April 1, 1958 L. K. KNIGHT 2,828,922

CRUSHING MILL WITH HAMMER-ROTOR, AND ADJACENT ADJUSTABLE SUPPORT CARRYING TRAVELING-BREAKER-PLATE AND SCREEN

Filed Feb. 8, 1955 2 Sheets-Sheet 1

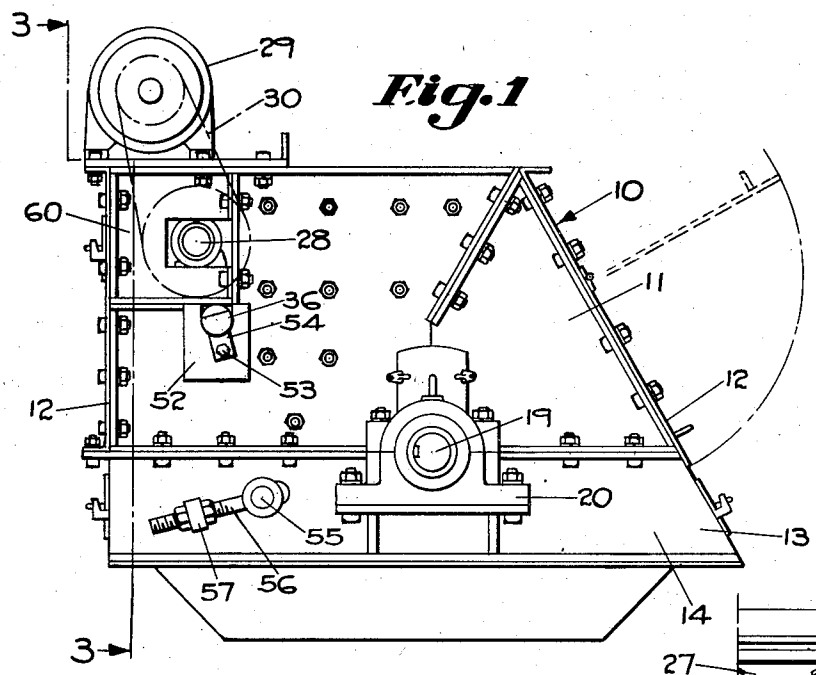


Fig. 1

