

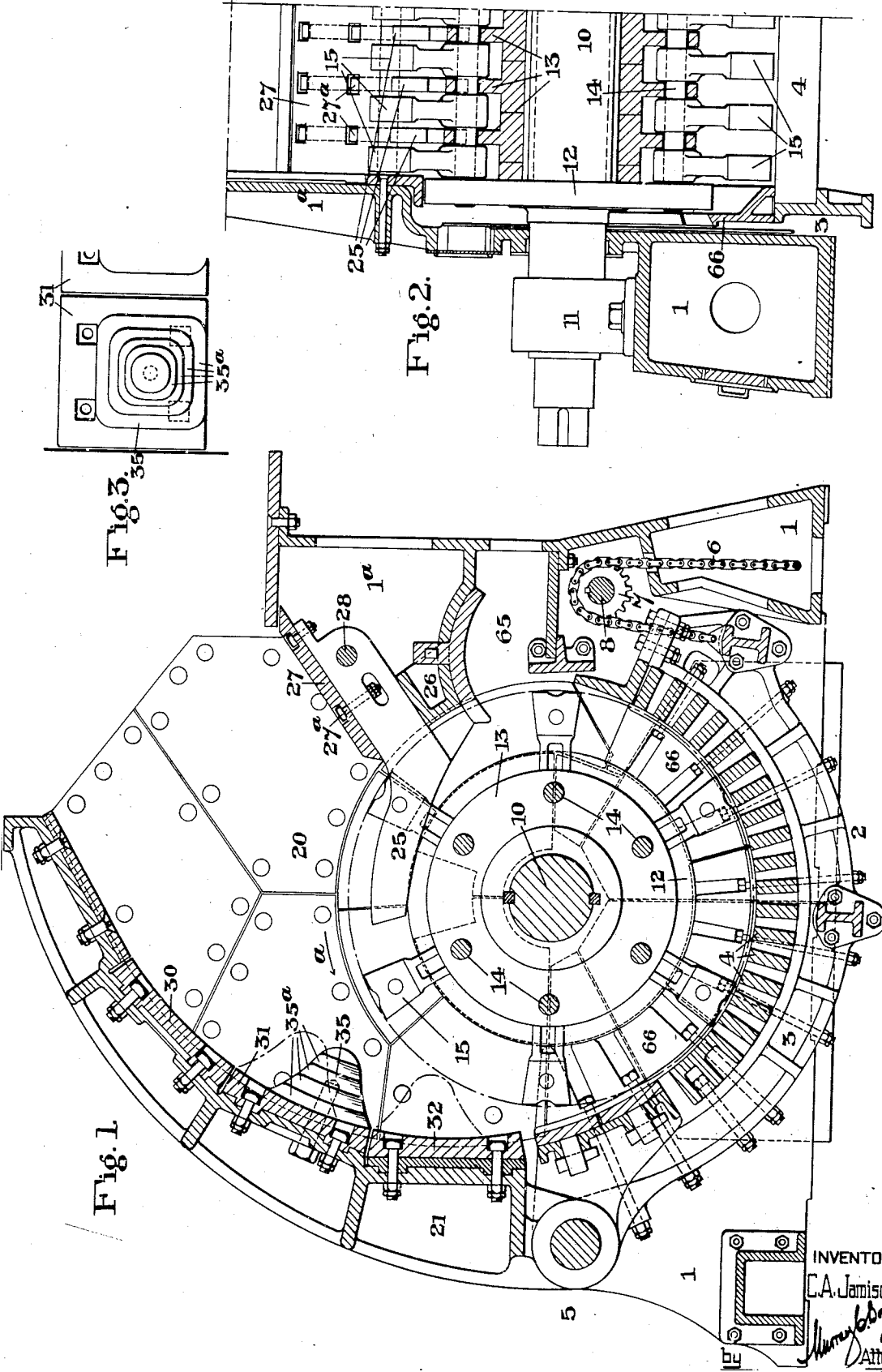
April 21, 1931.

