Aug. 30, 1960 F. E. SMITH 2,950,871

CRUSHER CONSTRUCTION

Filed May 23, 1956

Fig. 1

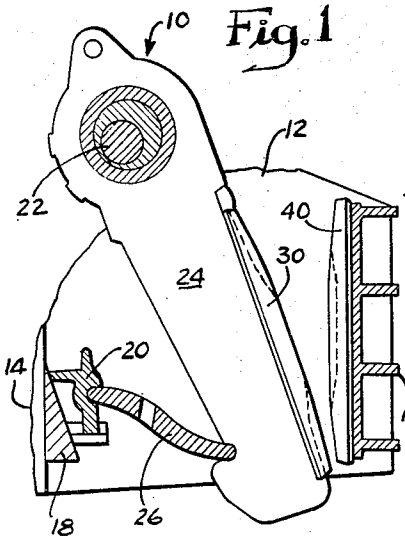


Fig. 4

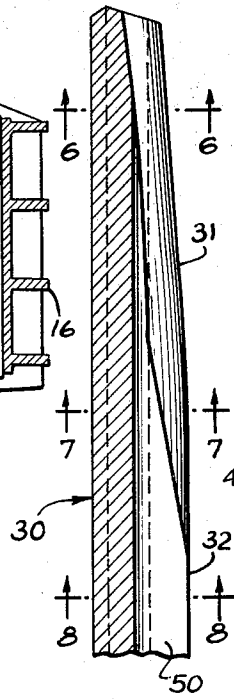


Fig. 5

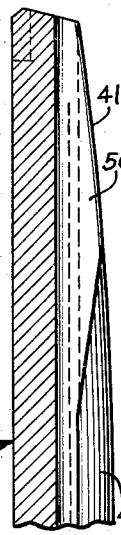


Fig. 10

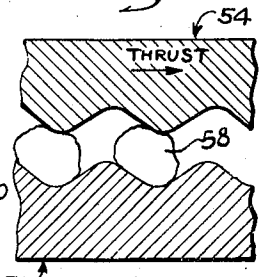


Fig. 9

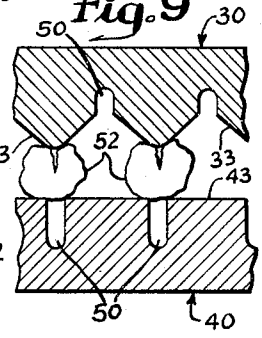


Fig. 2

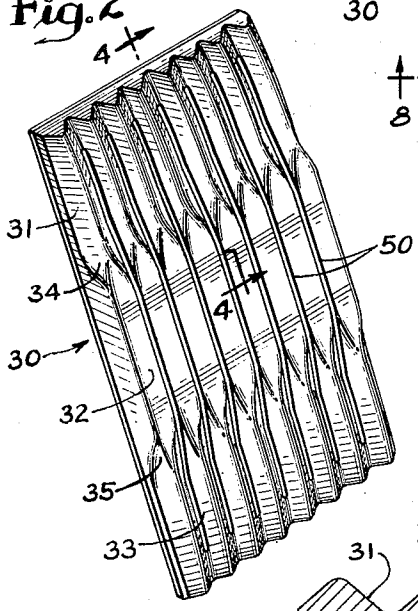


Fig. 3

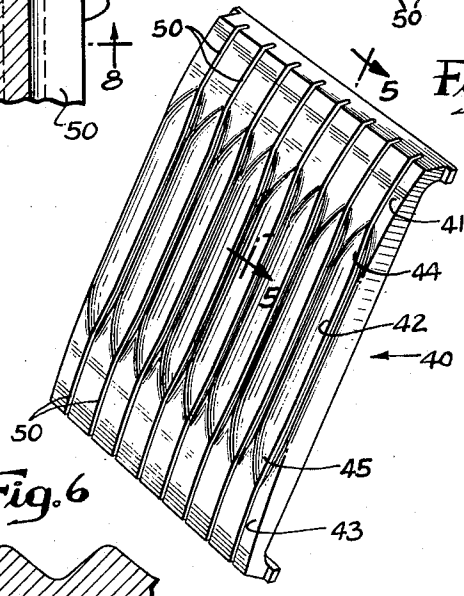


Fig. 6

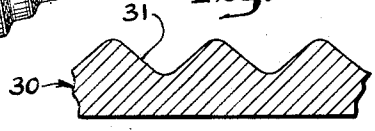


Fig. 7

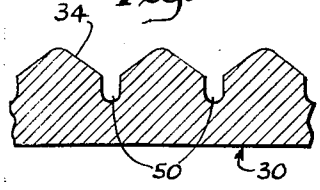
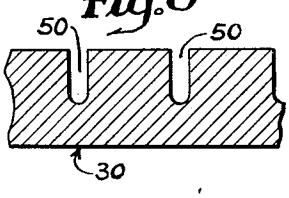


Fig. 8



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CRUSHER CONSTRUCTION

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5 Claims. (Cl. 241—217)

The present invention relates generally to jaw crushers for crushing rock and the like, and more particularly to improved jaw plates for use in such a crusher of the overhead eccentric type.

In conventional overhead accentric type jaw crushers a substantially vertically disposed pitman carrying a jaw plate thereon is rocked in a reciprocatory fashion toward and away from a fixed crusher jaw. The jaw plate on the pitman and the fixed jaw are arranged to be closer together at their lower than at their upper ends so that rock and the like is wedged downwardly between these elements while crushing is taking place.

In such jaw crushers the upper end of the pitman is eccentrically journaled on an overhead shaft with the lower end of the pitman being restrained somewhat against the reciprocatory motion by a toggle plate arrangement. In this way the upper end of the pitman reciprocates through a somewhat longer path than the lower end thereof. For example, a given point on the crushing surface of the upper portion of the movable jaw plate will pass through a generally circular path during reciprocation of the pitman, while a point on the crushing surface at the lower end of this jaw plate will describe a shorter, oval-shaped path. The natural result of such rocking jaw plate motion is a downward crowding action exerted on the rock at all points between the movable and fixed jaw plates.

