United States Patent [19]

DeDiemar et al.

[11] **3,750,809**

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[54] **GYRATORY CRUSHER HAVING CRUSHER HEAD RESTRAINER**

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[73] Assignee: **Barber-Greene Company**, Aurora, Ill.

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[52] **U.S. Cl.** **241/209**, 241/215

[51] **Int. Cl.** **B02c 2/04**

[58] **Field of Search** 241/207, 208, 209, 241/211, 212, 213, 214, 215, 216

[56] **References Cited**

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Primary Examiner—Granville Y. Custer, Jr.

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[57] **ABSTRACT**

A gyratory type crusher having a crushing head rotatably mounted on an upright eccentric wherein the head gyrates in respect to a cooperating concave and thereby effects a crushing action when material is in the annular crushing chamber which is formed between the head and the concave. The head is rotatably mounted on a rotating eccentric which imparts a gyratory movement to the head relative to the concave. Means are provided for restraining the rotation of the head relative to the concave when the crushing chamber is empty or when the material is initially being introduced into the crushing chamber. The construction of the restrainer is such that the head is permitted to rotate backwards during the crushing operation and which backward rotation is due to the crushing action.

2 Claims, 6 Drawing Figures

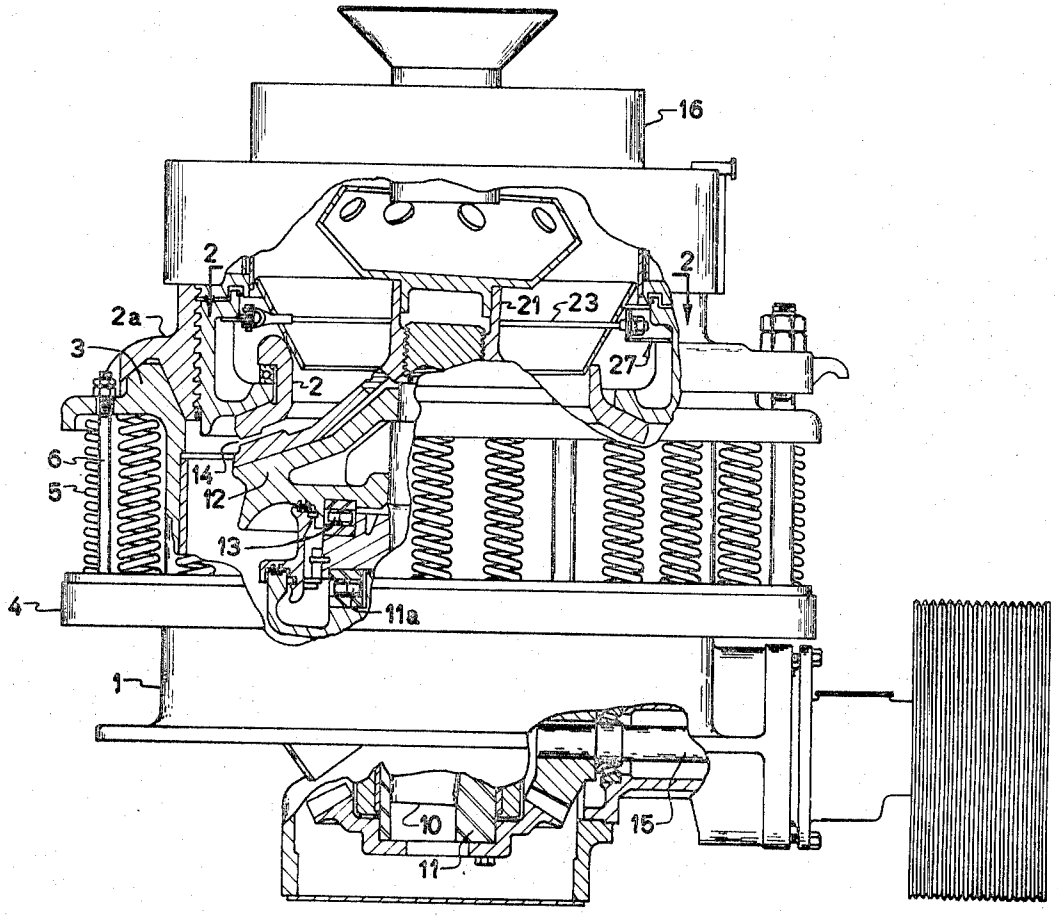


FIG. 1

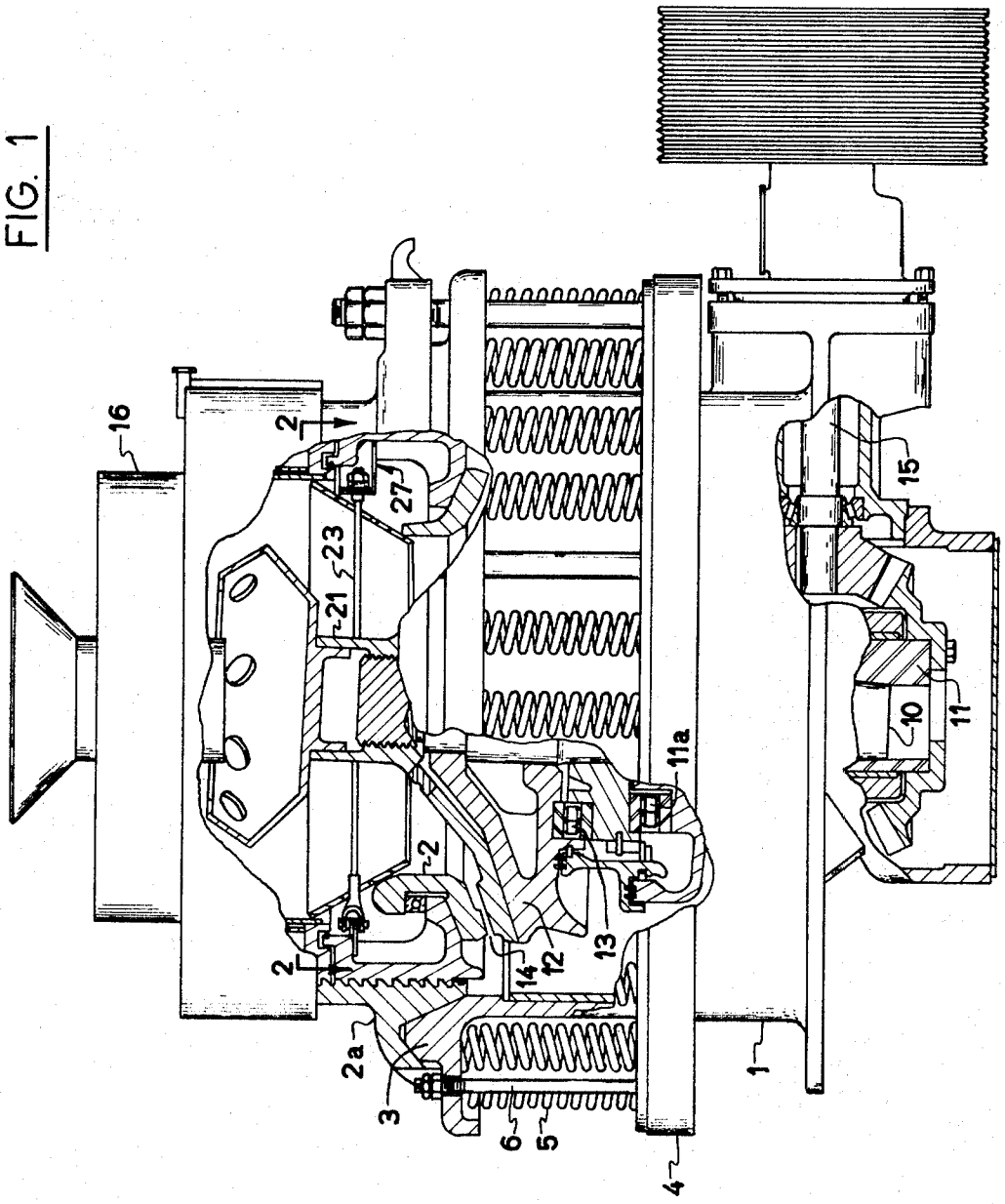


FIG. 2

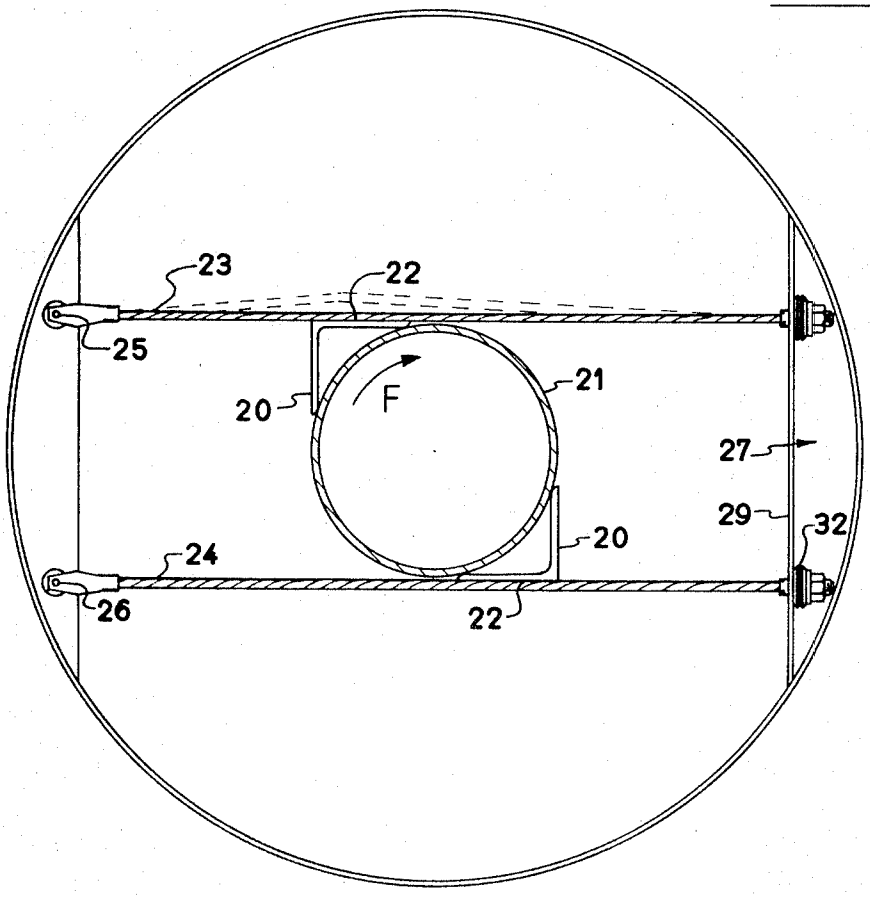


FIG. 3

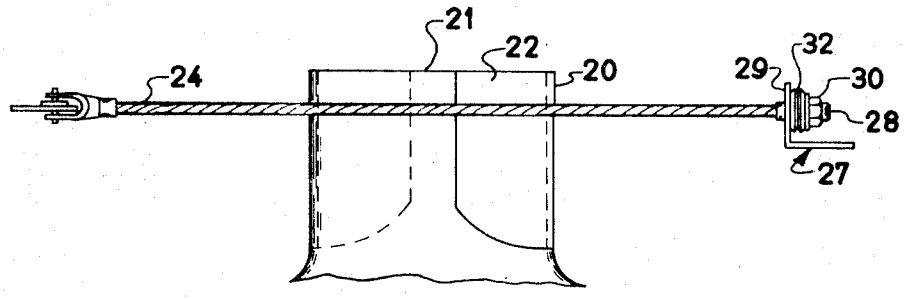


FIG. 4

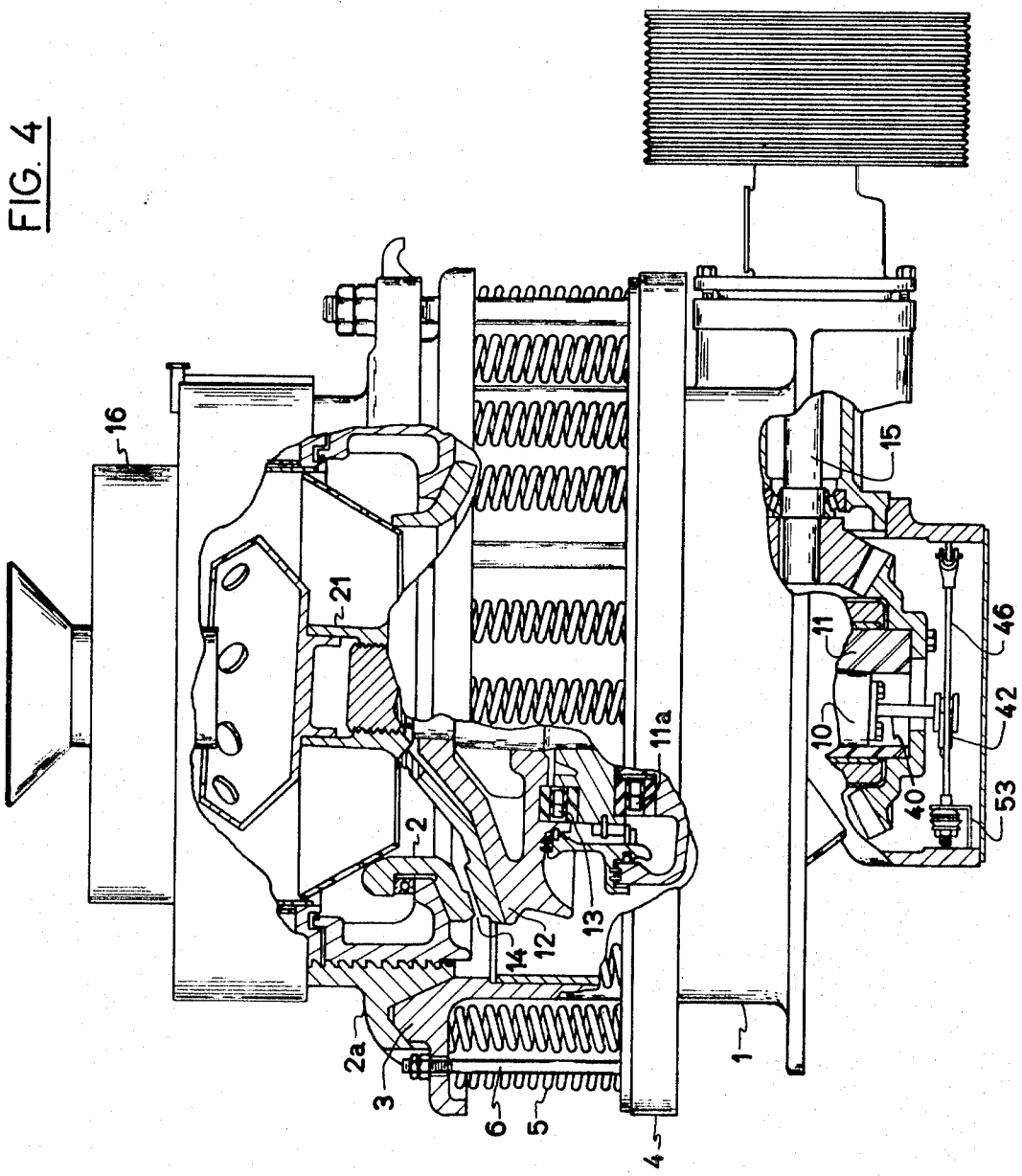


FIG. 5