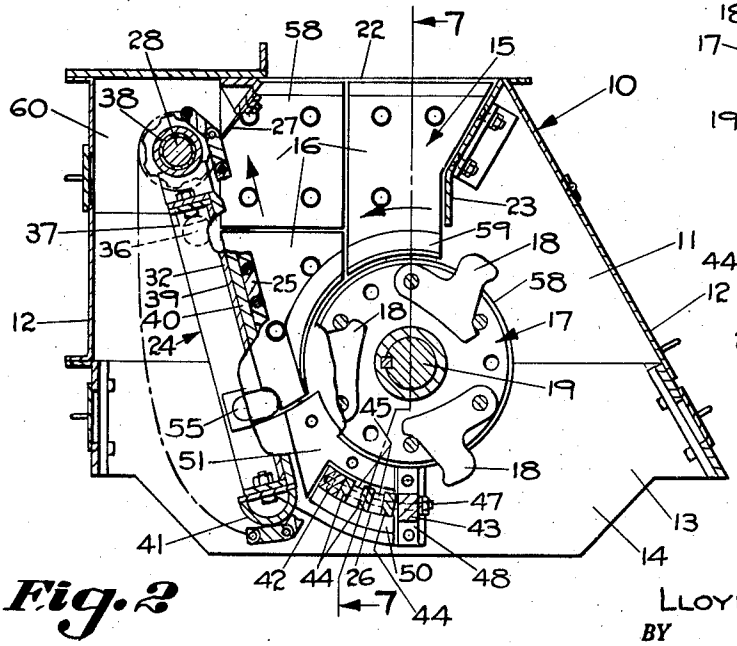


Fig. 2

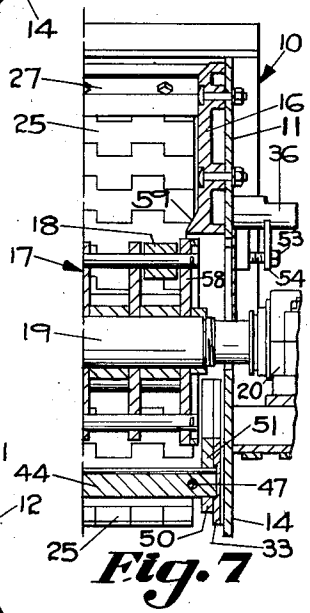


Fig. 7

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Fig. 3

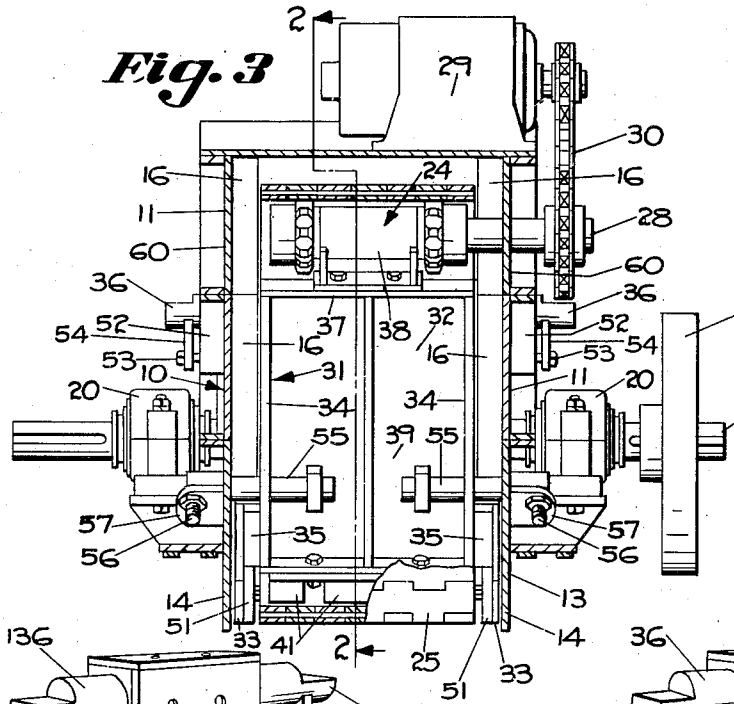
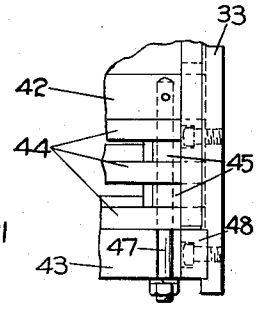