This forced feed action inherent in the operation of most overhead eccentric jaw crushers is found to promote uneven wear of the jaw plates. Moreover, it is found that such wedging action tends to accelerate wear of the lower portion of the stationary jaw plate and the central portion of the movable jaw plate. Such uneven wear of conventional jaw plates so changes the shape of the crushing chamber that the rock does not progress uniformly through the crusher, with the result that the production of crushed material is greatly reduced until the jaw plates can be replaced.

Accordingly, it is a primary object of the present invention to compensate for uneven jaw plate wear in such a crusher by providing cooperating crusher plates of novel construction.

More specifically, it is an object to provide in an eccentric overhead type crusher a pair of cooperating jaw plates adapted to efficiently crush rock or the like and yet shaped to assure more uniform wear over their entire crushing surfaces so that the plates retain their original shape longer. An ancillary object is to provide movable and fixed jaw crusher plates which have an unusually long wearing life as compared to conventional plates and are formed using a minimum quantity of plate material. It is a related object to provide a crusher plate construction which is capable of efficiently crushing over a wide range of particle size.

Another object of the invention is to provide a pair of novel crusher jaw plates which improve the efficiency of the crusher by increasing the output of crushed rock.

An allied object is to provide crusher jaw plates of improved configuration which bring about increased crusher production and yet consume less power than crushers having conventional jaw plates.

Yet another object of the invention is to provide novelly shaped crusher jaw plates for use in an overhead eccentric type jaw crusher, which are adaptable to efficiently grip the crushed rock therebetween and yet which reduce the side thrust normally encountered on the crusher pitman.

