June 15, 1937. G. BUCHANAN 2,084,188

JAW CRUSHER

Filed Aug. 17, 1933 4 Sheets-Sheet 1

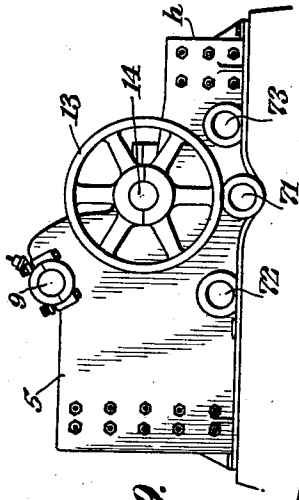


Fig. 9.



Fig. 1.

INVENTOR.
Gordon Buchanan
BY Edwards, Bower & Coal
ATTORNEYS.

June 15, 1937. G. BUCHANAN 2,084,188

JAW CRUSHER

Filed Aug. 17, 1933 4 Sheets-Sheet 2

Fig. 5.

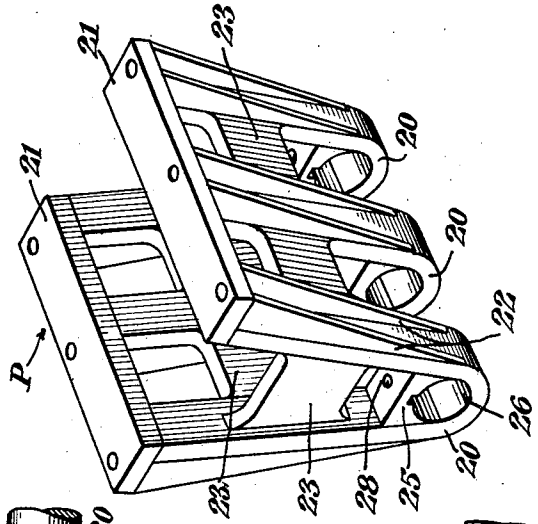



Fig. 4.

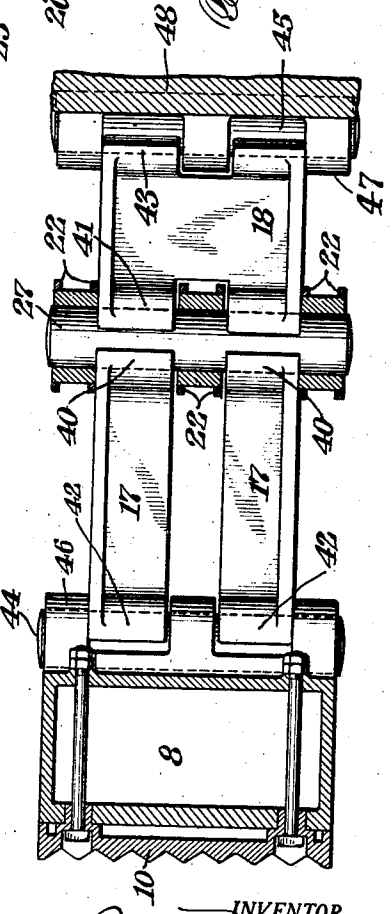



Fig. 3.

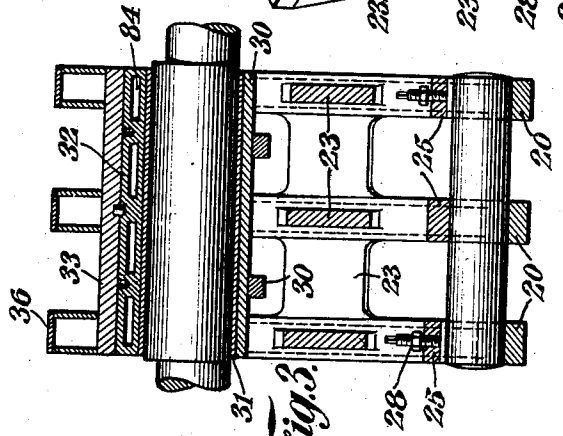
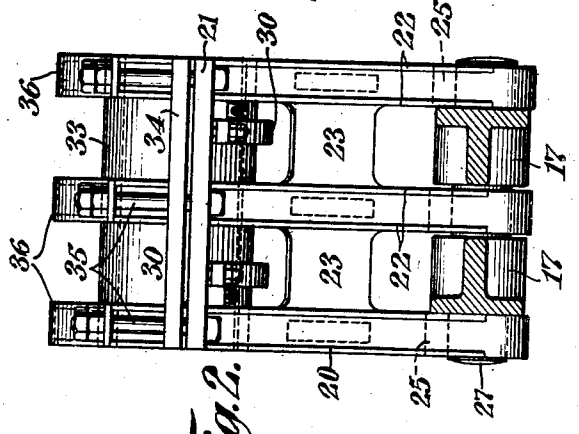



