

Feb. 9, 1943.

E. WERNER ET AL

2,310,758

IMPACT MEMBER FOR IMPACT CRUSHERS

Filed July 15, 1940

4 Sheets-Sheet 1

Fig. 1.

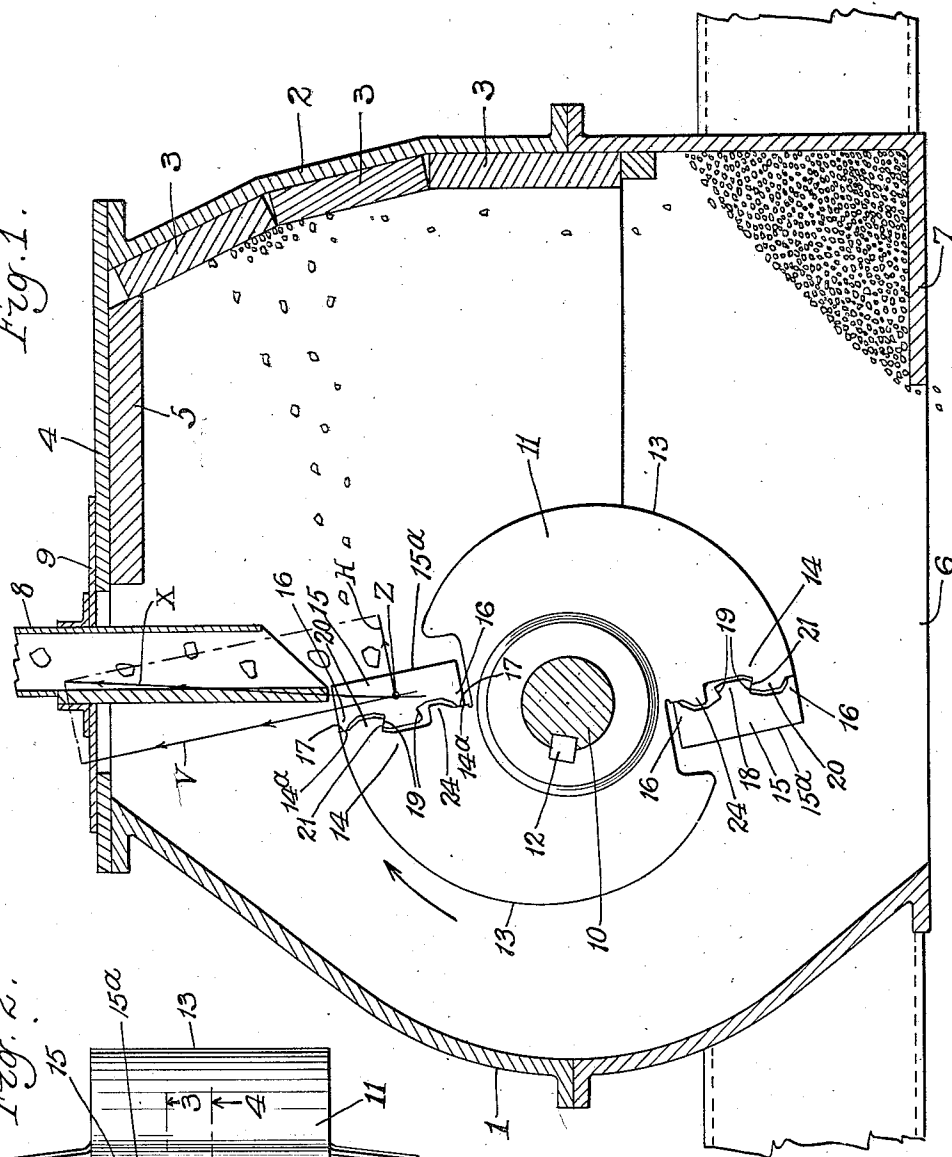
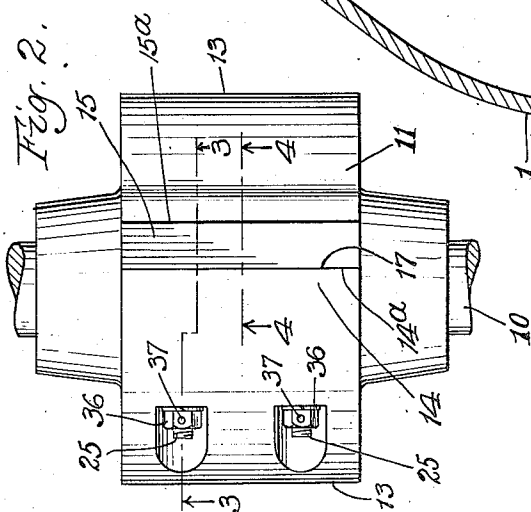


Fig. 2.



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4 Sheets-Sheet 2

Fig. 3.