Fig. 6



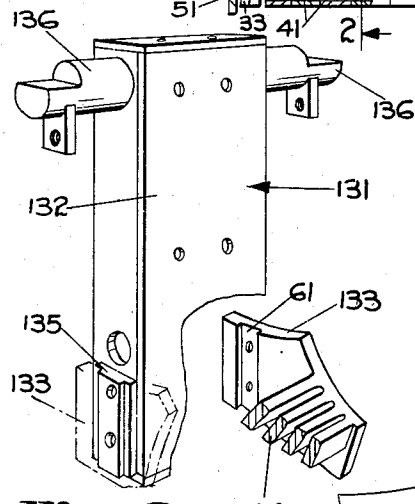


Fig. 8

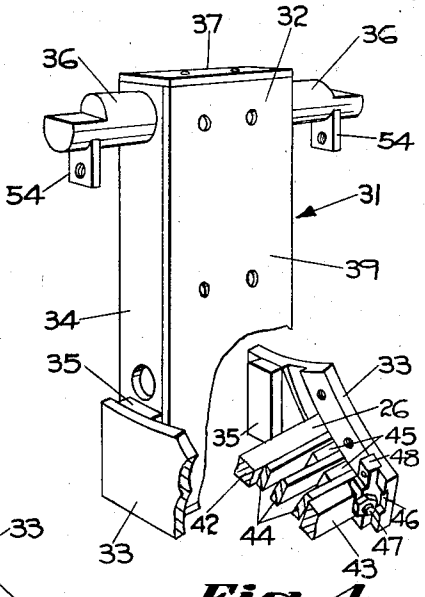


Fig. 4

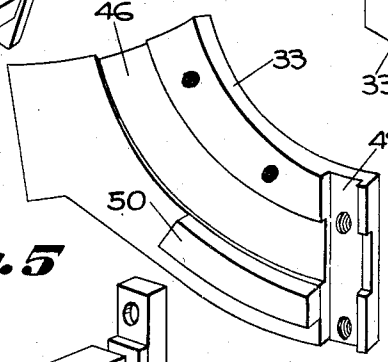
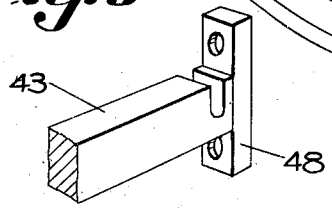


Fig. 5



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2,828,922

CRUSHING MILL WITH HAMMER-ROTOR, AND ADJACENT ADJUSTABLE SUPPORT CARRYING TRAVELING-BREAKER-PLATE AND SCREEN

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Application February 8, 1955, Serial No. 486,935

5 Claims. (Cl. 241—89)

This invention relates in general to material reducing apparatuses and more particularly to crushing, grinding or pulverizing apparatuses of the non-plugging type and to structures for use therein which may be employed with advantage in reducing different kinds of wet or sticky, as well as dry, materials such, for example, as ores, clays, phosphate shale, soft limestone, coal including clay, etc.

One object of the invention is to provide improved means for use in a crushing, grinding or pulverizing apparatus of the type set forth above that forms a support for a traveling breaker plate and a screen both of which cooperate with the rotor of the apparatus to reduce material.

Another object of the invention is to provide an improved crushing, grinding or pulverizing apparatus of the type set forth above including improved means, or the improved means per se, which means forms a support including a backing or bed plate about which a traveling chain breaker plate circulates while the latter cooperates with the crushing rotor of the apparatus and a screen also adapted to cooperate with the rotor and being spaced from the backing or bed plate whereby the traveling breaker plate may pass between said screen and backing or bed plate.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is a side view in elevation of a crusher, grinder or pulverizer apparatus including features of the invention and in which a flywheel is omitted;

Fig. 2 is a view in section and elevation showing the internal arrangement of the apparatus seen in Figs. 1 and 3, the section being taken on line 2—2 of Fig. 3 and looking in the direction of the arrows;

Fig. 3 is a view in section and elevation in which the major portion of the endless chain breaker plate is broken away, the section being taken on line 3—3 of Fig. 1;

Fig. 4 is a view in perspective, with portions broken away, of the screen and frame for carrying the endless chain breaker plate of the apparatus seen in Figs. 1, 2 and 3;

Fig. 5 is an exploded view in perspective of one of the screen side elements and a fragment of one of the screen bars seen in Fig. 4;

Fig. 6 is a view in plan of a portion of the screen seen in Fig. 4;

Fig. 7 is a view in section, the view being taken on line 7—7 of Fig. 2 looking in the direction of the arrows, the view showing only one-half of the symmetrical apparatus; and

Fig. 8 is a view in perspective, with portions broken away, of a modified form of screen and frame for carrying an endless chain breaker plate which may be substituted in the crusher, grinder or pulverizer seen in

Figs. 1, 2 and 3 for the screen and frame thereof which is shown in Fig. 4, the screen of Fig. 8 being a one-piece casting.

The crushing, grinding or pulverizing apparatus shown in the drawings includes a main frame, casing or housing 10 formed of upright end walls and side walls 11 and 12, respectively, mounted upon a rectangular base 13. As clearly indicated in Figs. 1, 2, 3 and 7 of the drawings, the upright end walls 11 are built up of a plurality of panels or plates including the upright end plates 14 of the base 13 and these upright end walls 11 form the upright end walls of the material reducing chamber 15 of the apparatus. Where the walls 11 would be subjected to wear by material being reduced they are provided with replaceable liner or wear plates 16.