Fig. 2.




INVENTOR.
Gordon Buchanan
BY
Edwards, Bauer & Pool
ATTORNEYS.

June 15, 1937. G. BUCHANAN 2,084,188

JAW CRUSHER

Filed Aug. 17, 1933 4 Sheets-Sheet 3

Fig. 6.

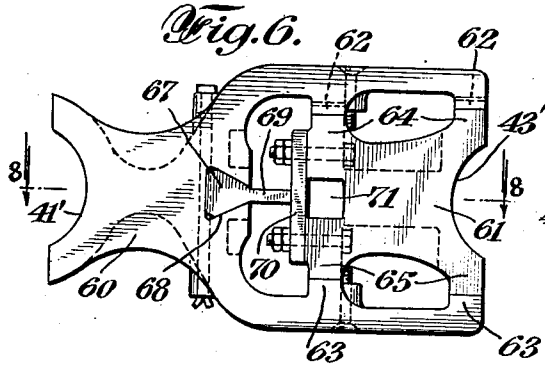



Fig. 7.

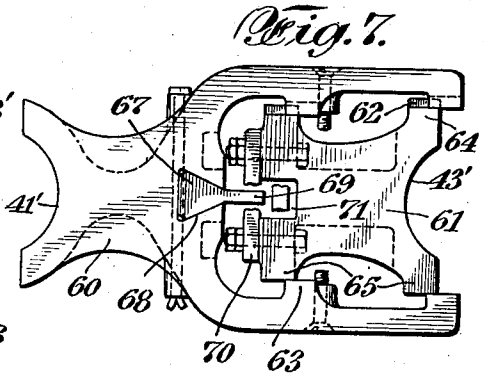



Fig. 8.

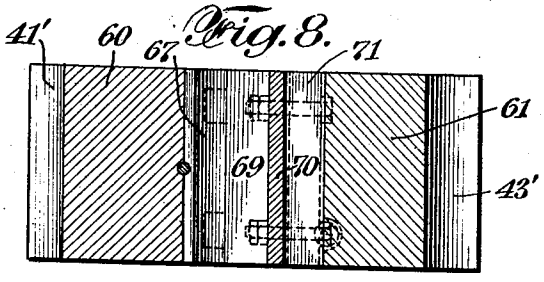



Fig. 11.

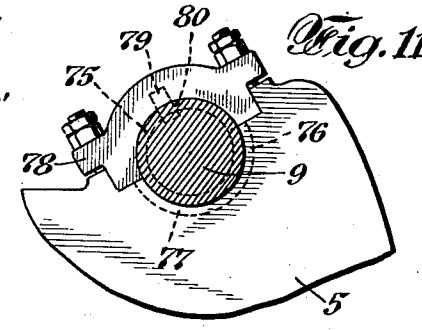



Fig. 10.