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1,801,604

HAMMER MILL

Filed Aug. 25, 1928 3 Sheets-Sheet 1



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HAMMER MILL

Filed Aug. 25, 1928 3 Sheets-Sheet 2

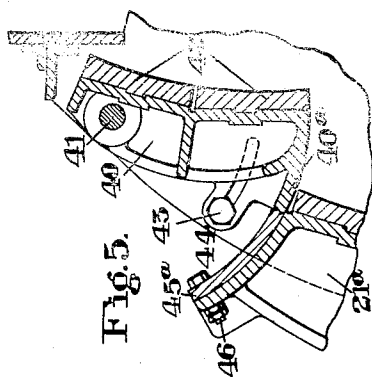


Fig. 5.

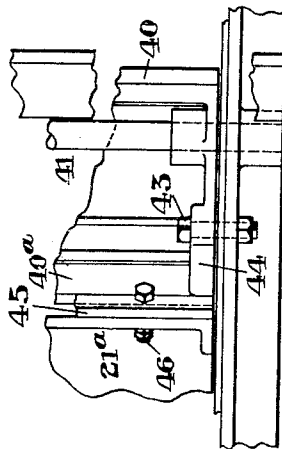


Fig. 6.

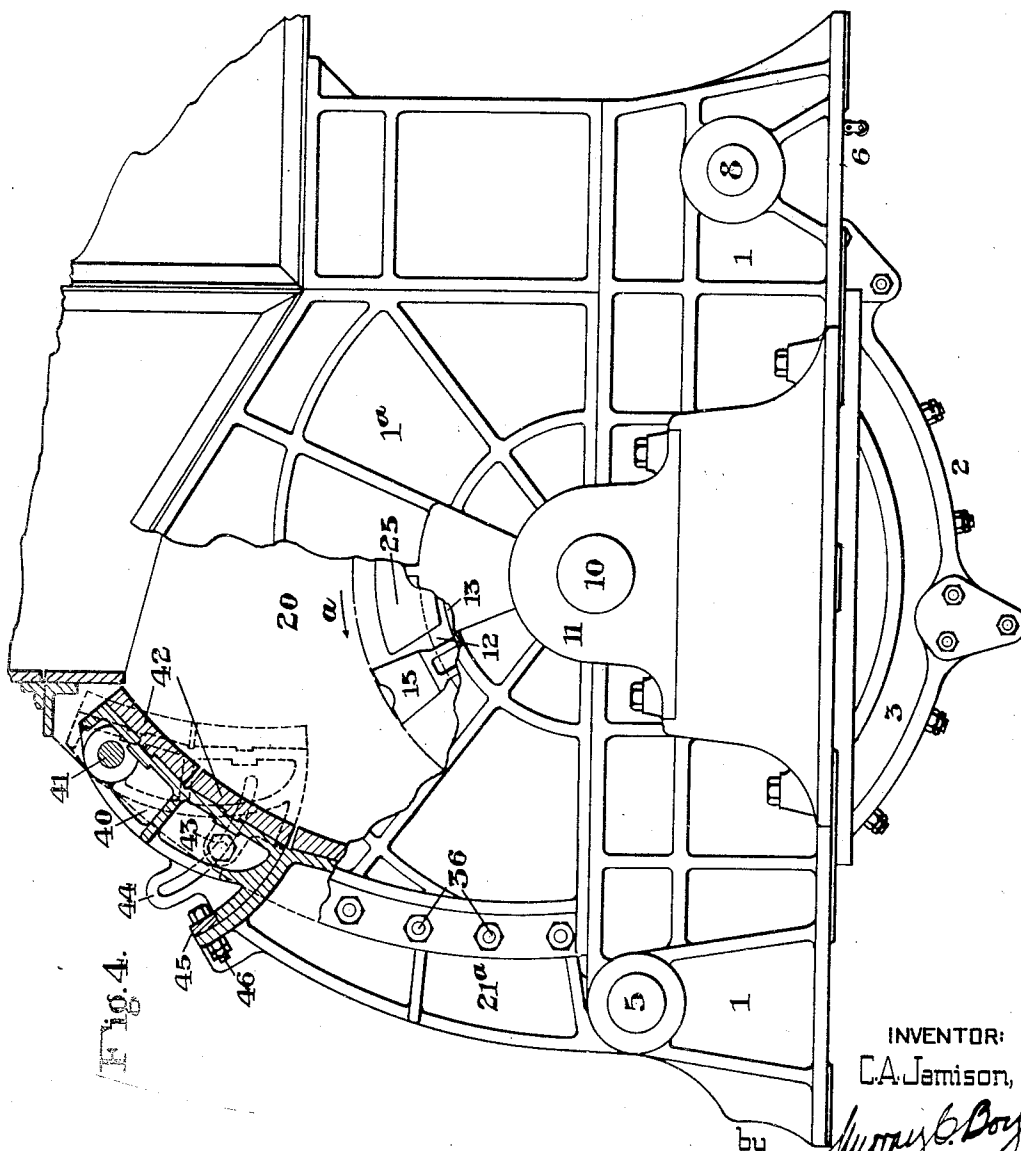


Fig. 4.