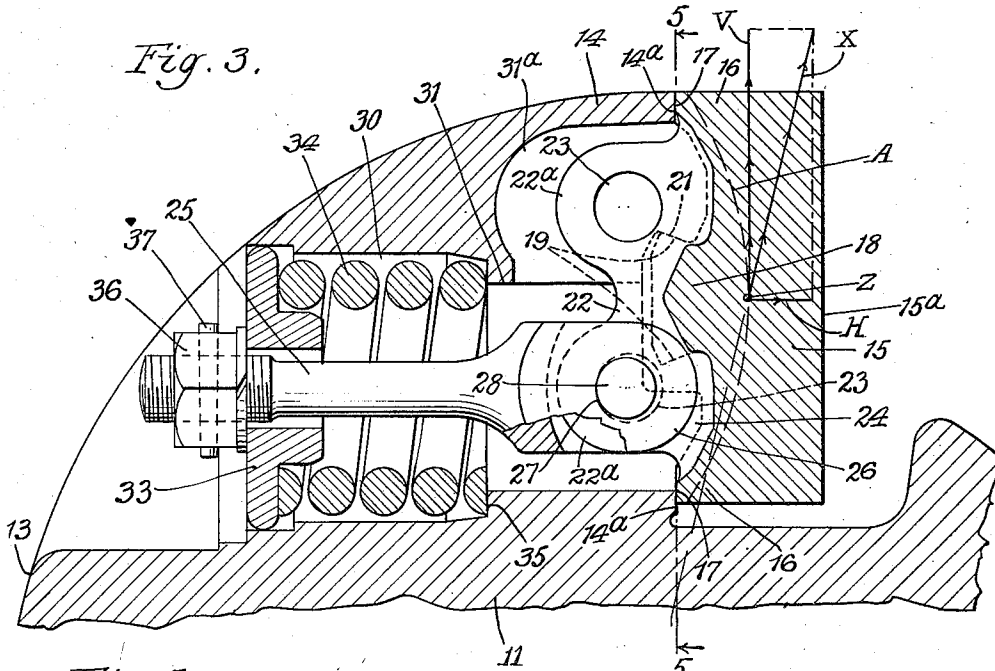


Fig. 5.

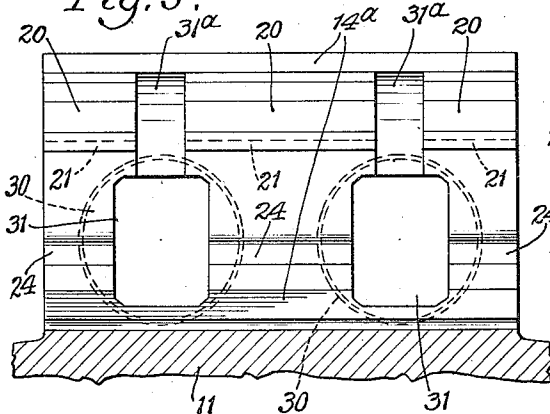


Fig. 4.

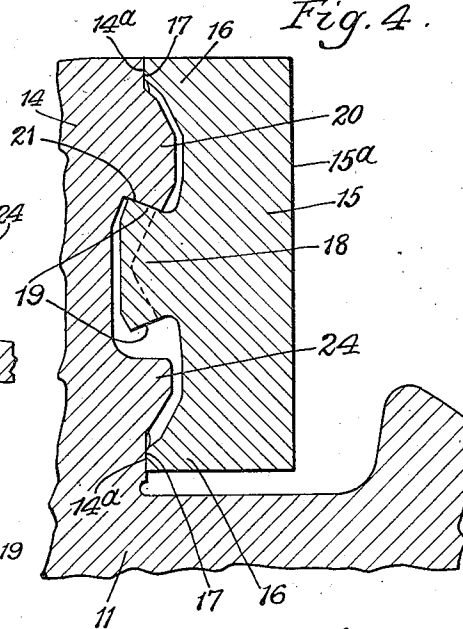
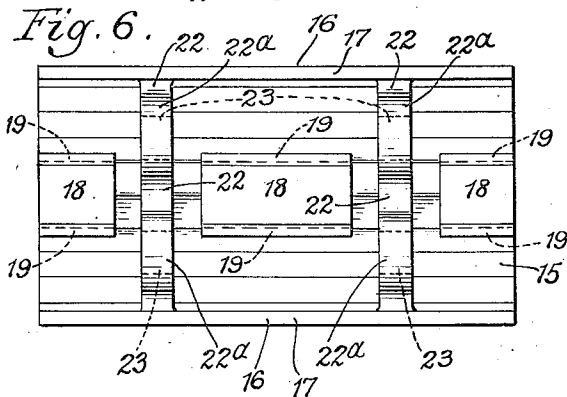


Fig. 6.