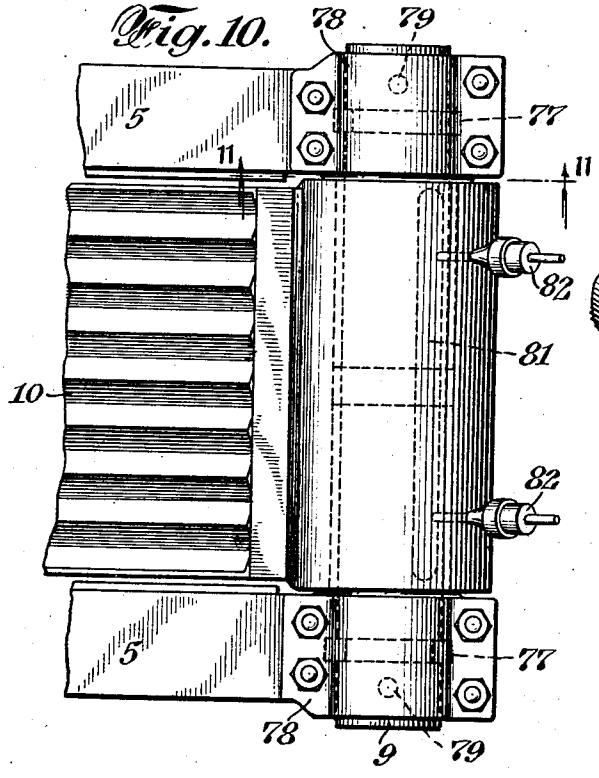
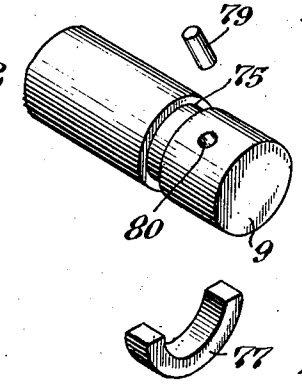



Fig. 12.




INVENTOR
Gordon Buchanan
BY
Edwards, Bowers & Pool
ATTORNEYS

June 15, 1937. G. BUCHANAN 2,084,188

JAW CRUSHER

Filed Aug. 17, 1933 4 Sheets-Sheet 4

Fig. 13.

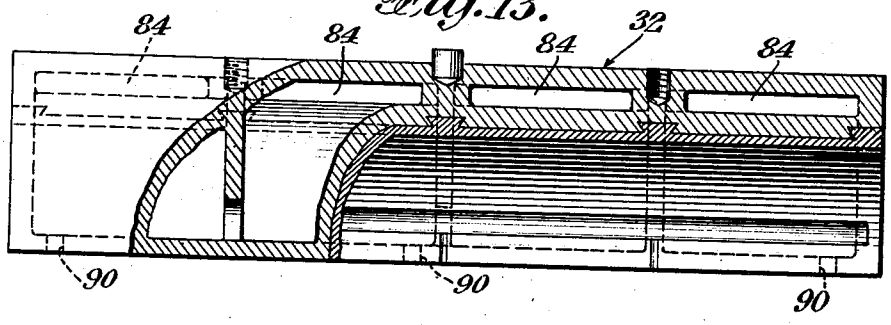



Fig. 14.

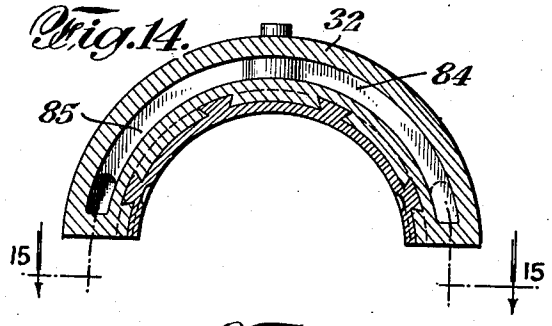
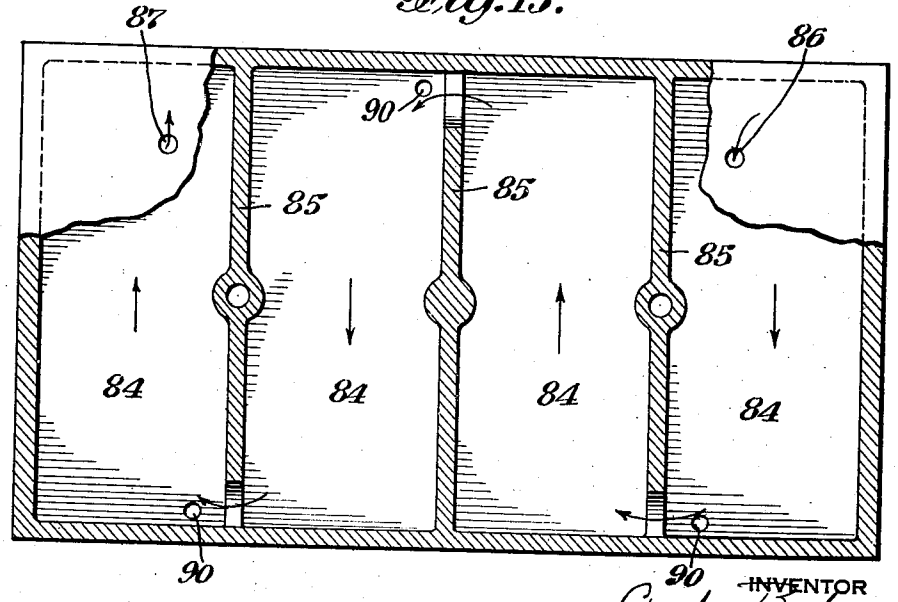