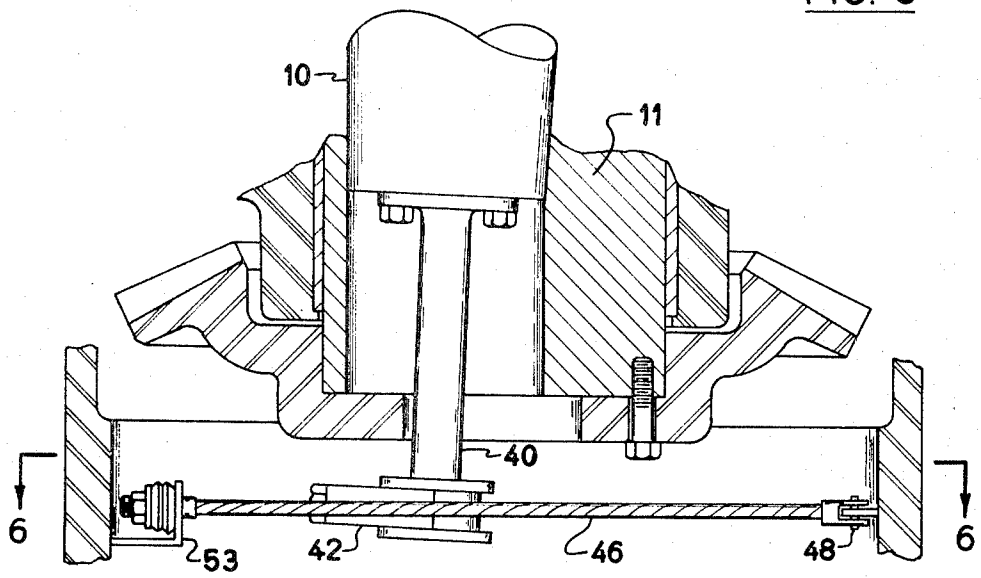
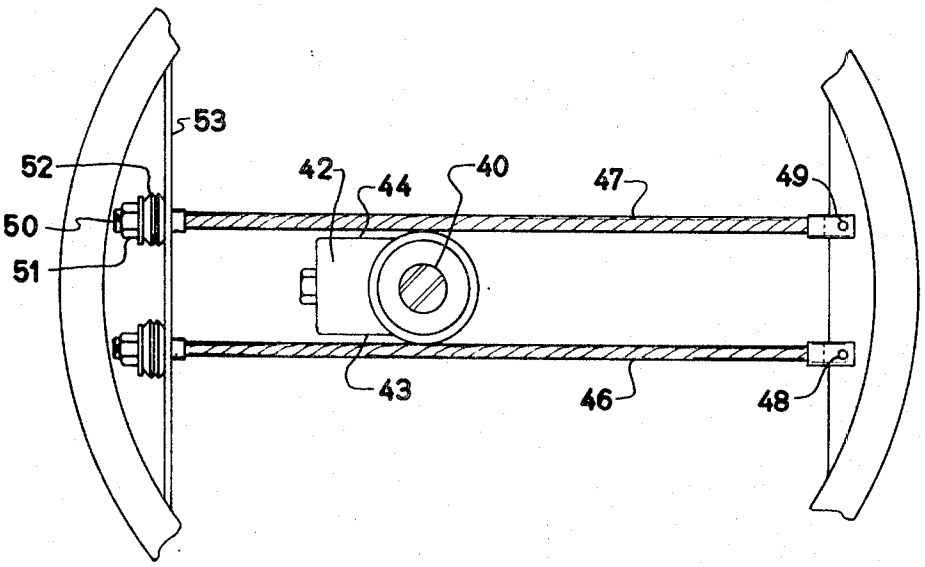


FIG. 6



GYRATORY CRUSHER HAVING CRUSHER HEAD RESTRAINER

BACKGROUND OF THE INVENTION

The invention pertains to crushers for reducing rock or ore aggragates or the like to the desired size and in which the crushing head is rotatably mounted by an eccentric whereby the head is gyrated upon rotation of the eccentric and relative to the stationary concave. Devices of this general type are shown in the U.S. Pat. No. 3,204,883, which issued Sept. 7, 1965 and entitled "Locking Means for Crushers" to Rumpel, and U.S. Pat. No. 3,341,138 which issued Sept. 12, 1967 to Allen and entitled "Adjusting Mechanism for Gyratory Crusher Bowls". Another type of prior art crusher over which the present invention is an improvement is U.S. Pat. No. 3,614,023, which issued Oct. 19 , 1971 and entitled "Gyratory Crusher" to Archer et al.

Another type of prior art device which deals with this problem and the particular way of overcoming it is shown in the U.S. patent application Ser. No. 212,553, filed Dec. 27, 1971 and entitled "Gyratory Crusher having Anti-Spin Means for Head" by Ronald DeDiemar and LeRoy Schuman.