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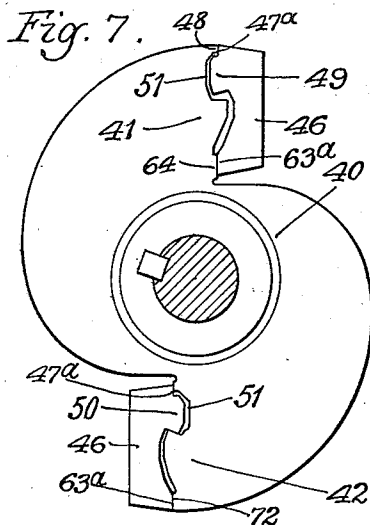
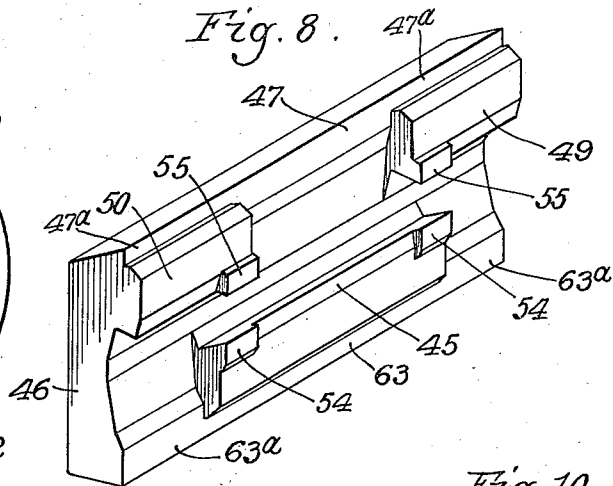
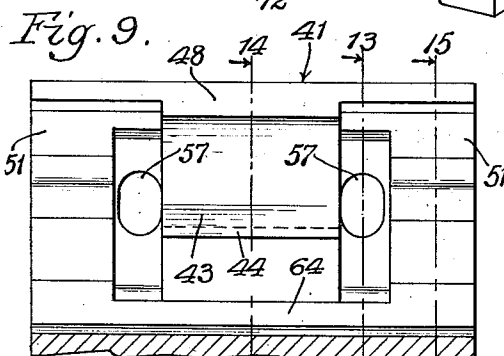
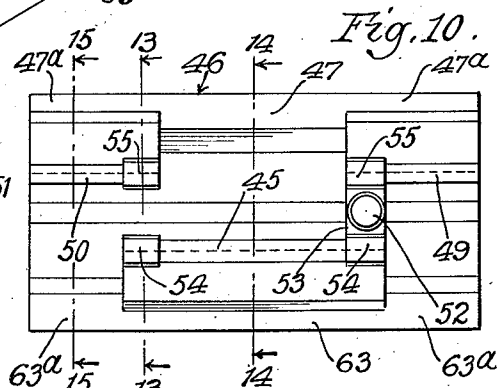
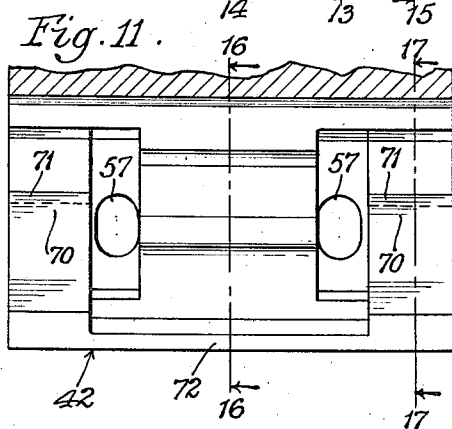
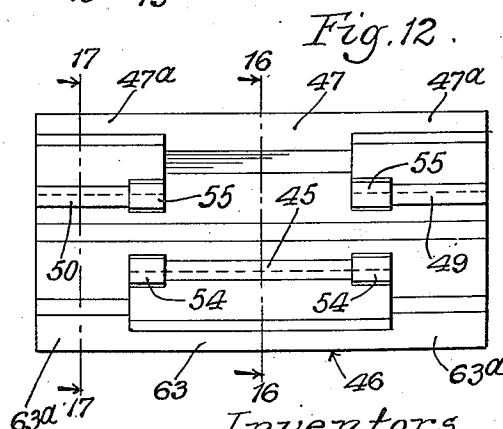
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4 Sheets-Sheet 4

Fig. 13.