A material reducing rotor 17 provided with hammers 18 extends across the bottom of material reducing chamber 15 and it rotates upon the axis of its central shaft 19 which extends transversely between, and at right angles to, the end walls 11. The ends of shaft 19 extend through the end walls 11 and are carried for rotation in suitable bearings 20 mounted on shelves made integral with the base 13. One end of shaft 19 carries a flywheel 21 (Fig. 3) and the other end of said shaft 19 may be driven by any well-known means from any suitable source of power, not shown, to drive the rotor 17 in the direction of the arrow seen in Fig. 2 of the drawings.

It may be mentioned that centrifugal force causes the hammers 18 to be maintained in their laterally outermost or crushing positions during the operation of the apparatus and that the hammers may swing radially inwardly when they strike material being reduced or non-crushable materials, such, for example, as tramp iron contained in the material.

The top of the main frame, casing or housing 10 is provided with a feed opening 22 through which material may be fed into the reducing chamber 15. Reduced material passes from the apparatus through the open bottom of the base 13.

An upright plate 23 at one side of the feed opening 22 extends transversely between the end walls 11 and forms one side wall of the reducing chamber 15. Plate 23 also functions as a chute for directing material fed into the reducing chamber 15 through the feed opening 22 toward the opposite side of the reducing chamber 15.

As seen in Fig. 2 of the drawings, the said opposite or left-hand side of the reducing chamber 15 is formed by an assembly 24 including a traveling breaker plate 25 and a screen 26 contained wholly within the main frame, casing or housing 10 and a breaker plate scraper assembly 27 adjacent the feed opening 22. The breaker plate and screen assembly 24 extends transversely between the end walls 11 of the main frame, casing or housing 10 and is adjustable as a unit with respect to the rotor 17.

The traveling breaker plate 25 of the assembly 24 is actually an endless chain conveyer formed of solid block links pivotally connected together and looped about a frame and a head or drive shaft 28 and driven by the latter to travel in the direction of the arrow seen in Fig. 2 of the drawings. Head shaft 28 extends through one of the end walls 11 of main frame, casing or housing 10 and is driven by an electric motor 29 through sprockets and a chain 30. The bar screen 26 of the assembly 24 is supported in cantilever and extends forwardly from the bottom of the traveling breaker plate 25 toward and under the rotor 17 and its free end is positioned substantially directly below the axis of said rotor as shown in Fig. 2 of the drawings.

The traveling breaker plate and screen assembly 24 includes a main frame or support 31 (see Fig. 4) which is common to both the conveyer and screen, and which is built up from a plurality of arms, plates and bars made

integral by welding to provide a relatively tall, thin, open-backed rectangular box-like portion **32** that forms a rigid backing, bed or support for the endless traveling chain breaker plate **25** and from which portion **32** a pair of spaced parallel screen bar supporting arms **33** extend. Arms **33** are mounted in cantilever, one on each upright end wall **34** of the upright frame portion **32** and adjacent the bottom thereof through a spacer block **35**. Arms **33** are identical, but of opposite hand, and one of them is shown in detail in Fig. 5 of the drawings.

Frame **31**, and consequently the entire traveling breaker plate and screen assembly **24**, is suspended or hung between the spaced opposite end walls **11** of the main frame, casing or housing **10** by a pair of identical axially aligned stub shafts or hanger bars **36** that project in opposite directions from adjacent the tops of the end walls **34** of the frame portion **32**. The top wall **37** of frame portion **32** carries an elongated bearing **38** through which the head or drive shaft **28** extends and said drive shaft is provided with a pair of sprockets, spaced one at each end of the bearing **38**, that carry and drive the endless chain breaker plate **25**. The front wall **39** of said upright frame portion **32** is covered by a replaceable backing, bed or support plate **40** over which the upwardly traveling or working run of the endless chain breaker plate **25** travels and upon which it bears. The bottom wall of said upright frame portion **32** carries a plurality of aligned semicylindrical guide shoes **41** which extend across the bottom of said portion **32** to guide the endless chain breaker plate **25** over the bottom of said replaceable backing, bed or support plate **40** and the rigid backing, bed or support portion **32** of the frame **31** where said breaker plate **25** passes between them and the screen **26** and begins or enters its upwardly traveling working run across the side of the reducing chamber **15**.