It is also an object of the invention to provide a pair of jaw crusher plates which may be economically produced and require no more plate material than is employed in conventional plates.

Finally, it is an object of the invention to provide a pair of jaw crusher plates of the type described which are susceptible of uniform heat treatment throughout their entire depth to impart to them tough, wear resistant qualities.

Other objects and advantages will become apparent upon reading the attached detailed description and upon reference to the drawing in which:

Figure 1 is a schematic side elevation of an illustrative overhead eccentric type jaw crusher, showing the jaw crusher plates which are the subject of the present invention.

Figs. 2 and 3 are perspective views of the movable and fixed jaw plates, respectively, which are employed in practicing the present invention.

Fig. 4 is an enlarged fragmentary section view taken along the line 4—4 in Fig. 2.

Fig. 5 is an enlarged fragmentary sectional view taken along the line 5—5 in Fig. 3.

Figs. 6, 7 and 8 are transverse fragmentary cross sectional views taken along the lines 6—6, 7—7, and 8—8 in Fig. 4.

Fig. 9 is a fragmentary transverse cross sectional view taken through the fixed and movable jaw plates which are employed in practicing the present invention.

Fig. 10 is a fragmentary transverse cross sectional view taken through a pair of opposed fixed and movable conventional jaw plates, which plates are corrugated over their entire crushing surfaces.

While the invention is described in connection with a preferred embodiment thereof, it will be understood that it is not intended to limit the invention thereto, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Turning now to the drawings, there is shown in Fig. 1 for illustrative purposes a schematic view of a typical overhead eccentric type crusher 10. As will be seen the crusher 10 includes a frame 12 and opposed base elements 14 and 16 on opposite sides of the machine. In the usual case the base element 14 backs up a vertically adjustable pull wedge 18 against which rests a bearing wedge 20. The crusher frame 12 journals an eccentric shaft 22 which has a flywheel (not shown) on one end and is driven by conventional means (not shown) on the other end.

A substantially vertically disposed pitman or movable jaw 24 is actuated by the overhead eccentric shaft 22, the lower end of the pitman being held in spaced relation to the bearing wedge 20 by means of a toggle plate 26. Mounted on the pitman 24 and the frame base member or fixed jaw 16 are movable and fixed jaw plates 30, 40, respectively.

Crushing of rock and the like is accomplished by rotation of the eccentric shaft 22 which causes the pitman 24 to move toward and away from the machine base 16. Accordingly relative motion as between the mov-

able and fixed jaw plates 30 and 40 results in a crushing action upon rock passing downwardly through the machine.

In the usual overhead eccentric crusher the lower ends of the pitman 24 and the plate 30 carried thereon are spaced much closer to the fixed plate 40 than are the upper ends thereof. The combination of the overhead eccentric at the top of the pitman 24 and the toggle plate 26 at the lower end of the pitman produces a crushing motion by the movable plate 30 that is circular at the top and gradually changes to a motion that is oval at the bottom. That is to say the upper end of the pitman mounted plate 30 follows a path which is circular and somewhat longer than the path followed by the lower end of this plate, which latter path approximates an oval shape due to the partial restraint thereon of the toggle plate 26. As a result a downward crowding or crushing action is exerted on rock passing through the machine.

In carrying out the invention, the movable and fixed jaw crusher plates 30, 40 each have a crushing surface divided into smooth and corrugated sectional areas so arranged that a smooth area on one plate is opposed to a corrugated area on the other plate. In this instance, it will be seen upon reference to Figs. 2 and 3 that the jaw plates 30, 40 respectively, secured to the pitman 24 and frame member 16, each comprises a rigid flat member having a generally rectangular outline and a slightly arcuate profile. As shown, the front crushing surface of the movable jaw plate 30 has three transversely extending sections, a top section 31, a central section 32 and a bottom or discharge section 33. The top or input section 31 of the plate 30 is formed with deep vertical corrugations which, in transverse section, have the shape of a sine wave. The next or central section 32 has a substantially smooth face, while the lowermost section 33 is formed with deep vertical corrugations similar to the top section. Between the corrugated and smooth sections are transitional regions indicated at 34, 35 in which the nature of the surface changes gradually from one type to the other, thereby avoiding any sudden discontinuity.