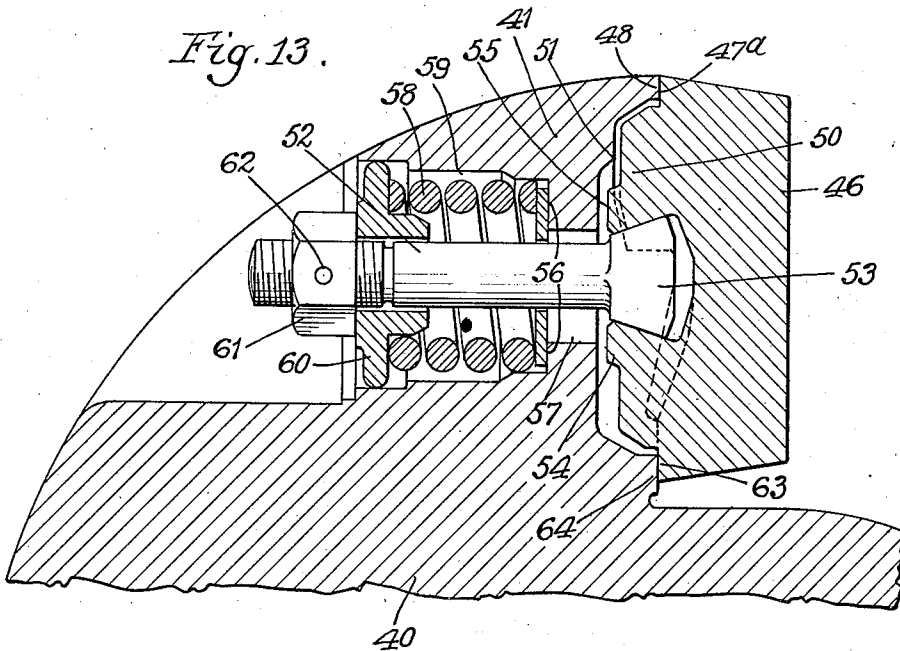
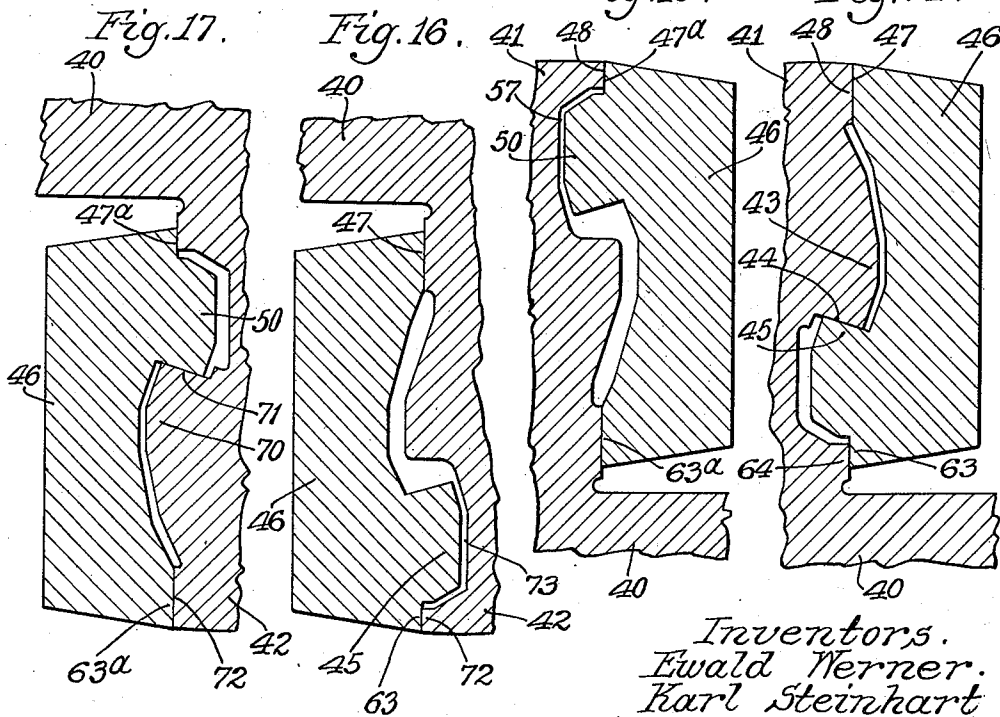


Fig. 15.

Fig. 14.



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## UNITED STATES PATENT OFFICE

2,310,758

## IMPACT MEMBER FOR IMPACT CRUSHERS

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Application July 15, 1940, Serial No. 345,570

18 Claims. (Cl. 83—46)

Our invention relates to an improvement in impellers and impact plates for impact crushers.

One purpose is the provision of an improved impeller embodying means for holding the impact plates against the terrific centrifugal force caused by the rapid rotation of an impact impeller.

Another purpose is the provision of an impeller and an impact plate which interlock with each other and thereby resist the centrifugal tendency for the impact plate to be thrown from the impeller.

Another purpose is the provision of means co-operating with the interlock to hold the plate in position.

Another purpose is the provision of impact plates and securing means therefor which permit the plates to be reversed in order to increase the effective life of the plates.

Other purposes will appear from time to time in the course of the specification and claims.

We illustrate our invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a housing in section illustrating the rotor in side elevation;

Fig. 2 is a plan view of the rotor;

Fig. 3 is a section at 3—3 on Fig. 2;

Fig. 4 is a section at 4—4 on Fig. 2;

Fig. 5 is a section at 5—5 on Fig. 3, with parts omitted;

Fig. 6 is a rear view of the impact plate removed from the rotor;

Fig. 7 is a side elevation showing a modified form of rotor and plate;

Fig. 8 is an isometric view of the rear of the plate;

Fig. 9 is a view of the top face of the rotor as shown in Fig. 7, with wearing plate removed;

Fig. 10 is a rear view of the plate as used on Fig. 9;

Fig. 11 is a view similar to Fig. 9 of the lower face of the rotor; ;

Fig. 12 is a rear view of the plate as used on the lower face of the rotor;

Fig. 13 is a view similar to Fig. 3, showing the plate in position on the rotor, the section being made on the lines 13—13 of Figs. 9 and 10;

Fig. 14 is an assembled section at the lines 14—14 on Figs. 9 and 10 of the rotor and plate;

Fig. 15 is an assembled section of rotor and plate at lines 15—15 on Figs. 9 and 10;

Fig. 16 is an assembled section of rotor and plate at lines 16—16 on Figs. 11 and 12; and

Fig. 17 is an assembled section of rotor and plate at lines 17—17 on Figs. 11 and 12.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, I generally indicate a crusher housing, which may be mounted on any suitable base. It includes a forward wall 2, having fixed impact members or plates 3. 4 indicates a top member or cover provided with a liner plate 5. If desired, the upper portion of the housing may be made removable, or any suitable access means may be provided for the interior of the housing. 6 generally indicates a discharge opening at the bottom of the housing, through which the crushed material may be deposited.