Fig. 15.




INVENTOR

Gordon Buchanan

BY

Edwards, Brewer & Pool

ATTORNEYS

Patented June 15, 1937 2,084,188

# UNITED STATES PATENT OFFICE

2,084,188

## JAW CRUSHER

Gordon Buchanan, East Orange, N. J., assignor to Pennsylvania Crusher Company, Philadelphia, Pa., a corporation of New York

Application August 17, 1933, Serial No. 685,537

4 Claims. (Cl. 83—53)

This invention relates to jaw crushers for rock, ore and the like, and particularly to such crushers operated by a toggle mechanism to oscillate the crushing jaw.

The main object of the invention is to provide a crusher having toggle operating means which is light in weight and of great strength and durability.

A further object of the invention is to provide a toggle mechanism having bearing members of simple formation and readily accessible for inspection and replacement.

Further objects of the invention particularly in the provision of yieldable means to take care of excessive crushing strains will appear from the following description taken in connection with the accompanying drawings in which

Fig. 1 is a vertical sectional view with parts omitted of a crusher illustrating one embodiment of the invention,

Fig. 2 is a vertical sectional view showing the toggle pitman in elevation,

Fig. 3 is a vertical sectional view through the toggle pitman,

Fig. 4 is a horizontal sectional view showing the toggle members in plan view,

Fig. 5 is a perspective view of the toggle pitman,

Fig. 6 is a side view of a modified form of toggle,

Fig. 7 is a view similar to Fig. 6 but illustrating the toggle parts in a different position,

Fig. 8 is a horizontal sectional view taken on line 8—8 of Fig. 6,

Fig. 9 is a side elevation of the complete machine illustrating the structure of the side members to give access to the replaceable wear parts,

Fig. 10 is a plan view on enlarged scale of a portion of the machine showing the oscillatory jaw suspension.

Fig. 11 is a vertical sectional view of a detail taken on the line 11—11 of Fig. 10,

Fig. 12 is a view of parts of the jaw supporting mechanism shown in perspective,

Fig. 13 is an elevational view with parts in section showing the construction of the upper bearing section for the pitman,

Fig. 14 is a transverse sectional view on line 14—14 of Fig. 13 and

Fig. 15 is a developed plan view partly in section along the surface indicated by the line 15—15 of Fig. 14.

Referring to Fig. 1 the crusher comprises the side members 5 having a front head (not shown) and a rear head *h* between the ends of the side members. An oscillatory crushing jaw 8 is swiveled on the shaft 9 and carries the crushing plates 10 as shown. A drive wheel 13 rotates the shaft 14, upon the eccentric 15 of which is mounted the toggle pitman designated generally at P operating the toggles 17 and 18.

In the apparatus of this invention the pitman P (Fig. 5) is built up of steel rolled and cut to shape and welded to provide a frame work construction which is very strong and at the same time relatively light in weight.