In prior art crushers of this type the rotatable eccentric imparts a gyratory motion to the head and relative to the stationary concave to effect a crushing action. Even though the head is rotatably mounted relative to the eccentric, rotational action of the eccentric also causes the head to rotate in the same direction as the eccentric rotates and this is known as forward direction of rotation of the head. This rotation of the head relative to the concave is undesirable, for one thing because it causes the material being crushed to excessively wear the crushing parts. This forward rotation of the head occurs when there is insufficient material in the hopper or in the crushing chamber. Once the crushing chamber fills and the crushing action due to the gyratory movement of the head commences, the head tends to stop rotating in a forward direction and instead assumes a rather slow backward rotation in respect to the direction of eccentric rotation. That is to say, during the crushing action, the head tends to rotate about four or five r.p.m. for example, in a direction opposite to that in which the eccentric rotates. This rearward rotation of the head is difficult if not impossible to stop because of the high magnitude of the crushing forces involved. Furthermore, as this backward direction is rather slow, it is not absolutely necessary to eliminate it.

SUMMARY OF THE INVENTION

The present invention provides a gyratory type crusher having a crushing head rotatably mounted by a rotatable eccentric and which head cooperates with a stationary concave to form a brushing chamber therewith. A material feeding hopper is located above the crushing chamber and acts to distribute material to the entrance of the crushing chamber, which chamber is located between the head and concave.

The present invention provides restrainer means for preventing the head from rotating in a forward direction, that is, in the same direction of rotation as that in which the eccentric rotates, which forward rotation is caused when the hopper is empty or contains an insufficient amount of material. This restrainer means is so constructed and arranged that it prevents this forward rotation of the head, but permits a relatively slow rotation of the head backwards relative to the eccentric, that is in a direction opposite to that in which the eccentric rotates.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of the crusher embodying the present invention, certain parts being shown as broken away or removed for the purpose of illustrating the clarifying the invention;

FIG. **2** is an enlarged, plan view of the restrainer means shown in FIG. **1**, the view being taken generally along the line **2—2** in FIG. **1**;

FIG. **3** is an elevational view of the device shown in FIG. **2**;

FIG. **4** is a view similar to FIG. **1**, but showing a modified form of the invention;

FIG. **5** is an enlarged, fragmentary view of the restraining means shown in FIG. **4**; and

FIG. **6** is a view taken generally along the line **6—6** in FIG. **5**.

DESCRIPTION OF THE INVENTION

The crusher provided by the present invention includes a stationary main frame **1** having a stationary concave **2** mounted in a supporting ring **2***a* which is resiliently held in a downward position on an upper ridge **3** of the main frame by means of the lower spring ring **4**, springs **5**, and the bolt means **6**. The crusher also includes a shaft **10** which is eccentrically and rotatably mounted in a driven eccentric **11** on anti-friction bearings **11a** on the main frame. A crushing head **12** is rotatably journalled on bearings **13** on the shaft and rotates therewith. A drive shaft **15** drives the eccentric **11** in a forward direction and this rotation of the eccentric also causes the shaft **10** and its head **12** to gyrate and also to rotate when there is no material to be crushed in the crushing chamber **14**. Chamber **14** is defined between the concave **2** and the head **12**. A material hopper **16** is located above the crushing chamber and acts to distribute material around the entrance to the crushing chamber.

If a more complete description of the structure and function of the crusher thusfar described is deemed to be either necessary or desirable, reference may be had to the said U.S. Pat. No. 212,553 However, it is believed sufficient to say for purposes of this disclosure that the head is gyrated bodily relative to the concave **2** and due to the rotation of the eccentric **11**; thereby effecting a crushing action of the material which falls into the crushing chamber.

When the chamber is empty or has little material in it, the head rotates in the same direction as that in which the eccentric **11** rotates and this is referred to as a forward direction of rotation. When material is then added to the crushing chamber, it creates an extremely abrasive or high impact force on the crushing members, and consequently, it is desirable to have the head remain rotationally stationary, if possible, relative to the stationary concave.

On the other hand, during the crushing action, due to the gyration of the head relative to the concave, the head has a tendency to rotate slightly, for example 4 or

5 r.p.m. in a direction opposite that to which the eccentric 11 rotates. This latter rotation is known as a backward rotation and is difficult, if not impossible to prevent due to the high forces involved in a crusher of this type.

In accordance with the present invention, restrainer means are provided for restraining the head against forward rotational movement,that is against rotational movement in the same direction as that in which the eccentric rotates. This prevents the highly abrasive and high impact force between the crushing members when the crushing chamber is empty or being loaded with material. The invention furthermore permits backward rotation of the head relative to the direction of rotation of the eccentric, that is in a backward direction, during the actual crushing operation. This restrainer means will now be described in detail.