The material is centrifugally thrown by the below described impeller, for example against the plates 3, and will thus extend against the top liner plate 5. The material drops, and may for example be received on a bottom shelf 7, and thence flows downwardly through the aperture 6.

8 is any suitable feed chute, herein shown as vertical, and which may be transversely adjustable, as upon the supporting plate 9. The details of the chute and plate 9, however, do not of themselves form part of the present invention, it being understood that any suitable means may be employed to project or drop the particles to be crushed into the path of the impact members of the impeller.

10 indicates an impeller shaft, which may be driven in any suitable manner, not herein shown. 11 is an impeller body or hub keyed upon the shaft, as by the key 12. The body 11 is spiraled as at 13, 13, the spirals terminating in enlarged front base portions 14, 14. It will be understood that any suitable form of impeller may be employed, but this is a convenient method for providing abutments to receive impact plates, generally indicated as at 15. Each such plate has a generally plane forward or impacting face 15a. It is also provided with reinforced top and bottom edge portions 16, terminating in abutting faces 17, herein shown as lying in a common plane and abutting against corresponding surfaces formed on the impeller abutment portions 14.

Extending from end to end of the plate, about halfway between top and bottom thereof, is a flange or dovetail 18, having at each side an overhanging wedge face 19. Penetrating into the space between the flanges 16 and 18 at the top of the plate when the plate is in the position shown in Fig. 4, is a flange 20, outwardly extending from the abutment portion 14 to the rotor,

and provided with a wedge face 21 opposed to the wedge face 19 of the flange 18. Intermediate the ends of the plate, as shown in Fig. 6, are rearwardly extending flanges or ridges 22, 22, each of which is provided with a pair of enlargements 22a formed with apertures 23, the plane of which is parallel with the length of the impact plate 15.

When the impact plate is in the position of Figs. 3 and 4, the faces 17 of the flanges 16 abut against the corresponding surfaces 14a of the rotor abutment portions 14, and the inclined surface 19 of the flange 18 interlocks with and abuts against the opposed surface 21 of the upper or outer flange 20 of the abutment portion 14.

A smaller flange 24 is illustrated as extending into the space between the lower flange 16 and the central flange 18 of the impact plate, but with the plate formed as shown in Fig. 4, the flange 24 is normally out of contact with the rear of the plate.

Referring to Fig. 1, it will be observed that a radial centrifugal thrust, indicated by the line X, is resisted by the interlocking action between the flanges 18 and 20. The centrifugal force may, for example, be in the neighborhood of 90,000 pounds, exerted generally radially. The above mentioned interlock between the rear of the plate and the face of the rotor provides a locking means in response to centrifugal force, which holds the outside edge or upper flange 16 of the impact plate 15 in position against the opposed face 14a of the impeller.

The major portion of the centrifugal force is resisted by the interlock between plate and impeller, at 19, 21, but there is a lateral thrust, which is substantially less, indicated for example by the horizontal component H of the force diagram of Figs. 1 and 3. In order to take up this lateral thrust we provide tension means in the form of bolts 25, of which two are shown, each bolt having a fork 26 surrounding the lower flange portions 22a and having apertures 27 aligned with the apertures 23 of the flange portions 22a. Pivot pins 28 are inserted through the three flanges, thus providing a flexible connection between the bolts 25 and the lower flange portions or ears 22a.

The rear of each enlarged portion 14 of the rotor is penetrated by a pair of apertures, the outer portions of which may be generally cylindrical, as at 30, the inner portions of which may be squared or generally rectangular, as at 31. The bolts 25 extend outwardly through these apertures and receive abutment members 33.

34 are springs compressed between ledges 35, centered by the inner ends of the rounded portions 30, and the abutment members 33, on the bolts 25. The compression of the springs 34 can be controlled by the nuts 36, which may be properly said to prevent over compression of the springs, as by dropping a pin 37 through mating apertures in the nuts 36 and the outer end of the bolts. In the response to the compression of the springs 34, the bolts 25 are urged to the left, referring to the position of the parts in Fig. 3, and the thrust of the springs is sufficient to hold the lower or inner face 17 of the flange 16 of the plate 15 firmly against the opposed face 14a of the abutting portion 14 of the impeller. Recesses 31a receive the outermost ears 22a.