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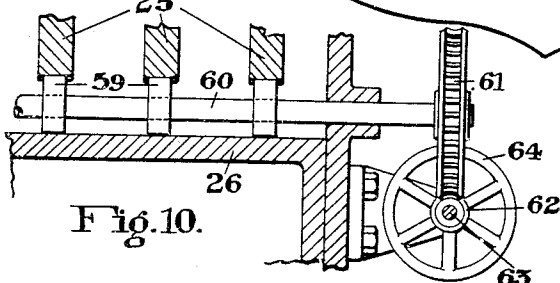
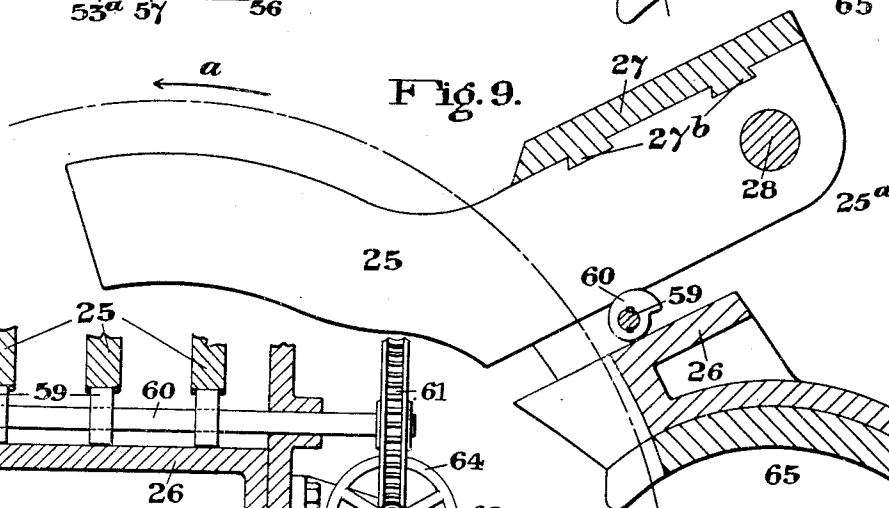
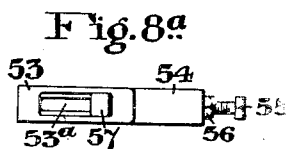
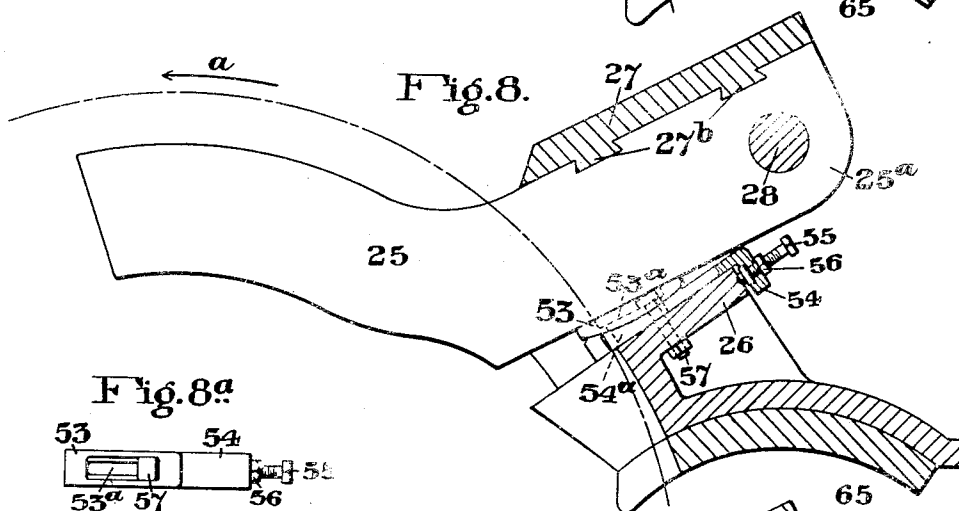
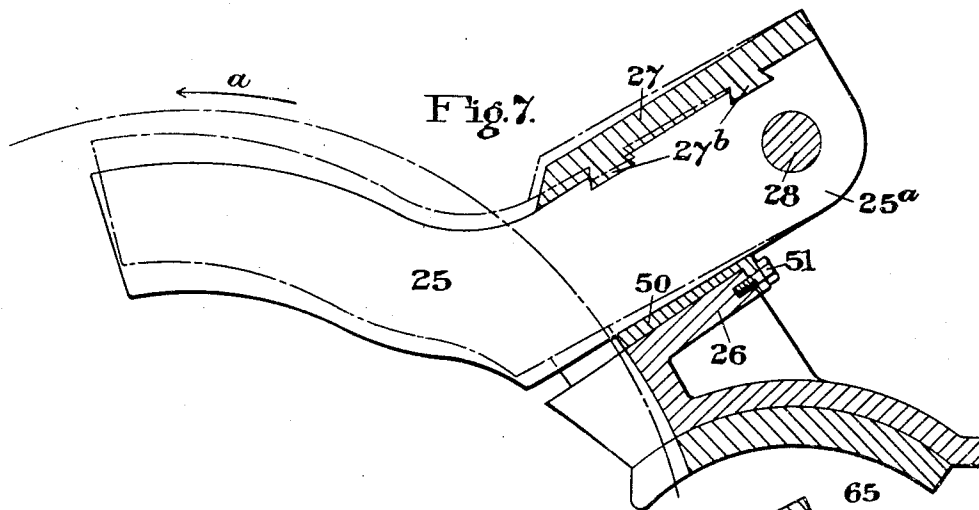
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HAMMER MILL

Filed Aug. 25, 1928 3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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HAMMER MILL

Application filed August 25, 1928. Serial No. 302,108.

My invention relates to crushing structures of the character or type known as hammer mills, that is to say structures which involve a supporting base, a suitable housing or frame mounted thereon and enclosing a chamber receiving the material to be crushed and including a cage or screen made up of suitable grate bars, a breaker plate (or plates), and a rotor structure carrying a series of hammers designed to act upon material to be crushed. The machine is of massive and rigid construction and is designed to receive what is known as "steam shovel feed"; or the contents of a quarry car may be delivered into the hopper leading to the crushing zone.

One object of my invention is to provide means whereby the material to be crushed may be retarded in its movement and temporarily supported in a position to be engaged by the hammers of the rotor structure in their uprunning or overhead movement whereby large masses temporarily supported may be reduced in size before passage to the main crushing zone.

