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(56) Documents Cited:
GB 0934518 A **GB 0491986 A**
GB 0407245 A **US 4248390 A**
US 2701107 A

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(54) Title of the Invention: **Jaw crusher**
Abstract Title: **Jaw crusher**

(57) A jaw crusher comprises a pair of opposed fixed anvil plates 2 mounted so as to define a chamber tapering downwardly therebetween. A generally up-right jaw 8 is mounted on a pivot 9 extending transversely of the chamber, a lever 13 being connected to one end of the jaw 8 remote from the pivot 9. A drive means is provided to reciprocate the lever 13, thereby rocking the jaw 8 about the pivot 9. A feed hopper 16 is provided above the jaw 8 to deposit material to be crushed into the space between the jaw 8 and the anvil plates 2 on each side of the jaw 8.

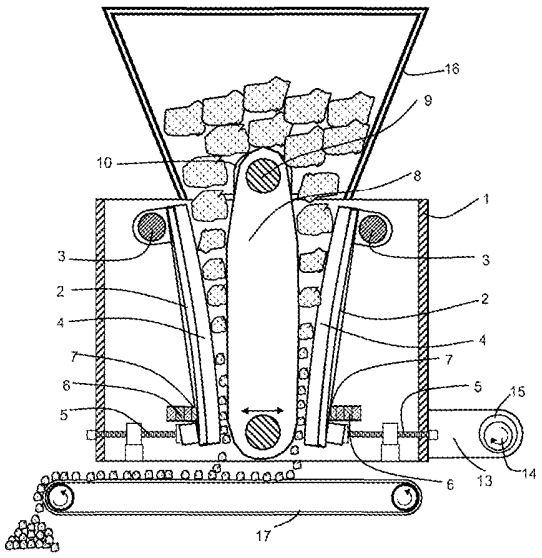

Fig 1

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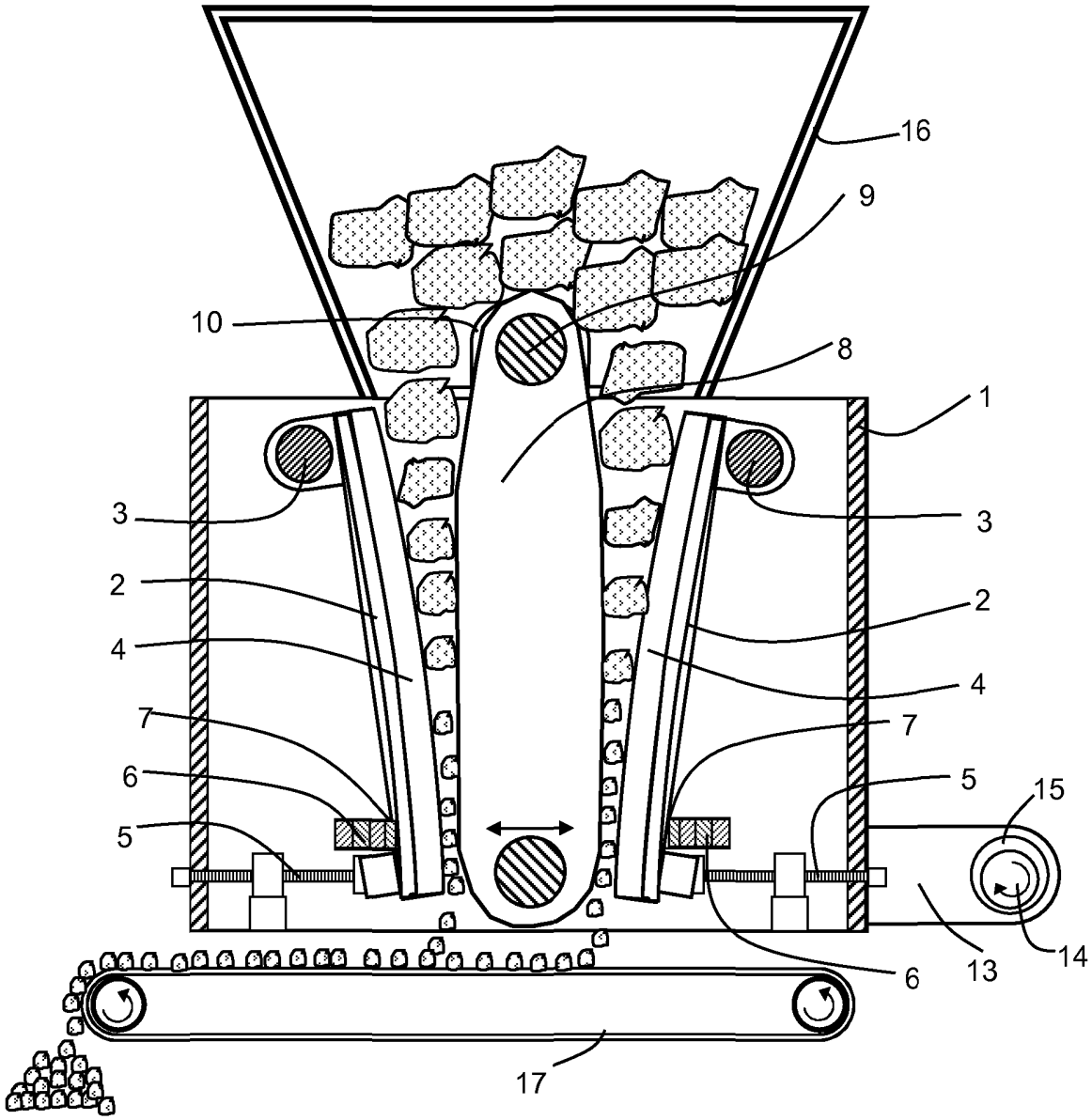