Referring to the force diagram on Figs. 1 and 3, Z may indicate the center of gravity of the plate 15, X the centrifugal force, V the vertical component of this force, and H the horizontal or lateral component. This relatively small lateral component is readily taken up by the springs 34.

The pin 37 is effective to prevent undue compression of the springs 34, which might result in breakage. The sloping portion 21 of the projection 18 tends to aid the spring 34 in overcoming the horizontal force H.

The relation between the impact face 15a of the plate 15 and the path of the falling particles, and the speed of movement of the impeller, is such as to provide, in the first place, a substantially complete penetration of the particles into the path of the plates, and, in the second place, a substantially full face crushing impact whereby there is a minimum abrasion of the face of the plates. The wear, however, is concentrated in the center and upper portion of the plates, and the upper portion of the plate eventually wears down fairly deeply. In order to economize on metal and to increase the life of the plate, all that is necessary is to reverse the plate after the limit of wear is reached. This limit of wear may be theoretically indicated by the line A in Fig. 3. When the upper portion of the plate is pretty well worn down, the plate may be removed by removing the pins 37, releasing the nuts 36, and drawing the bolts 25 forwardly through the aperture through which they pass. The plate is then reversed, and the bolts 25 are removed from the ears 22a to which they have been pivoted, and are positioned in the opposite ears. If this were not done, a reversal of the plate would leave the bolts secured to the upper or outer ears. The plate is then drawn in position as above described, and the unworn or less worn inner edge of the plate now becomes the outer edge, which is subjected to maximum wear.

In the form of Figs. 1 to 6, each plate 15 may be reversed on the particular seat or abutment portion 14. In the form of Figs. 7 and following, when the plates are reversed, they must be transferred to the opposite seat, as there is a differentiation between the seats. Referring for example to Fig. 7, the impeller is generally indicated as 40, and is shown with abutment portions 41 and 42.

Referring first to the abutment portion 41, as shown for example in Figs. 9 and 14, we provide a centrally located flange 43, with a locking lip 44, opposed to a corresponding locking lip 45 on the lower central portion of the impact plate 46. 47 is an abutting surface along the upper edge of the plate 46, which engages the corresponding bearing portion 48 on the impeller. As will be shown from a comparison of the sections of Figs. 13 and 14, this bearing portion is of somewhat greater width at the center of the plate than it is at the ends of the plate where it narrows, as at 47a. Along the upper edge of the plate 46, as shown in Fig. 8, we provide a pair of flanges 49, 50, which are effective as locking members when the plate is reversed. When the plate is in the position in which it is shown in Fig. 7, they are simply received in recesses 51 of the impeller.

In order to lock the plate in position against the above discussed lateral thrust, we provide bolts 52, with wedge heads 53, which penetrate between the overlapping ends of the flanges 49, 49, and 50. These may be somewhat enlarged or rearwardly extended, as at 54, 55, to provide an adequate seat for the wedge head 53. 56 indicates a spring seat, shown as an enlargement of the apertures 57 through which the bolts 52 pass. A spring 58 is located in the enlarged aperture portion 59, and is compressed as by the spring abutment member 60, which may be positioned by the nut 61, which in turn is held in adjusted position by the pin 62. The compression of the

5 springs 58 is sufficient to draw the lower edge of the abutment portion 63 of the plate 46 against a corresponding opposed portion 64 of the impeller. As shown for example in Fig. 13, this abutment portion 63 is narrowest along the flange 45 and widens out somewhat at the ends beyond the flange 45, as at 63a. It will be understood that, when the plate 46 is in the position in which it is shown in Figs. 7, 13 and 14, the interlock which resists the major centrifugal thrust is provided at 44, and the flanges 49 and 50 do not perform an interlocking function to resist the centrifugal thrust. As previously pointed out, the sloping portion 44 of the projection 45 acts to aid the bolt 52 to hold the impact plate 46 against the effect of the horizontal force H.

When the upper portion of the plate 46 has been worn down, it is then reversed and positioned on the opposite abutment 42, illustrated for example in Figs. 16 and 17, and in full face in Fig. 11. This lower seat 42 is provided at each end with flanges 70 having an interlocking surface 71 for interlocking engagement with the lugs or flanges 49 and 50 at the ends of the plate. Since the plate has been reversed, these lugs 49 and 50 are now at the inner edge of the plate, and the outer edge of the plate, as at 63, 63a, abuts against the impeller, as at 72. Meanwhile, the central flange 45, which in the initial position of the plate performed the locking function, is now located within a depression 73 of the impeller abutment portion 42. Since the bolts 52 are located intermediate the upper end lower edge of the plate, they are not changed as to position, and perform the same function at each position of the plate. Thus, when the plate is in the upper position of Fig. 7, the compression spring 58 draws the abutment surface 63, 63a against the corresponding surface 64 on the impeller. When the plate is reversed and is positioned on the opposite impeller seat, it has the surface 63, 63a, which is drawn against the abutment 72.