The screen **26** of the traveling breaker plate and screen assembly **24** includes a plurality of parallel screen bars which extend transversely between the arms **33** at right angles thereto and are supported at their ends by the arms **33**. The screen bars mentioned include a pair of heavy side clamping bars **42** and **43** between which there are three screen bars **44**. Screen bars **44** are spaced apart by spacer blocks **45** positioned between the opposite end portions of bars **44**, and the opposite ends of said screen bars **42** and **44** as well as the ends of the spacer blocks **45** are received in aligned arcuate channels or grooves **46**, one of which is formed in each of the spaced arms **33**. All of the screen bars **42** and **44** and the spacer blocks **45** are clamped together and to the heavy side clamping bar **43** of the screen by a pair of arcuate clamping rods or bolts **47** located one at each end of the screen. Rods or bolts **47** extend through aligned openings in the ends of the screen bars **44** and spacer blocks **45** and one end of each of the rods or bolts **47** is secured in the heavy side clamping bar **42**. The opposite end of each rod or bolt **47** is received in a notch formed in the heavy side clamping bar **43** and is provided with a nut which is tightened against the clamping bar **43** to cause the rods or bolts **47** and the clamping bars **42** and **43** to clamp the screen elements **44** and **45** tightly together.

Each end of the heavy side bar **43** is made to include an integral rectangular mounting block **48** that seats and is bolted into a groove or channel **49** formed in one of the arms **33** (see Fig. 5). The groove or channel **49** extends radially vertically across the arcuate groove or channel **46** and because the grooves or channels **46** and **49** intersect each other nearly at right angles and because the screen bars are rigidly interlocked there will be no movement of any of the screen bars along the said grooves or channels **46** and **49** in arms **33**.

The ends of the screen bars **42** and **44** are further supported at their bottoms by an arcuate block **50** welded to each arm **33** and the sides of the arms **33**, adjacent and facing the screen bars **42** and **44**, are protected by removable liner or wearing plates **51** that overlap the ends of said bars.

The entire traveling breaker plate and screen assembly **24** is hung or suspended from adjacent its top between the spaced end walls **11** of the main frame, casing or housing **10** by the stub shafts **36** which extend through the end walls **11** and are carried in bearing blocks **52** welded to the latter. The axis of stub shafts **36** extends transversely of, and at right angles to, the end walls **11** and the position of the entire traveling breaker plate and screen assembly **24** may be adjusted parallel to the axis of stub shafts **36** between the walls **11** by screws **53** which abut the bearing blocks **52** and are carried by ears or lugs **54** on the stub shafts **36**. The position of the entire breaker plate and screen assembly **24** is adjusted about the axis of stub shafts **36** with respect to the rotor **17** through a pair of axially aligned rods or bars **55** removably attached to the bottom of its upright frame portion **32** which extend through arcuate slots in the opposite end walls **11** and are adjustably connected to said end walls **11** by threaded adjusting rods **56** carried in ears **57** on said walls.

As clearly indicated in Figs. 2, 3 and 7 of the drawings the box-like portion **32** of the main frame or support **31** of breaker plate and screen assembly **24**, as well as the traveling breaker plate **25** thereof, extends transversely between the liner or wear plates **16** and the opposite end walls **11**. The arms **33** of screen **26** are spaced laterally of the end walls **34** of frame **31** by the spacer blocks **35**, as illustrated most clearly in Figs. 3 and 4 of the drawings, in order that the arms **33** and the liner or wearing plates **51** which they carry will light directly below the lowermost liner plate **16** and extend adjacent and parallel to the end walls **11** of the main frame, casing or housing **10**. As clearly shown in Figs. 2 and 7 of the drawings, the liner plates **16** above and adjacent the end disks **58** of rotor **17** are sloped as at **59** to overlap said end disks **58** thereby to prevent material falling in the material reducing chamber **15** from entering between the end disks **58** and the walls **11** and to direct the material into the path of the hammers **18**. The arms **33** and liner plates **51** thereon are spaced apart a distance greater than the distance measured axially along the rotor **17** and between the outside end surfaces of end disks **58** and they extend between the end disks **58** and the end walls **11** of the main frame, casing or housing **10** thereby to permit the breaker plate and screen assembly to be adjusted about the axis of stub shafts **36** toward the rotor progressively as the diameter of the path of travel of the hammers is reduced due to wear.