The plate 40 is similar to the plate 30 having corresponding sections, namely an input section 41, a central section 42 and an output section 43. These sections are surfaced complementary to the sections of the plate 30, the top section being smooth, the central section corrugated with vertical corrugations, and the bottom section being smooth. As in the case of the plate 30, transitional regions 44, 45 are provided to avoid an abrupt change from smooth to corrugated.

In practice the wearing plates 30, 40 are preferably cast from a manganese steel alloy which is wear resisting under hard use due to the ductility imparted by the manganese component. The plates are formed with a plurality of spaced vertical slots 50 arranged parallel to one another in the crushing surfaces thereof. Such slots 50 are preferably alined with the valleys of the corrugations. The primary purpose is to facilitate rapid cooling of the rather massive plate incident to heat treatment thereof, thereby tempering and toughening the metal for the rugged use that it must undergo in crushing rock and ore.

In the practical case each plate 30, 40 may have outline dimensions of four feet by about eight feet and may be approximately six inches thick at the center tapering off to about four inches at the ends. The corrugations are preferably spaced about five and one half inches apart valley to valley, having a depth on the order of two inches. The grooves 50 have a depth of about three and one half inches. The configuration of the crushing surface of the movable plate 30, for example, is also illustrated upon reference to Figs. 6, 7 and 8 which are transverse cross sectional views taken therethrough.

Referring to Fig. 9 there is shown a typical cross sectional view taken at the lower ends of the respective wearing plates 30, 40 employed in practicing the invention. Illustrative rock particles 52 are shown being crushed between the opposed corrugated face 33 of the movable jaw plate 30 and the lower smooth face 43 of the fixed jaw plate 40. Such cooperation as between smooth and corrugated crushing faces assures efficient and positive crushing action without the high power consumption attendant with use of conventional crusher plate constructions. It is found that this arrangement results in substantially longer life of the central and lower portions of both the movable and fixed jaw plates 30, 40. When the plate wear becomes excessive the fixed plate 40 may be reversed end for end to subject the other end to wear.

To illustrate the marked difference between the wearing plate configuration employed in practicing the invention and conventional wearing plate arrangements, reference is made to Fig. 10. There are shown a pair of opposed jaw crusher wearing plates 54, 56 which plates are both corrugated over their entire crushing surfaces in the manner of most conventional wearing plates. Rock particles 58 being crushed are gripped between opposed raised corrugations and complementary grooves. It will be apparent to one skilled in the art that a high degree of side thrust is exerted on the plates as a result of the crushing action. The extremely high thrust forces encountered present serious problems in the mounting of the movable crusher pitman. As distinguished from this, the jaw crusher plates of the present invention are designed to minimize side thrust forces by the elimination of opposed corrugations and the employment instead of opposed corrugated and smooth plate portions.

Moreover, one of the important features of the present invention resides in the provision of smooth and corrugated portions on each of the movable and fixed jaw plates 30, 40 without at the same time increasing the weight or cost or these plates. Since the corrugated plate areas of the plates 30, 40 are in the zone of least wear, it is possible to provide sharper and deeper corrugations on the illustrative plates. Such sharper corrugations result in more positive and complete rock crushing action. Any tendency of the sharper corrugations to wear faster than conventional corrugations is overcome by the provision of the smooth plate portions 32, 41, 43 over the plate areas subjected to the greatest wear. Thus the sharp corrugations are disposed over the plate portions undergoing the least wear. Experience has shown that such provision of smooth jaw plate portions over areas subjected to extreme wear greatly reduces the side thrust forces normally exerted on the crusher pitman when the plates are conventionally corrugated over their entire surfaces.