A further object of my invention is to provide a series of grid bars projecting partway into the hopper and partly across the path of feed; said grid bars partly overlying the rotor structure and serving as temporary retarding means for the material to be crushed and the hammers of such rotor structure passing between said grid bars.

A further object of my invention is to provide one wall of the hopper or feed passage, which may be pivotally mounted, with projections which may occupy a relatively fixed position with respect to the ends of the grid bars and may be arranged substantially opposite the same; such projections having stepped surfaces in some instances.

A further object of my invention is to provide the end wall of the hopper in the form of a wear plate member (or members) pivotally supported by the side wall of the crusher structure and arranged to be projected into the hopper and reduce the space between the hopper wall and the ends of the grid bars, with means for holding said pivotally hung wear plate member (or members) in adjusted positions.

And a still further object of my invention is to provide means for adjusting the position of the grid bars relatively to the hammer circle.

These and other features of my invention, embodying various details of construction making up the improved crushing structure, are more fully described hereinafter; reference being had to the accompanying drawings, in which:

Figure 1 is a cross sectional elevation, more or less diagrammatic in character, illustrating hammer crushing means within the scope of my invention.

Fig. 2 is a sectional elevation of a portion of the crushing structure, taken on the line I—I, Fig. 1.

Fig. 3 is a view on a slightly larger scale, illustrating a detail of the structure shown in Fig. 1.

Fig. 4 is a view similar to Fig. 1, partly in section, illustrating a further detail of my invention.

Fig. 5 is a sectional view illustrating a portion of the structure shown in Fig. 4 in another position.

Fig. 6 is a fragmentary plan view of a portion of the structure shown in Figs. 4 and 5.

Figs. 7, 8 and 9 are fragmentary sectional views, more or less diagrammatic in character, illustrating means for effecting adjustment of the grid bars.

Fig. 8^a is a view illustrating a detail of the construction shown in Fig. 8, and

Fig. 10 is a view illustrating a detail of the adjusting mechanism shown in Fig. 9.

My invention involves a structure highly efficient for the crushing of material by what may be termed uprunning hammers, that is to say, hammers which pass upwardly between the adjustable grid bars located in the feed chute and in addition to the incremental breaking or crushing action imparted to the material, tend to lift the same; thereby assisting in the dislodgement of the larger masses of material to be crushed and insuring proper reduction of the material subsequently delivered substantially by gravity into the path

of the hammers and which had been temporarily retarded by the grid bars.

My improved structure may comprise a base 1, supporting a frame or housing indicated generally at 1^a, which may be made of structural metal and/or heavy cast parts, suitably secured together and supporting the various elements making up the crushing structure, and more particularly referred to hereinafter. A screen or cage 2, made up of arcuate side members 3, supporting a series of bars 4, is disposed in the lower portion of the casing; such screen or cage as a whole being pivotally mounted on a shaft 5 at one end of the machine, and adjustably supported at the opposite end; preferably by chains 6, passing over pinions 7, carried by a shaft 8, which chains may be adjusted as desired to elevate or lower the right hand end of the cage or screen by imparting rotative movement to said shaft 8. The bars 4 may be of the type illustrated in the patent of George W. Borton, No. 1,624,886, Apr. 12, 1927, or like those shown in the co-pending application of Oscar Anderson. The shaft 5 supporting the left hand end of the cage or screen, as illustrated in the drawings, may be of an adjustable type, such as illustrated in the patent of Charles R. Rouse, No. 1,695,562, Dec. 18, 1928.

Within the crushing chamber provided by such cage or screen and above the latter a hammer-carrying rotor structure is mounted, which may comprise a shaft 10, journaled in suitable bearings 11; end plates 12; a series of disks 13 arranged between said end plates; rods 14 extending longitudinally of the rotor structure and passing through said disks and secured to said end plates, and hammers 15 which are pivotally hung on said rods. Rotor structures of this general type are well known in the art and the hammers may be of any suitable type, preferably of massive and heavy construction, which may have renewable tips in order that wear may be compensated for and fresh tips supplied without removing the shanks of the hammers from the suspension rods 14.

