as to define an inlet (82) of crusher chamber (84); and the upper portion of said feeder means (28) is disposed at a height not substantially higher than the uppermost portion of said first crusher jaw (39).

4. A method of crushing hard material, comprising crushing said material with crusher apparatus, said method being characterized by the use of a crusher apparatus as claimed in any one of claims 1 to 3.

5. A method as claimed in claim 4, characterized in that said material comprises mine ore and/or hard rock.

6. A method as claimed in claim 4 or 5, characterized in that it is performed underground.

Patentansprüche

1. Niedrigprofil-Brecher zum Zerkleinern von Erz oder hartem Gestein, bestehend aus:

einem Hauptrahmen (20),

einer ersten Brechbacke (39), die an dem Rahmen und in einer vertikal geneigten Stellung angebracht ist,

einer zweiten Brechbacke (60), die an einem Ständer (62) angebracht und unterhalb und mit Abstand von der ersten Brechbacke (39) angeordnet ist, wobei dieser Abstand in einer vertikal geneigten Stellung so vorgenommen ist, dass ein Brechraum (84) zwischen der ersten und der zweiten Brechbacke gebildet ist, und wobei der Ständer (62) an dem Rahmen angebracht ist,

einer an dem Rahmen angebrachten exzentrischen Antriebseinrichtung (66, 68) zum Erzeugen einer wiederholten Hin- und Herbewegung der zweiten Brechbacke (60) im Verhältnis zur ersten Brechbacke (39),

einer Einrichtung (28, 30) zum Zuführen von Material in den Brechraum (84) und zum Sammeln und Abtransportieren des den Brechraum passierenden Materials,

dadurch gekennzeichnet, dass

(a) an dem Hauptrahmen (20) eine Stützgelenkanordnung (64) angebracht ist, derart, dass sie von der exzentrischen Antriebseinrichtung (66, 68) getrennt und mit dem Ständer (62) zur Abstützung des oberen Endes der zweiten Brechbacke (60) verbunden ist und

(b) die exzentrische Antriebseinrichtung (66, 68) am oberen und am unteren Ende des Ständers (62) der zweiten Brechbacke (60) angeschlossen ist.

2. Brecher nach Anspruch 1, dadurch gekennzeichnet, dass die Zuführ- und Sammeleinrichtung (28, 30) besteht aus:

an den Brechraum (84) anschliessenden Zuführmitteln (28) zum Zuführen von Material in einen oberen Bereich des Brechraums und an das untere Ende des Brechraums (84) anschliessenden Mitteln (30) zum Sammeln und Abtransportieren des den Brechraum passierenden Materials.

3. Brecher nach Anspruch 2, dadurch gekennzeichnet, dass der oberste Teil der zweiten Brechbacke (60) niedriger als der oberste Teil der ersten Brechbacke (39) angeordnet ist, derart, dass ein Einlass (82) zur Brechkammer (84) gebildet ist, und dass der obere Teil der Zuführmittel in einer Höhe nicht wesentlich über dem obersten Teil der ersten Brechbacke (39) gelegen ist.

4. Verfahren zum Zerkleinern von hartem Material, bestehend darin, dass das Material mit einem Brecher zerkleinert wird, gekennzeichnet durch die Verwendung eines Brechers, wie in einem beliebigen der Ansprüche 1 bis 3 beansprucht.

5. Verfahren nach Anspruch 4, dadurch gekennzeichnet, dass das Material Erz und/oder hartes Gestein ist.

6. Verfahren nach Anspruch 4 oder 5, dadurch gekennzeichnet, dass es unter Tage ausgeführt wird.

Revendications

1. Broyeur destiné au broyage de minerais ou de roches comportant: un bâti principal (20), une première mâchoire (39) montée sur ledit bâti en une position verticalement inclinée, une deuxième mâchoire (60) montée sur un support (62) en-dessous et à une certaine distance de ladite première mâchoire (39), cet espacement étant verticalement incliné de façon à définir une chambre de broyage (84) entre les deux mâchoires, ledit support (62) étant porté par le bâti, des moyens d'entraînement par excentrique (66, 68) portés par le bâti, mettant en mouvement de façon répétitive ladite deuxième mâchoire (60) par rapport à la première (39), des moyens pour alimenter la chambre (84) en matières et pour recueillir et transporter la matière ayant traversée la chambre, ledit broyeur étant caractérisé par la fait que:

a) un levier articulé (64) est monté sur le bâti (20) de façon à être séparé de l'entraînement à excentrique (66, 68) et à être relié audit support (62) afin de supporter l'extrémité supérieure de la deuxième mâchoire et que

b) les moyens d'entraînement à excentrique sont reliés aux extrémités supérieure et inférieure du support (62) de la seconde mâchoire (60).

2. Appareil selon la revendication 1, caractérisé en ce que lesdits moyens d'alimentation et de reprise (28, 30) comportent: des moyens d'alimentation (28) adjacents à la chambre (84) destinés à amener la matière à la partie supérieure de la chambre (84) et des moyens de reprise (30) adjacents à la partie inférieure de la chambre (84) pour recueillir et transporter la matière passant à travers la chambre de broyage (84).