Another advantageous feature of the present invention is that an optimum relationship is attained between plate wear and operating power consumption. The provision of the complementally formed smooth and corrugated opposed crusher plate portions results in an efficient rock crushing action while at the same time avoiding the dissipation of unusable energy in the rapid wearing down of opposed plate corrugations. The more efficient crushing action adds to the lift of the crusher itself since the operating parts thereof are subjected to less wear and tear. For example, it is found that the crusher bearings have an increased life due to their not becoming overheated.

From the above it will be seen that the novel wearing plates disclosed herein possess a longer service life than conventional plates because they eliminate opposed corrugated surfaces at the points of greatest wear in the crusher, which corrugated surfaces inherently tend to wear faster than smooth surfaces. At the same time the provision of a relatively deeply corrugated surface on one of the opposed plate portions at areas of least wear

serves to prevent inefficient slippage of uncrushed rock downward therebetween.

It should be understood that although the invention has been described as employed with an overhead eccentric type crusher, there is no intent to limit the invention to this environment. Thus the present invention might also be advantageously employed in the crushing chambers of cone or gyratory crushers, or the like.

I claim as my invention:

1. A jaw crusher comprising, in combination, a crusher frame, a fixed jaw rigid with the frame, a movable jaw, means supporting the movable jaw from the frame for substantially bodily reciprocatory movement toward and away from the fixed jaw, means for actutaing said movable jaw toward and away from the fixed jaw including a drive shaft and eccentric cam means thereon, a first plate mounted on said fixed jaw and presenting a crushing face having formed therein a plurality of spaced grooves and having a corrugated central portion and smooth end portions, and a second plate mounted on said movable jaw for cooperating with said first plate to crush rock and the like therebetween, said second plate presenting a crushing face having formed therein a plurality of spaced grooves and having corrugated end portions and a smooth central portion so that substantially all of the rock crushing takes place between opposed corrugated and smooth portions of the respective plates.

2. A jaw crusher comprising, in combination, a crusher frame, a fixed jaw rigid with the frame, a movable jaw, means supporting the movable jaw from the frame for substantially bodily reciprocatory movement toward and away from the fixed jaw, means for actuating said movable jaw toward and away from the fixed jaw, a first plate mounted on said fixed jaw and presenting a crushing face having a corrugated central portion and smooth end portions, and a second plate mounted on said movable jaw for cooperating with said first plate to crush rock and the like therebetween, said second crusher plate presenting a crushing face having corrugated end portions and a smooth central portion.

3. In an overhead eccentric type jaw crusher for crushing rock and the like, a pair of cooperating and opposed jaw crusher plates, one of said plates being non-movable and presenting a crushing face having a corrugated central portion and smooth end portions, and the other of said plates being mounted for substantially bodily reciprocatory movement toward and away from the non-movable plate and presenting a crushing face having corrugated end portions and a smooth central portion so that rock passing between said plates is crushed between opposed smooth and corrugated plate portions.

4. A pair of cooperating and opposed jaw crusher plates for use in an overhead eccentric type jaw crusher, one of said plates presenting a relatively smooth crushing face in areas of extreme wear and a corrugated crushing face in areas of less severe wear, and the other of said plates having smooth and corrugated crushing face portions complementally formed with respect to said first mentioned crushing face so that substantially all of the rock crushing takes place between opposed corrugated and smooth portions of the respective plates.

5. A pair of cooperating and opposed jaw crusher plates for use in an overhead eccentric type jaw crusher, one of said plates presenting a relatively smooth crushing face in areas of extreme wear and a corrugated crushing face in areas of less severe wear, and the other of said plates having smooth and corrugated crushing face portions complementally formed with respect to said first mentioned crushing face so that substantially all of the rock crushing takes place between opposed corrugated and smooth portions of the respective plates, the corrugated and smooth plate portions of each plate gradually changing from one to the other.

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