It will be realized that, whereas we have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of our invention. We therefore wish our description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting us to our precise showing. The use and operation of our invention are as follows:

In impact crushers of the type herein shown, in which the particles are permitted to fall or move freely into the path of movement of the plates 15 or 46, the rotor is rotated at high rotational speeds. The plates 15 and 46, which are massive members formed for example of manganese steel, are urged centrifugally outwardly in relation to the rotor. The centrifugal force may be in the neighborhood of as high as ninety thousand pounds, this force being exerted generally radially. So far as this thrust is radial, it may be made by providing an interlock or dovetail between the plate 15 or 46 and the impeller.

In the form of Fig. 1 and following, the central flange 18 performs this function. It is located along the central line of the plate 15 and has interlocking surfaces 19 at top and bottom thereof, which interlock with the overhanging portion 20 of the impeller. The plate is simply reversed when worn. However, the thrust is not completely radial, and there is a lateral component, as indicated by the force diagram of Figs.

1 and 3. This lateral component is taken up by the bolts 25 and the springs 34, which are adequate to hold the inner or lower edge of the plate 15 firmly seated against the abutting portion 17 of the impeller. The interlock of the inclined surfaces 21 or 44 also acts to assist in holding the impact plates against the effect of the horizontal force H. When the plate is reversed, the bolts 25 are also reversed, or moved to what were the opposite eyes, and the life of the new impeller is doubled.

In the form of Figs. 7 and following the plates are reversible, but since the upper and lower halves of the plates and the corresponding seating portions of the impeller are isometric, it is necessary, when each plate is reversed, to position it on the opposite seat. The securing means, however, the bolts 52, are centrally located and do not have to be changed. The same force diagram, however, will apply to both forms, and in each case the major centrifugal thrust is taken care of by an interlock between the plate and the impeller, while the lateral thrust is resisted by securing bolts and springs, as well as the interlocking surfaces.

We claim:

1. In an impact crusher, an impeller and means for rotating it, and an impact plate reversibly mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending flange located midway between the upper and lower edges of the plate, said flange having undercut bearing surfaces at top and bottom thereof, said impeller having an aperture adapted to receive said flange, said aperture having a mating undercut surface adapted to engage either of the undercut bearing surfaces of the flange, and additional means for drawing the inner edge of the plate against said impeller, said aperture having a minimum radial width sufficiently greater than the maximum radial width of said flange to permit the ready insertion of said flange directly into said aperture.

2. In an impact crusher, an impeller and means for rotating it, and an impact plate reversibly mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending flange located midway between the upper and lower edges of the plate, said flange having undercut bearing surfaces at top and bottom thereof, said impeller having an aperture adapted to receive said flange, said aperture having a minimum radial width greater than the maximum radial width of said flange, said aperture having a mating undercut surface adapted to engage either of the undercut bearing surfaces of the flange, and additional means for drawing the inner edges of the plate against said impeller, including a tension member extending rearwardly from said plate, said impeller being apertured to receive it, and means for securing it in relation to said impeller, and means for selectively securing said tension member to said plate at one of a plurality of points.

3. As a new article of manufacture, an impact plate for impact crushers, including a body portion and a rearwardly extending lug in the rear face thereof, said lug having one or more undercut faces, a tension member extending from the rear face of said plate, and means for selectively securing said tension member to said plate at one of a plurality of radially spaced points, said body portion having an aperture adapted to receive

said lug, the minimum radial width of said aperture being greater than the maximum radial width of said lug.

4. As a new article of manufacture, an impact plate for impact crushers, including a body portion, a rearwardly extending lug extending longitudinally along the rear face thereof, substantially midway between the upper and lower edges thereof, said lug having undercut faces at each side thereof, the rear face of said plate being formed with longitudinally extending depressed portions intermediate said lug and each of the long edges of the plate, said body portion having an aperture adapted to receive said lug, the minimum radial width of said aperture being greater than the maximum radial width of said lug.

5. As a new article of manufacture, an impact plate for impact crushers, including a generally rectangular body portion and a rearwardly extending lug in the rear face thereof, substantially midway said upper and lower edges, and generally parallel therewith, said lug having undercut faces along the upper and lower edges thereof, and an additional lug extending substantially perpendicular to the upper and lower edges of the plate, said lug having a plurality of apertures therein.

6. As a new article of manufacture, an impact plate for impact crushers, including a generally rectangular body portion and a rearwardly extending lug in the rear face thereof, substantially midway said upper and lower edges, and generally parallel therewith, said lug having undercut faces along the upper and lower edges thereof, and a tension member extending from the rear face of the impact plate, and means for selectively securing it to said plate at one of a plurality of radially spaced points, one of said points being located nearer the upper than the lower edge, and the other being located nearer the lower than the upper edge.

7. As a new article of manufacture, an impact plate for impact crushers, including a generally rectangular body portion and a plurality of rearwardly extending lugs at the rear face thereof, extending in general parallelism with the upper and lower edges of the impact plate, each such lug having an undercut face along one edge thereof, one of said lugs being nearer the upper than the lower edge, and another being nearer the lower than the upper edge of the plate, the undercut faces of said lugs being in opposition to each other, said lugs being of different length whereby they overlap but do not completely coincide.