The chute or hopper into which the material to be crushed may be delivered is indicated generally at 20, and is substantially like that shown in the co-pending application of George W. Borton, filed August 25, 1928, Serial No. 302,080; having a curved breaker member 21, which may be pivotally connected to the shaft 5; such member forming one end of the crusher structure and constituting one wall of the hopper. In order that the feed of such material into the crushing zone may be retarded to a certain extent and the desired reduction by the hammers insured, a series of grid bars 25, may be supported by a portion 26 of the frame extending across the machine adjacent to the bottom of the hopper; said grid bars being connected in spaced

relation to a plate 27 extending across the machine, and said grid bars and plate may be pivotally supported by a shaft 28 which may extend across the machine and be journaled in the side walls of the same. Such arrangement permits adjustment of said grid bars on the shaft 28 with respect to the path of the hammers. Various forms of means for effecting such adjustment may be employed, some of which are illustrated in Figs. 7, 8, and 9, more particularly referred to hereinafter.

These grid bars may be of cantilever type and may extend substantially halfway across the lower part of the hopper or chute, or any other distance that will insure the desired function. They lie in such position as to temporarily support the larger masses of material to be crushed by the hammers 15, which move in the direction of the arrow *a*, and permit gradual nipping and incremental reduction of the larger masses supported by said grid bars in the uprunning or overhead movement of said hammers before passage to the lower crushing zone for further action by said hammers 15, cooperating with the bars 4 of the cage or screen.

On the opposite curved wall 21 of the hopper or feed chute, a series of relatively fixed wear plates may be secured, indicated at 30, 31 and 32. For the purpose of assisting in the temporary support of the material to be crushed, additional retarding means may be provided and one of these plates, that indicated at 31 for instance, may be provided with a series of spaced projections 35, which may have stepped side walls 35^a, as clearly shown in Fig. 3. These projections may be disposed in line with the ends of the grid bars or set in any manner with respect to the same that may be desired in order to perform the desired function. The position of these projections is such that they afford additional means for retarding delivery of large masses of material to be crushed and permit the same to be acted upon by the hammers during their movement through the upper arc of their path of movement. Instead of arranging these projections 35 in the position indicated by full lines, Fig. 1, they may be arranged as indicated by the broken lines in said figure; the lower set being indicated for support by the wear plate shown at 32.

In Figs. 4, 5 and 6, I have indicated a form of supplemental retarding means for the material undergoing crushing, involving a pivotally hung breaker plate carried by the side walls of the crusher structure; being disposed above and cooperating with the breaker member pivotally supported by the shaft 5. In this arrangement, the member mounted on the shaft 5, indicated at 21^a, is much shorter than the member 21, shown in Fig. 1. Like that element it is secured to the side wall of the crusher structure; bolts 36 being

indicated for such purpose. The supplemental and pivotally supported retarding member is indicated at 40 and may be carried by a cross shaft or rod 41, supported by the side walls of the crusher structure. This member 40, whose inner face forms substantially a part of the hopper wall, may conform to the curve of the member 21, shown in Fig. 1, (as well as the member 21^a) and such member 40 may carry wear plates 42. The lower end of the member 40 may be flanged as indicated at 40^a, and is movable as a whole with respect to a curved seat formed by the upper portion of the member 21^a. The member 40 is adapted to be projected into the hopper space, as indicated by dotted lines, Fig. 4, and full lines Fig. 5, and it may be held in adjusted positions by means of bolts, set screws, or the like, indicated at 43 and carried by the side walls of the structure and adapted for operative engagement with the slotted arms 44 of said member 40. The seat carried by the member 21 is preferably provided with a stop 45, limiting the rearward movement of the member 40; such stop being detachably held in place by a bolt (or bolts 46) and permitting removal for the placement of other stop members such as indicated at 45^a Fig. 5, which may be employed when said member 40 is projected into the hopper space, in order that proper support may be afforded. The length of these filler members, 45 or 45^a, will depend upon the extent which said member 40 is projected into the hopper space.