In the specific embodiment shown (Fig. 5) three straps 20 bent into generally V shape are welded at their ends to the flange members 21 with the triangular flange strips 22 inset between these parts and welded in place as shown. Strut members 23 are provided between the strap members 20 intermediate their ends and are also welded in place as shown to complete the frame structure. Blocks 25 are secured in place in the lower ends of the V straps and these blocks 25 and the cooperating surfaces 26 of the straps 20 are rounded to receive a heavy shaft or bar member 27 secured in place by keys and set screws 28 threaded through the two end blocks 25. Cradle members 30 (Fig. 1) are fastened to the under surfaces of the flanges 21 and receive and hold the semi-cylindrical lower shell 31 of the eccentric bearing. The upper bearing shell 32 is carried by the segment 33 welded at its edges to the flange members 34, and the upper part of the pitman structure is completed by the hollow reinforcing ribs 36 of plate steel strips welded together and to the segment 33 and flanges 34 as shown, bolts 35 passing through the flanges 21, 34 and the ribs 35 and fastening the upper and lower parts of the pitman together.

The front toggles 17 are separate members with socketed ends 40, 42 fitting respectively the bearing surfaces of the pitman bar or shaft 27 and the corresponding shaft 44 carried by the oscillatory jaw. The rear toggle 18 is formed as a single piece with bifurcated socketed ends 41, 43 fitting between the pitman straps 20 and bearing on the surfaces of the bar 27 as to sockets 41 and on the bar or shaft 45 of the pillow block 48 as to the sockets 43. These bars or shafts 44, 45 are rotatably or stationarily held in the circular sockets 46, 47 respectively of the jaw 8 and pillow block 48.

Preferably the shafts 44, 45 are keyed to the circular sockets 42, 43 of the swing jaw 8 and pillow block or tail piece 48, but these shafts may be keyed to the end of toggles 17, 18 by set bolts 50, 51 so that the shafts oscillate slightly in their bearings in the sockets of the jaw 8 and pillow block 48. This pillow block 48 is detachably and

adjustably mounted so that its position horizontally and vertically may be adjusted by means of the shims 53, 54.

In the modified form of rear toggle link shown in Figs. 6, 7 and 8 there is a frame or shell member 60 detachably and slidably carrying a relatively movable member 61. The frame member 60 is provided with the upper guides 62 and lower guides 63 in which the member 61 is closely fitted by projections 64 above and 65 below. The frame member 60 is provided with a bifurcated end and sockets 41' adapted to fit the surfaces of the shaft 27 while the member 61 is similarly bifurcated and provided with sockets 43' adapted to fit the shaft 45.

To hold the members 60, 61 in predetermined relative position a compression unit 67 preferably of hard steel is carried by the slot 68 of the member 60 as shown and has its projecting end 69 resting against the detachable, replaceable plate 70 adapted to shear under abnormal strains so as to protect the other parts of the crusher from breaking. When the crushing strain exceeds a predetermined amount the end 69 will shear its way across the plate 70 and project into the transverse groove 71 and permit the member 60 to move relative to the member 61 as indicated in Fig. 7. Under these conditions the outer shell 60 will slide over the internal member 61, and in this way open the jaws of the crusher and at the same time stop the jaws from operating. When the pitman P moves up and down parts 60 and 61 will merely work up and down inside of each other because sufficient play is provided to permit this, and in this way all crushing action will cease in the machine.

The hard steel member 67 and plate 70 may be made of any desired extent, but preferably are substantially of length equal to the full width of the toggle so as to provide ample bearing surface for the strains of normal operation.

The shafts 27, 44 and 45 are renewable and may be removed and replaced by transverse endwise movement, the side frame members having openings 71, 72 and 73 and sufficiently larger in diameter than these shafts to permit them to be inserted and replaced through these openings with the swing jaw in retracted position. In operation all that is necessary is to properly position the toggle parts, release the key connections between the shafts and toggles or other parts and then drive the shafts out endwise, the toggle parts being, of course, supported, for instance, by jacks in the pit space at the bottom of the machine. This replacement may, therefore, be effected without disturbing the other machine parts and simply involves the insertion of the new shaft in place of one that has become outworn.