The traveling breaker plate and screen assembly **24** may be removed from the main frame or housing **10** as a unit upon the withdrawal of the adjusting rods or bars **55** from the frame **31** and the removal of a section or panel **60** from each end wall **11** of the main frame or housing **10**.

When the crushing, grinding or pulverizing apparatus is in operation, the rotor **17** and the endless chain breaker plate **25**, of course, are being driven in the directions indicated by the arrows in Fig. 2 of the drawing. When the endless chain breaker plate **25** is being so driven it travels or circulates around the head shaft **28** and upright, box-like portion **32** of the breaker plate and screen frame **31** and follows a path indicated in part by a broken line in Fig. 2 of the drawings. This path is from the sprockets on drive shaft **28** downwardly behind the frame portion **32**, over the guide shoes **41**, through the space between the heavy screen bar **42** and the front of plate **40** on frame portion **32** and upwardly across said plate and one side of reducing chamber **15**, under the scraper assembly **27** and to the sprockets on head shaft **28**.

Material fed into the reducing chamber **15** through feed opening **22** will be struck by the hammers **18** of rotor **17** and some of it will be reduced thereby. Some or all of the material struck by the hammers **18** will be thrown or hurled against the substantially solid material

reducing surface formed by the upwardly traveling or working run of endless chain breaker plate **25** to be further reduced upon impact therewith, and some of the material may be crushed between said breaker plate **25** and the hammers **18** by repeated pounding of the latter upon the material as it is fed by the hammers between the breaker plate **25** and rotor **17** toward the screen **26**. The fully reduced material will pass over or through the screen **26** to be discharged from the apparatus.

Material that sticks to and is carried upwardly on the working surface of the traveling breaker plate **25** will, of course, be scraped therefrom and caused to fall downwardly into the path of the hammers **18** by the flexible scraper blade of the scraper assembly **27**.

In Fig. 8 of the drawings there is shown a modified form of traveling breaker plate frame and screen **131** which may be substituted for the frame **31** in the crushing, grinding or pulverizing apparatus seen in Figs. 1, 2 and 3 of the drawings. Frame **131** includes an upright portion **132** and stub shafts **136** which are identical to the upright portion and stub shafts **31** and **36**, respectively, of frame **31** and which, therefore, require no further description. The traveling breaker plate and frame **131** differs from the frame **31** substantially only in that it includes a screen **136** which is a casting including integral side frame arms **133** that are slotted at **61** to interfit with blocks **135** which are the equivalent of blocks **35** welded to the end walls **34**. Arms **133** of screen **126** are bolted to the upright portion **132** of the frame **131** through the blocks **135**.

From the foregoing description it will be seen that by this invention there is provided a crushing, grinding or pulverizing apparatus of improved and simplified construction wherein there is a material reducing chamber including oppositely spaced walls positioned one at each end of a material reducing rotor and between which walls there extends, transversely and at one side of the rotor, an endless traveling chain breaker plate and screen assembly adapted to cooperate with the rotor to reduce material, and which assembly is adjustable with respect to the rotor to adjust the apparatus to grind the same or different materials to different degrees of fineness and/or to permit adjustment to compensate for wear of the reducing elements of the apparatus.