8. As a new article of manufacture, an impact plate for impact crushers, including a generally rectangular body portion and a plurality of rearwardly extending lugs at the rear face thereof, extending in general parallelism with the upper and lower edges of the impact plate, each such lug having an undercut face along one edge thereof, one of said lugs being nearer the upper than the lower edge, and another being nearer the lower than the upper edge of the plate, the undercut faces of said lugs being in opposition to each other, and a tension member for said plate including a T-headed wedge bolt conforming to said opposed undercut faces.

9. In an impact crusher, an impeller, and means for rotating it, and an impact plate mounted on said impeller, and means for holding said impact plate against the major centrifugal thrust, including interpenetrating overlapping portions on the rear portion of

the plate and the opposed portion of the impeller, having opposed undercut faces on plate and impeller, located adjacent the outer edge of the plate and extending parallel with the axis of rotation of the plate, and additional means for locking the plate on said impeller, including a tension member between the plate and the impeller located adjacent the inner edge of the impeller, said interpenetrating overlapping portions on plate and impeller including a rearwardly extending lug on the plate and an aperture in said impeller adapted to receive it, the minimum radial diameter of said aperture exceeding the maximum radial diameter of the lug.

10. In an impact crusher, an impeller, and means for rotating it, and an impact plate mounted on said impeller, and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending lug on the rear face of the plate having an undercut face, said impeller having a single, opposed undercut face adapted to receive it and hold it against the centrifugal thrust of the plate, and a yielding tensional connection between said plate and said impeller, the axis of which is radially spaced from said lug.

11. In an impact crusher, an impeller, and means for rotating it, and an impact plate mounted on said impeller, and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending lug on the rear face of the plate having an undercut face, said impeller having a single, opposed undercut face adapted to receive it and hold it against the centrifugal thrust of the plate, and a tensional connection between said plate and said impeller, the axis of which is radially spaced from said lug, said tensional connection including an eye bolt, and a removable connection between said eye bolt and the plate.

12. In an impact crusher, an impeller, and means for rotating it, and an impact plate mounted on said impeller, and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending lug on the rear face of the plate having an undercut face, said impeller having a single, opposed undercut face adapted to receive it and hold it against the centrifugal thrust of the plate, and a tensional connection between said plate and said impeller, the axis of which is radially spaced from said lug, said tensional connection including an eye bolt, a perforated flange rearwardly extending from the plate, and a connecting pin therefor.

13. In an impact crusher, an impeller, and means for rotating it, and an impact plate mounted on said impeller, and means for holding said impact plate against the major centrifugal thrust, including a rearwardly extending lug on the rear face of the plate having an undercut face, said impeller having a single, opposed undercut face adapted to receive it and hold it against the centrifugal thrust of the plate, and a tensional connection between said plate and said impeller, the axis of which is radially spaced from said lug, said plate being reversible on said impeller, said tensional connection including an eye bolt, a flange rearwardly extending from the plate, and having a plurality of radially spaced perforations, and a connecting pin, one such perforation being aligned with the eye of said bolt when the plate is in one position, and the other when the plate is reversed.

14. In an impact crusher, an impeller and means for rotating it, and an impact plate mount-

ed on said impeller and means for holding said impact plate against the major centrifugal thrust, including interpenetrating overlapping portions on the rear face of the plate and the opposed portion of the impeller, each having a single opposed face parallel with the axis of rotation of the impeller, and yielding tension means for drawing the plate against the impeller, radially spaced from the opposed faces.

15. In an impact crusher, an impeller and means for rotating it, and an impact plate mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a flange rearwardly extending from the plate, the impeller being recessed to receive it, the flange and said recess having opposed undercut faces, the maximum radial extension of said flange being substantially less than the minimum radial extension of said recess, and additional tensional means for drawing said plate toward the impeller.

16. In an impact crusher, an impeller and means for rotating it, and an impact plate mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a flange rearwardly extending from the plate, the impeller being recessed to receive it, the flange and said recess having opposed undercut faces, the maximum radial extension of said flange being substantially less than the minimum radial extension of said recess, and additional tensional means for drawing said plate toward the impeller, said plate being reversible on the

impeller and having identical faces at each side thereof, adapted to be opposed to the radially exterior overhanging face of said recess.

17. In an impact crusher, an impeller and means for rotating it, and an impact plate mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a flange rearwardly extending from the plate, the impeller being recessed to receive it, the flange and said recess having opposed undercut faces, the maximum radial extension of said flange being substantially less than the minimum radial extension of said recess, and additional yielding tensional means for drawing said plate toward the impeller.

18. In an impact crusher, an impeller and means for rotating it, and an impact plate mounted on said impeller and means for holding said impact plate against the major centrifugal thrust, including a flange rearwardly extending from the plate, the impeller being recessed to receive it, the flange and said recess having opposed undercut faces, the maximum radial extension of said flange being substantially less than the minimum radial extension of said recess, and additional yielding tensional means for drawing said plate toward the impeller, said plate being reversible on the impeller and having identical faces at each side thereof, adapted to be opposed to the radially exterior overhanging face of said recess.

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