The shaft 9 of the jaw 8 is held stationary by the supporting side members as shown in Figs. 10, 11 and 12. Each end of the shaft is provided with a circular groove 75 and the lower half of the bearings in each side member is provided with a corresponding semi-circular groove 76 adapted to receive a semi-circular washer or key 77 fitting in the grooves of the shaft and the bearings and holding the shaft against endwise thrust. Each cap member 78 for the ends of the shaft 9 is provided with a pin 79 fitting into a drilled hole 80 in the corresponding end of the shaft to prevent rotation. This mounting of the shaft is simple in formation and provides accurate and strong holding means retaining the shaft in centered position and against rotation so that its interior surfaces within the jaw bearing may be provided with a flattened portion or groove 81 to receive and spread the lubrication from the lubricators 82.

In Figs. 13, 14 and 15 the special construction of the cap segment 32 is shown providing a water jacket for circulation of the cooling fluid. This segment is cast with the interior passages 84 with intermediate partitions 85 staggered as shown in Fig. 15 to provide circulation in series during the successive passages from the inlet 86 at one end to the outlet 87 at the other end. These inlet and outlet passages are connected to the cooling fluid circulation by flexible tubing 88, and the water jacket will also be provided with draining means 90 permitting the interior fluid to be drained away.

The machine of this invention is strong and durable in construction with the cooling segment for the pitman bearing bringing the cooling liquid into very close relation to the upper bearing surfaces developing the heating effect. The welded construction of the pitman combines lightness with strength reducing the inertia effects and adding to the durability of the machine. The center bearing for the toggles constrains the moving surfaces to accurate circular motion around a predetermined center and eliminates misalinement of the opposite toggle thrusts which in previous constructions have tended to impose a stress in form of a tipping torque or movement on the pitman. With the new center bearing the opposite thrusts are closely alined to meet at the center of the shaft 27 and without any resultant torque or tendency to tip.

Similarly the shaft bearings of the crushing jaw and the pillow block provide a relatively large bearing surface, reducing the intensity of the bearing pressures and minimizing wear while at the same time avoiding any tendency of the parts to overheat. These larger bearings not only reduce the intensity of pressure but also provide for less concentration and better radiation of any heating that does occur. These bearings are, therefore, permanently cool even under the most severe conditions of use. All of this is combined with the ready replacement of worn bearing parts, the old and new shafts being simply slipped out endwise through the openings in the side frames.

I claim:

1. In an oscillatory jaw crusher the combination with a frame and jaw, of toggle means for operating said jaw comprising a toggle member formed into two parts, one part shaped as a transversely open yoke and the other part shaped as a block member slidable in said yoke, means between said parts for maintaining them in longitudinal alinement while permitting relative movement between them, a transverse frangible plate carried by one of said parts and a blade member carried by the other of said parts in contact with said plate, said plate being accessible through said transverse opening of said yoke member with the parts in assembled position.

2. In an oscillatory jaw crusher the combination with a frame and jaw, of toggle means for operating said jaw comprising a toggle member formed into two parts, one part shaped as a transversely open yoke and the other part shaped as a block member slidable in said yoke, means between said parts for maintaining them in longitudinal alinement while permitting relative movement between them, a transverse frangible

plate carried by one of said parts and a blade member carried by the other of said parts in contact with said plate, the support for said plate providing opposite contact surfaces spaced apart a distance substantially twice the width of said blade member so as to provide substantial separation between the said surfaces and the end of said blade.

3. In a jaw crusher, an oscillating jaw, a drive shaft and an eccentric driven thereby, a pitman carried by said eccentric comprising a plurality of strap members formed into similar loops which are joined and spaced apart by integral webs forming a rigid unitary structure, a toggle shaft carried by said loops, and longitudinally aligned toggle links having socketed ends engaging said toggle shaft between said loops, for reciprocating said jaw.

4. In a jaw crusher, a crushing jaw and means for imparting reciprocating motion to said jaw comprising a drive shaft having an eccentric, a pitman carried on said eccentric comprising a plurality of strap members formed into loops which are provided along the sides thereof with reinforcing strips and are joined and spaced apart by integral webs forming a rigid unitary structure, a replaceable wear shaft carried by said loops, and longitudinally aligned toggle links having socketed ends engaging said shaft from opposite sides thereof through the spaces between said loops, the opposite ends of said links engaging respectively said jaw and a fixed support.

GORDON BUCHANAN.