3. Appareil selon la revendication 2, caractérisé en ce que la partie supérieure de la deuxième mâchoire (60) est située à un niveau inférieur à celui de la partie supérieure de la première mâchoire (39) de façon à définir un passage d'entrée (82) de la chambre de broyage (84), et en ce que la partie supérieure des moyens d'alimentation (82) est disposée à une hauteur qui n'est pratiquement pas plus haute que la partie supérieure de la première mâchoire (39).

4. Procédé de broyage de matières dures au moyen d'un broyeur, caractérisé en ce que l'on utilise un broyeur selon l'une quelconque des revendications 1 à 3.

5. Procédé selon la revendication 4, caractérisé en ce que la matière broyée est du minerai ou de la roche dure.

6. Procédé selon l'une quelconque des revendications 4 et 5, caractérisé en ce que le broyage est réalisé en sous-sol.

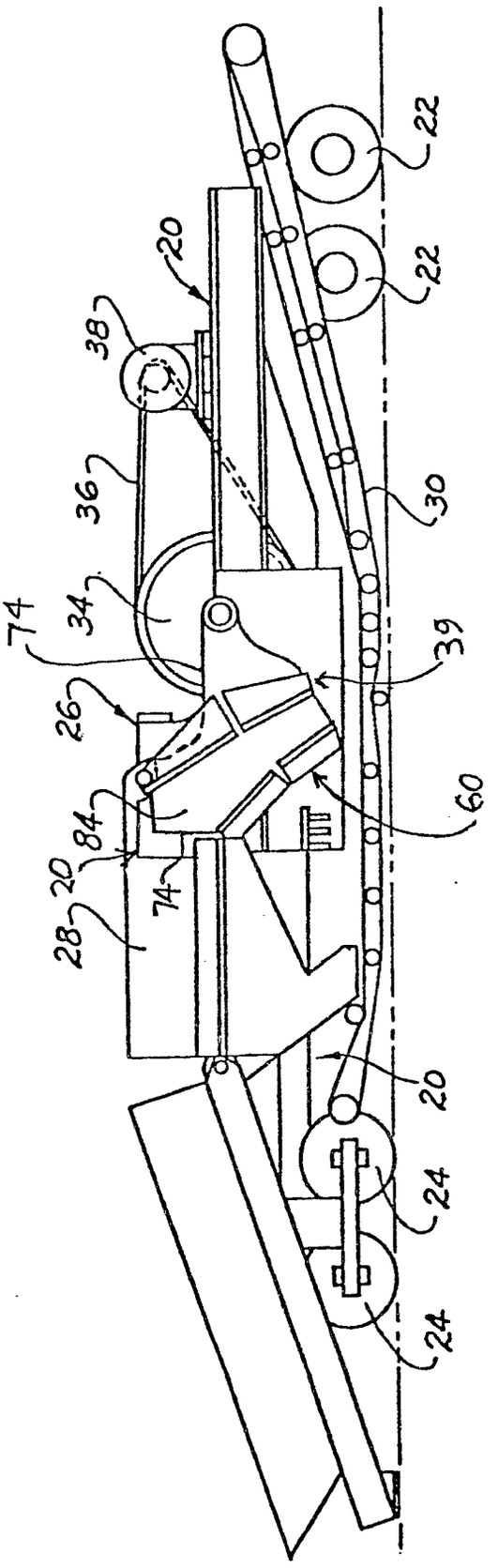

FIG. 1.

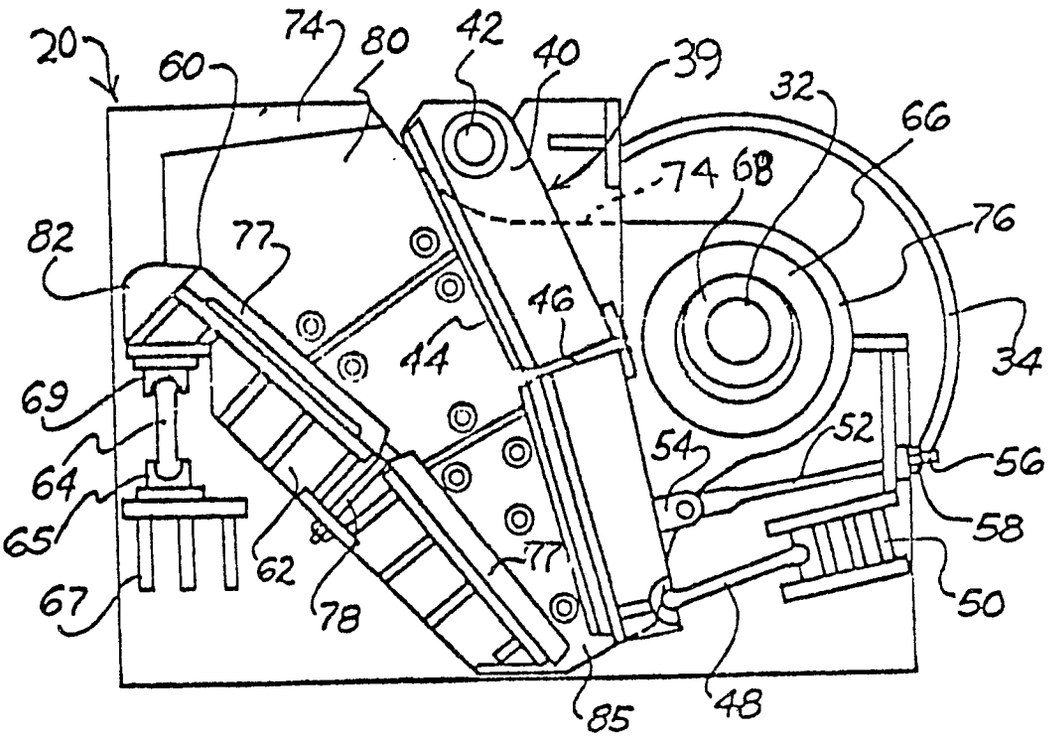
20
60
74
80
42
40
39
32
66
74
68
76
82
77
46
44
34
69
64
65
62
78
77
54
52
56
58
50
67
85
48