Fig 1

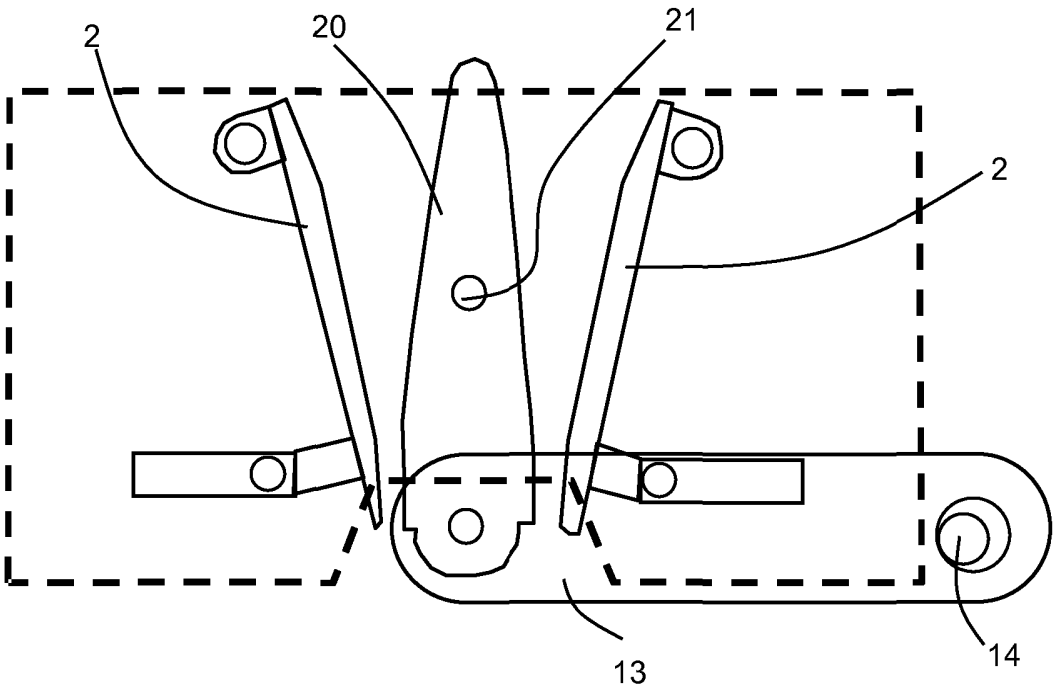

Fig 2

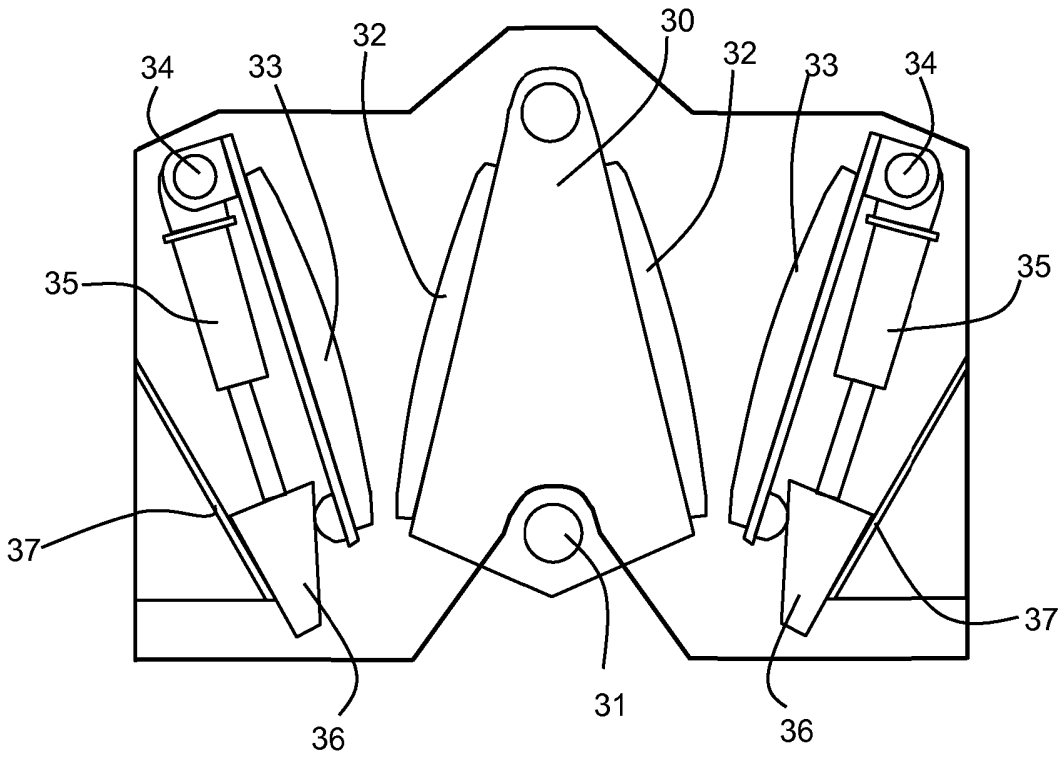

Fig 3

JAW CRUSHER

Field of the Invention

This invention relates to a jaw crusher for use in breaking rock, concrete or masonry.

Background to the Invention

A typical jaw crusher has a generally upright anvil plate, and a jaw pivoted at or near to the upper part thereof so that the lower part can be swung towards and away from the anvil plate, creating a varying tapering space between the jaw and the anvil plate in which materials are progressively crushed, discharging downwardly. The jaw and anvil are preferably vertically ribbed. The jaw is typically reciprocated by means of an eccentric on the pivot shaft, so that as the shaft is rotated, for example using a belt and flywheel powered by a hydraulic motor, the jaw is caused to swing towards and away from the anvil plate. A spring tensioner holds the jaw at the desired opening relative to the anvil plate. Material is introduced from above and passes downwardly as it is crushed.

While such crushers are very effective, there are two principal areas where the arrangement offers disadvantages. Firstly, since the jaw reciprocates, the action of the crusher is a repeated sequence of crushing and then release, allowing the reduced material to drop further. Because the gap tapers, the material is reduced in size progressively as it descends through the crusher, but only 50% or less of the movement of the jaw is carrying out the crushing. This imposes a limitation for any given size of machine on the throughput of material it can handle. Secondly, the reciprocation of the jaw occurs as a circular motion, because of the eccentric mounting on the suspending shaft, and this can lead to a slight rubbing action of the materials relative to the jaw and the anvil plate, increasing abrasive wear thereon. This tends to reduce the working life of these components before replacement of the surfaces thereof is required. This is typically achieved by unbolting ribbed surface plates and installing new ones, and involves downtime of the machine and costly components. The longer the machine can operate between such replacements, and the higher the throughput of the machine when operating, the lower will be the operating costs.

Summary of the Invention

Accordingly, the present invention provides a jaw crusher comprising a pair of opposed fixed anvil plates mounted so as to define a chamber tapering downwardly therebetween, and a generally upright jaw mounted on a pivot extending transversely of the chamber, a lever being connected to one end of the jaw remote from the pivot, and drive means being provided to reciprocate the lever, thereby rocking the jaw about the pivot, feed means being provided above the jaw to deposit material to be crushed into the space between the jaw and the anvil plate on each side of the jaw.