The grid bars may be of any suitable number and they are arranged to lie between the paths of the hammers. They may be connected to the plate 27 which extends across and forms part of the bottom of the hopper, by means of bolts 27^a. Various means of adjusting the position of these grid bars on their supporting shaft 28 and positioning their ends vertically with respect to the path of the hammers may be provided, and in Figs. 7, 8 and 9 I have illustrated several forms of mechanism which may be employed for effecting the desired adjustment. Other and equivalent means are within the scope of my invention.

In Fig. 7, I have shown what may be termed fixed adjustment means, comprising a wedge or shim 50 introduced between the grid bars and the portion 26 of the frame. The introduction of such wedge tends to raise the ends of the grid bars with respect to the hammer circle; said bars swinging on the shaft 28, and wedges of various thicknesses (one of which is shown by dotted lines) may be employed so as to increase or decrease the amount of adjustment, as may be desired. By preference, such wedges are retained in place by set screws 51.

In the arrangement shown in Fig. 8, provision is made for variable wedge adjustment.

In this instance, the several grid bars are provided with rocking bearings 53, engaging complementary members 54, both of which are carried by the frame 26. Both of these members are adjustable along the under sides of the grid bars, and may be held in such adjusted position by means of a set screw 55 engaging the frame portion 26, and having lock nuts 56. The lower member 54 is provided with a concave surface adapted to receive the convex upper member 53, directly underlying the ends 25^a of the grid bars. These members are adjustable as a whole with respect to the grid bars and frame and may be held in such adjusted positions by a suitable bolt 57 supported by the portion 26 of the frame; both of the wedge members meeting on the curved surface indicated and being slotted at 53^a and 54^a for the passage of the bolt 57, which occupies a relatively fixed position.

In Fig. 9 adjusting means are shown in the form of cams 59, which may be carried by a shaft 60, extending across the frame of the machine and supported by the side walls thereof; such shaft carrying a series of spaced cams 59 with high and low points for direct engagement with the grid bars, as shown in Fig. 10. In this arrangement the cam shaft may carry a worm wheel 61 at one end for engagement by a worm 62, carried by a shaft 63, which may be actuated by a suitable hand wheel 64. In the arrangements shown in Figs. 7, 8 and 9, the plate 27 is shown as keyed at 27^b to the several grid bars.

In my improved hammer crusher, as in that illustrated in the co-pending application of George W. Borton, before referred to a tramp iron pocket may be arranged at the right hand side of the machine, just above the screen, as indicated at 65.

It will be understood, of course, that the wall of the machine will be provided with wear plates and that shedding members will be carried by the side frames of the cage below the end plates of the hammer-carrying rotor and designed to shed or direct material being crushed into the path of the hammers and through the spaces between the grate bars of the cage or screen.

It will be understood, of course, that the inner walls of the crusher structure will be provided with wear plates and that shedding members will be carried by the side members 3 of the cage or screen adjacent the end plates of the hammer-carrying rotor structure and designed to shed or direct the material being crushed into the path of the hammers for discharge through the spaces between the grate bars 4. The shedding members employed in the present arrangement, clearly indicated at 66 in Figs. 1 and 2, are wide enough to lie behind the end plates 12 of the rotor structure and insure diversion of material into the crushing zone

and at the same time prevent discharge of material at the sides of the crusher structure.

As in the Borton structure referred to, the feed chute cuts into the uprunning hammer circle at a point below the high point of the same, in other words, the uprunning hammers have an opportunity of impacting the material on an upgrade for a considerable arc of the hammer circle, before the center or highest part of the hammer circle is reached.