FIG. 2.

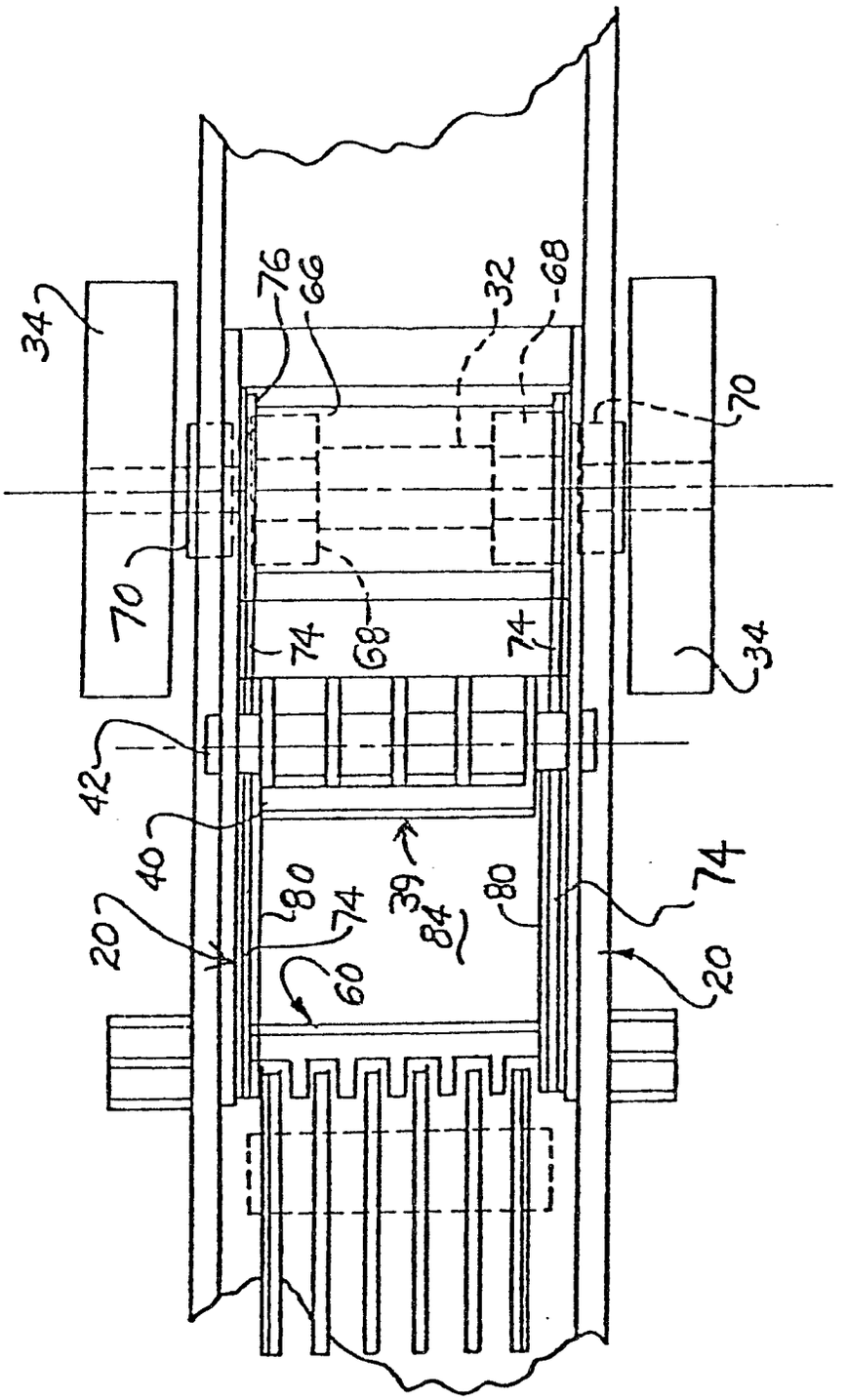

FIG. 3.