The lever is preferably connected to a drive shaft through an eccentric, the drive shaft, which may carry a flywheel, or more than one flywheel, being driven by a motor, which is conveniently a hydraulic motor. However, in many instances, direct drive by a hydraulic motor will be sufficient without the need for a flywheel. The motor may be coupled to the drive shaft through at least one flexible endless drive belt, but it could be directly connected to the drive shaft.

The jaw is suitably pivoted adjacent to the upper end thereof, with the lever being coupled to the lower part of the jaw, but it would be possible for the lever to be coupled to the upper part of the jaw, with the pivot point being below this.

Each of the anvil plates may itself be mounted on a pivot, preferably at the uppermost part thereof, with an adjustable stop being located externally of each of the plates to permit the gap between the jaw and the anvil plate at its point of closest approach to be pre-adjusted according to the desired size range of the crushed material. The adjustable stop may comprise a plurality of transverse spacing bars, with a screw adjuster to hold the anvil plate against the bars. Alternatively, a hydraulic adjuster could be used, preferably with a release valve to allow release of the anvil plates if a pre-determined loading is exceeded. This could be employed to prevent the risk of damage to the machine through overloading.

The anvil plates and/or the jaw may be provided with vertical ribs thereon to assist in the breaking of materials. Where both the jaw and the anvil plates

are provided with ribs, these may be configured to intermesh, further enhancing breaking.

Typically the frequency of reciprocation will be essentially the same as in conventional jaw crushers, i.e. about 6Hz (360 r.p.m.), with a maximum amplitude of around 15-16mm, although greater and smaller amounts may be selected according to the material to be crushed and the size of machine. Adjustment of the amplitude may be achieved by replacing the eccentric connection to the drive shaft.

In one embodiment of the invention, the jaw is pivoted midway along the height thereof, thereby amplifying the movement of the uppermost portion of the jaw through a lever effect, increasing the initial crushing action.

Because the crusher is doing work on each stroke, its throughput is substantially increased over a conventional single-sided jaw crusher, while the forces on the moving parts are more uniform. This, coupled with the more linear movement of the jaw towards and away from each anvil plate, reduces wear on the machine, increasing its operating life and reducing costs. The power consumption of the machine does not increase in proportion to its increased throughput, further reducing operating costs. It has been found that the machine can be operated with a lower-powered motor than that which would be needed to drive conventional crushers of the same throughput.

Brief Description of the Drawings

In the drawings, which illustrate exemplary embodiments of the invention:

Figure 1 is a diagrammatic sectional elevation of a crusher according to a first embodiment of the invention;

Figure 2 is a diagrammatic side elevation of a crusher according to an alternative embodiment; and

Figure 3 is a diagrammatic side elevation of a crusher according to yet another embodiment.

Detailed Description of the Illustrated Embodiment

Referring to Figure 1, the crusher comprises a main casing 1 in which are mounted two adjustable anvil plates 2, each being suspended from a respective axle 3 mounted in the casing adjacent to the upper face thereof. Each

anvil plate has a vertically-ribbed face 4, in conventional manner, and is provided with a central adjusting screw 5 to adjust the gap between the anvil plates 2, the outward load on the plates 2 being carried by bearing bars 6 which extend through slots 7 in the sides of the casing 1 and which engage the outer sides of the plates 2. Adjusting the spacing of the plates 2, and therefore the crushing size, is thus carried out by inserting or removing bearing bars 6 and adjusting the screws to draw the plates 2 into engagement with the innermost bar.

A generally vertical jaw 8 is mounted on an axle 9 which extends between bearings 10 mounted on the upper side of the casing 1. The jaw 8 is thus able to swing in the space between the anvil plates 2. At its lower end, the jaw 8 carries a transverse axle 11 extending through slots 12 in the sides of the casing 1 and coupled at each end thereof to a respective drive lever 13 through a suitable roller bearing or the like (not shown). The levers 13 extend to one end of the crusher, where they are connected to a drive shaft 14 through a respective eccentric bearing 15 such that rotation of the drive shaft 14 causes reciprocation of the jaw 8 towards and away from each of the anvil plates 2. The surface of the jaw 8 may be smooth, but is preferably provided with vertical ribs in the same general form as those on the anvil plates 2. Preferably, the ribs on the anvil plates fall between those on the jaw 8 so as at least partially to mesh together for more effective breaking or crushing of materials.