I claim:

1. In a hammer crusher, the combination of a frame providing a crushing chamber, a cage having a series of grate bars defining the bottom of said crushing chamber, a pivotal support for said cage, a feed hopper delivering into said crushing chamber, a rotor structure within the crushing chamber, hammers carried by said rotor structure, a pivotally mounted curved breaker plate forming one wall of the hopper and overhanging said rotor, and a series of retarding projections detachably mounted on the face of said breaker plate.

2. A hammer crusher comprising a frame having a crushing chamber and a hopper delivering into said crushing chamber, a series of spaced bars extending partway across the lower end of said hopper and serving to retard the feed, a rotor within the crushing chamber, and hammers carried thereby and arranged to pass between said grid bars to reduce the material undergoing treatment before it reaches the crushing chamber.

3. A hammer crusher comprising a frame having a crushing chamber and a hopper delivering into said crushing chamber, a series of spaced grid bars extending partway across the lower end of said hopper and serving to retard the feed, means for adjusting the position of said grid bars, and rotating hammers arranged to pass between said grid bars to reduce the material undergoing treatment before it reaches the crushing chamber.

4. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally supported cage mounted in the lower portion of said crushing chamber, a hopper delivering into said crushing chamber, breaker plates lining the lower portion of said hopper, and rounded projections carried by one of said breaker plates for retarding delivery of the material to the crushing chamber.

5. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally supported cage mounted in the lower portion of said crushing chamber, rotating hammers within said chamber, a hopper delivering into said crushing chamber, breaker plates disposed in the lower portion of said hopper against which material will be thrown by the hammers, projections carried by one

of said breaker plates for retarding delivery of the material under treatment, and a grid support for the material being crushed and oppositely disposed with respect to said projections; said hammers being arranged to pass through said grid support and engage and move material supported thereby toward the breaker plate.

6. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally mounted cage forming a lower portion of said crushing chamber, a rotor mounted in said crushing chamber, hammers carried by said rotor, and a series of cantilever bars forming retarding means above said rotor structure; said hammers being arranged to move across the crushing chamber between said bars and engage the material to be crushed before the latter reaches the crushing chamber of the cage.

7. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally mounted cage forming the lower portion of said crushing chamber, a rotor mounted in said crushing chamber, hammers carried by said rotor, and a series of adjustable bars forming retarding means and extending partway across the hopper portion of the crushing chamber; said hammers being arranged to move between said grid bars and engage the material to be crushed before it reaches the crushing chamber of the cage.

8. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally mounted cage forming the lower portion of said crushing chamber, a rotor mounted in said crushing chamber, hammers carried by said rotor, a series of grid bars forming retarding means extending partway across the crushing chamber, and means for adjusting said grid bars with respect to the hammer circle; said hammers being arranged to move between said grid bars and engage the material to be crushed before the latter reaches the crushing chamber of the cage.

9. In a hammer crusher, the combination of a frame providing a crushing chamber and a hopper leading thereto, a pivotally mounted cage forming the lower portion of said crushing chamber, a rotor mounted in said crushing chamber, hammers carried by said rotor, a series of grid bars forming retarding means and extending partway across the hopper portion of the crusher chamber; said hammers being arranged to move across the hopper portion of the crushing chamber between said grid bars and engage the material to be crushed before it reaches the crushing chamber of the cage, a breaker plate forming part of the wall of said hopper opposite said bars, and retarding projections carried by said breaker plate; said combined retarding means serving to slow the feed and permit delivery of material to the crushing chamber in such

quantity as to insure the desired reduction in one operation.

10. In a hammer crusher, the combination of a frame providing a crushing chamber, a pivotally mounted cage forming the lower portion of said crushing chamber, a hammer-carrying rotor mounted relatively to said cage and having end plates supporting hammer-carrying bars, and shedding members carried by said cage and extending toward the axis of rotation beyond the margin of said end plates.

In witness whereof I have signed this specification.

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