It will also be seen that the endless traveling chain breaker plate and screen assembly or unit includes frame means which is common to both the traveling breaker plate and the screen means thereof and that this frame means provides a bed portion about which the traveling endless chain breaker plate circulates or travels and that adjacent its bottom the frame also supports in cantilever the screen in such manner that the screen is spaced from the bed portion to provide a space between the bed portion and screen through which the traveling endless chain breaker plate may pass and whereby the screen extends from said bed portion under the rotor to cooperate with it in reducing material.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. A crusher having a material reducing chamber, a material reducing rotor supported in the chamber for rotation about an axis extending transversely of the reducing chamber, a traveling breaker plate adjacent the rotor adapted to cooperate with the rotor in reducing material, a carrier and backing member for the traveling breaker plate disposed transversely in the reducing chamber parallel to the axis of rotation of the rotor, means swingably supporting the carrier and backing member in the chamber for adjustment of the spacing of the breaker plate relatively to the rotor, said carrier and backing member including means supporting a screen adjacent and beneath the rotor, said screen extending downwardly and away from the breaker plate adjacent the circumference of the rotor, said screen being spaced from the carrier and backing member permitting the breaker plate to travel between the carrier and backing member and the screen with the screen forming a continuation of the breaker plate, means for adjusting the carrier and backing member to vary the disposition of the breaker plate relatively to the rotor while maintaining the breaker plate and the screen in fixed position relatively to each other.

2. A crusher having a material reducing chamber, a material reducing rotor supported in the chamber for rotation about an axis extending transversely of the reducing chamber, a traveling breaker plate adjacent the rotor adapted to cooperate with the rotor in reducing material, a carrier and backing member for the traveling breaker plate disposed transversely in the reducing chamber parallel to the axis of rotation of the rotor, said carrier and backing member including means supporting a screen adjacent and beneath the rotor, said screen extending downwardly and away from the breaker plate adjacent the circumference of the rotor, said screen being spaced from the carrier and backing member permitting the breaker plate to travel between the carrier and backing member and the screen with the screen forming a continuation of the breaker plate, means for adjusting the carrier and backing member to vary the disposition of the breaker plate relatively to the rotor while maintaining the breaker plate and the screen in fixed position relatively to each other.

3. A crusher having a material reducing chamber, a material reducing rotor supported in the chamber for rotation about an axis extending transversely of the reducing chamber, a traveling breaker plate adjacent the rotor adapted to cooperate with the rotor in reducing material, a carrier and backing member for the traveling breaker plate disposed transversely in the reducing chamber parallel to the axis of rotation of the rotor, said carrier and backing member including means supporting a screen adjacent and beneath the rotor, said screen extending downwardly and away from the breaker plate adjacent the circumference of the rotor with the screen forming a continuation of the breaker plate, means for adjusting the carrier and backing member to vary the disposition of the breaker plate relatively to the rotor while maintaining the breaker plate and the screen in fixed position relatively to each other.

4. A crusher having a material reducing chamber, a material reducing rotor supported in the chamber for rotation about an axis extending transversely of the reducing chamber, a traveling breaker plate adjacent the rotor adapted to cooperate with the rotor in reducing material and operating in a direction opposite to that of the rotor, a carrier and backing member for the traveling breaker plate disposed transversely in the reducing chamber parallel to the axis of rotation of the rotor, said carrier and backing member including means supporting a screen adjacent and beneath the rotor, said screen extending downwardly and away from the breaker plate adjacent the circumference of the rotor with the screen forming a continuation of the breaker plate, means for adjusting the carrier and backing member to vary the disposition of the breaker plate relatively to the rotor while maintaining the breaker plate and the screen in fixed position relatively to each other.

5. A crusher having a material reducing chamber, a material reducing rotor supported in the chamber for rotation about an axis extending transversely of the reducing chamber, a traveling breaker plate adjacent the rotor adapted to cooperate with the rotor in reducing material, a carrier and backing member for the traveling breaker plate disposed transversely in the reducing cham-

ber parallel to the axis of rotation of the rotor, said traveling breaker plate operating over the surface of the carrier and backing member in a direction opposite to the direction of rotation of the rotor, means swingably supporting the carrier and backing member in the chamber for adjustment of the spacing of the breaker plate relatively to the rotor, said carrier and backing member including means supporting a screen adjacent and beneath the rotor, said screen extending downwardly and away from the breaker plate adjacent the circumference of the rotor, said screen being spaced from the carrier and backing member permitting the breaker plate to travel between the carrier and backing member and the screen, with the screen forming a continuation of the breaker plate, means for adjusting the carrier and backing member to vary the disposition of the breaker plate relatively to the rotor while maintaining the breaker plate and the screen in fixed position relatively to each other.

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