The drive shaft carries at least one flywheel (not shown) and is conveniently driven by means of a belt drive from a hydraulic motor, although it will be appreciated that other forms of motor could be used.

A feed hopper 16 is located above the jaw 8 to feed material to be crushed evenly to both sides of the jaw, the top of the jaw being shaped to deflect material to assist this. Crushed material issuing from beneath the crusher is received on a conveyor 17 and is led away for collection, for example passing on to another conveyor to be carried on to a receiving heap or the like.

In use, the reciprocation of the jaw operates at a frequency of about 6Hz and with a displacement of approximately 16mm, the materials to be crushed

being progressively reduced in size as they pass downwardly between the jaw and the anvil plates.

Referring now to Figure 2, the jaw 20 in the alternative embodiment tapers generally outwardly from the top to the bottom, and is carried by a central axle 21 approximately midway between the ends thereof, so that the movement near to the upper end is substantially greater as the jaw reciprocates than in the first embodiment illustrated in Figure 1. This enhances the initial crushing action, further increasing throughput of material. It will be appreciated that this will require a greater power input than in the first embodiment, but the overall efficiency of crushing will be enhanced.

In the embodiment shown in Figure 3, the jaw 30 is pivotally mounted adjacent to its upper end, and is reciprocated by means of an eccentric drive (not shown) on the transverse axle 11 adjacent to the lower end. The jaw 30 is of a generally triangular cross-section, and has convex crushing surfaces 32 mounted on the side faces. The anvil plates 33 are mounted on the opposed sides of the jaw 30 by means of axles 34, and are adjustable towards and away from the jaw 30 around the axles 34 by means of respective hydraulic adjusting rams 35, each of which drives a wedge 36 between the rear of the anvil plate and a camming surface 37 mounted within the casing of the crusher. Extension of the rams 35 thus closes the distance between the jaw 30 and the lower part of the respective anvil plate 33, while retraction allows the anvil plates 33 to pivot outwardly around the axles 34 away from the jaw 30.

CLAIMS

1. A jaw crusher, comprising a pair of opposed fixed anvil plates mounted so as to define a chamber tapering downwardly therebetween, and a generally upright jaw mounted on a pivot extending transversely of the chamber, a lever being connected to one end of the jaw remote from the pivot, and drive means being provided to reciprocate the lever, thereby rocking the jaw about the pivot, feed means being provided above the jaw to deposit material to be crushed into the space between the jaw and the anvil plate on each side of the jaw.

2. A jaw crusher according to Claim 1, wherein the lever is connected to a drive shaft through an eccentric, the drive shaft being driven by a motor.

3. A jaw crusher according to Claim 2, wherein the drive shaft carries at least one flywheel.

4. A jaw crusher according to Claim 2 or 3, wherein the drive shaft is coupled to the motor through a flexible drive belt.

5. A jaw crusher according to Claim 2, 3 or 4, wherein the motor is a hydraulic motor.

6. A jaw crusher according to any preceding claim, wherein each anvil plate is mounted on a pivot, an adjustable stop being located outwardly of the plate to permit the gap between the jaw and the anvil plate at its point of closest approach to be pre-adjusted according to the desired size range of the crushed material.

7. A jaw crusher according to Claim 6, wherein the adjustable stop comprises a plurality of transverse spacing bars, with a screw adjuster to hold the anvil plate against the bars.

8. A jaw crusher according to any preceding claim, wherein the jaw is pivoted at a position adjacent to the upper end thereof.

9. A jaw crusher according to any of Claims 1 to 7, wherein the jaw is pivoted midway along the height thereof.

10. A jaw crusher, substantially as described with reference to, and/or as shown in, Figure 1, Figure 2 or Figure 3 of the drawings.

Application No: GB0904439.7 **Examiner:** Mr Marc Collins

Claims searched: 1-10 **Date of search:** 26 March 2009

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-10	US 2701107 A (JOHNSON) See whole document especially figures.
X	1-10	GB 0407245 A (BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY) See whole document especially figures 3 and 9.
X	1-10	US 4248390 A (TOOLE) See whole document especially column 5, lines 25-35, claim 10 and figures.
X	1 at least	GB 0934518 A (GARTNER) See whole document especially figures.
X	1 at least	GB 0491986 A (NORDBERG MANUFACTURING COMPANY) See whole document especially abstract and figures.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

B2A

Worldwide search of patent documents classified in the following areas of the IPC

B02C

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
B02C	0001/06	01/01/2006