One embodiment is shown in FIGS. 1–3 and includes cam like extensions in the form of a pair of angle members 20 which are welded on diametrically opposed sides of the shaft nut 21 so as to define thereon, a non-circular portion having diametrically opposed flat sides 22. A pair of steel cables 23, 24 are anchored respectively at 25 and 26 to one side of the concave supporting structure and these cables then extend adjacent the flat sides 22 and abut thereagainst. The opposite ends of the cables are yieldingly mounted in a steel frame 27 which is rigidly secured to the concave frame. The ends of the cables are threaded as at 28 and extend through the flange 29 of the frame 27 and a nut 30 is threadably engaged on the threaded ends of the cables. Spring means 32 in the form of Belleville washers for example, are inserted between the nut means 30 and the flange 29 and are of sufficient strength so as to hold the cables taut and prevent rotation of the shaft nut and its attached eccentric shaft in the same direction as that in which the eccentric shaft rotates. In this manner, the cables act as restraining means that restrains rotation of the head, which rotation is due to the forward rotation of the eccentric as indicated by the arrow F in FIGS. 2 and 6.

The springs however provide sufficient resiliency so that the head can rotate backwards in respect to the direction of eccentric rotation, as when crushing action occurs. As shown in FIG. 2 by the dotted lines, the springs have yielded sufficiently to permit the cables to yield due to the backward relative rotation of the nut 21 and its associated angle iron members 20.

As shown in FIGS. 4–6, another modification of the invention is disclosed wherein the lower end of the eccentrically positioned shaft 10 has an extension 40 bolted thereto to the lower end of which shaft is rigidly secured an eccentric member 42. This eccentric member 42 presents oppositely disposed flat sides 43 and 44 which abut against the cables 46 and 47, respectively. The cables 46 and 47 are anchored, respectively at 48 and 49 at one side of the frame and are resiliently anchored at the opposite side of the frame. The resilient anchoring means is similar to that shown in FIG. 2 and includes a threaded shaft portion 50 on the end of the cables and nuts 51 threaded thereon. Belleville springs 52 act between the nut 51 and the rigid flange 53 of the frame member.

The action of the eccentric member 42 and the resilient mount of the cables 46 and 47 is substantially the same as that described above in connection with FIGS. 1 and 2. The resiliently loaded restraining cables 46 and 47 act to hold the eccentric portion 42 of the shaft 10 captive against forward rotation of the eccentrically disposed shaft. Nevertheless, there is sufficient resiliency in the springs 52 to permit the cables to flex sufficiently when excessive loads are placed thereon, as when crushing occurs and causes the head and the shaft attached thereto to rotate in a direction opposite to the direction in which the eccentric rotates.

The invention has been described in connection with a crusher of the type having a shaft which is eccentrically mounted in an eccentric and wherein the head and shaft rotate together relative to the eccentric. It will be understood of course, that the invention is equally applicable to other forms of drive mechanism such as for example as in the said U.S. patent application Ser. No. 212,553 wherein the shaft itself has an eccentric portion at the upper end and the head is mounted on that eccentric portion and rotates relative to the shaft.

We claim:

1. In a gyratory crusher having a stationary main frame and crusher head assembly including a crusher head and rotatably mounted by an eccentric member in said frame, means for rotating said eccentric member to cause gyratory movement of said head assembly, a stationary concave defining a crushing chamber with said head,and restrainer means including resiliently mounted cable means for preventing rotation of said head assembly in the same direction as that in which said eccentric rotates, said cable means being mounted at opposite ends in said main frame and extending adjacent a portion of said head assembly, said head assembly portion being of non-circular cross section for abutting relation with said cable means, whereby said cable means is resiliently held taut and can yield sufficiently to permit said head to rotate in a direction opposite to that in which said eccentric rotates.

2. The crusher as set forth in claim 1 including spring means for securing said cables to said main frame and maintaining said cable means taut whereby said cable means can yield upon excessive force applied thereto by said non-circular portion when the latter is rotated in a direction opposite to that in which direction said eccentric rotates.

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