Nov. 20, 1962

H. B. BIEHN

3,064,907

SECONDARY CRUSHER

Filed April 3, 1961

4 Sheets-Sheet 1

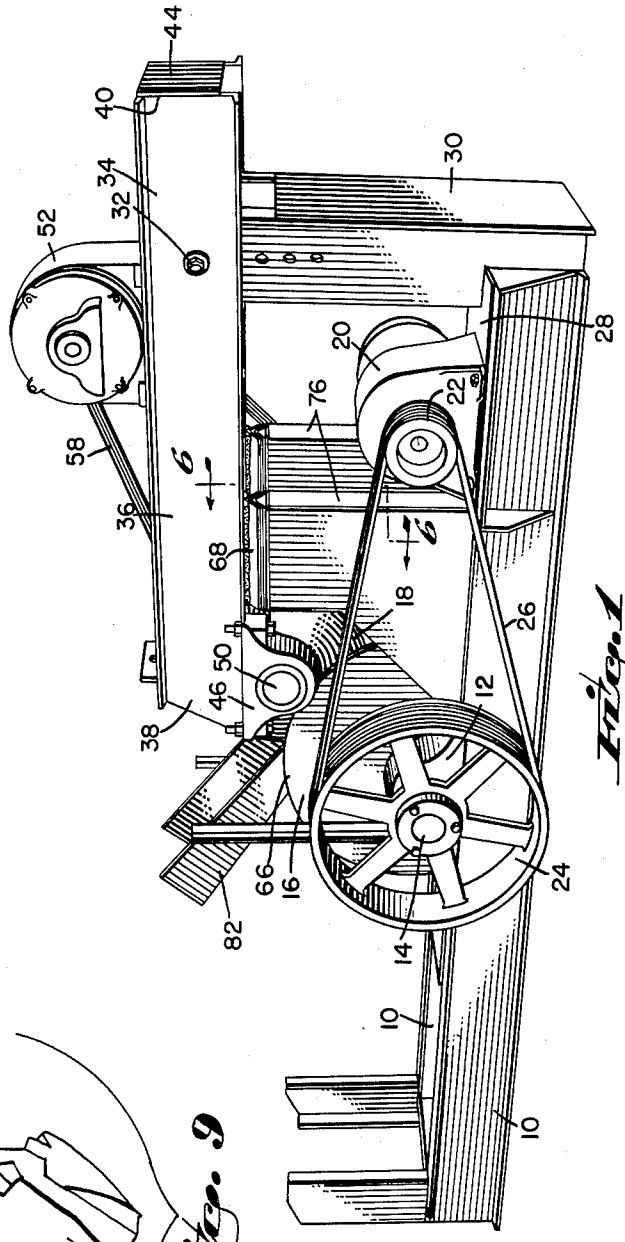


Fig. 1

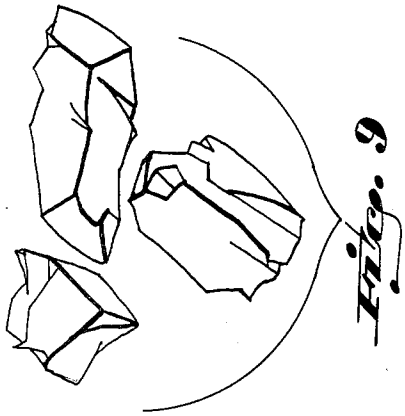


Fig. 9

INVENTOR.

HAROLD B. BIEHN

BY

J. Warren Kinney, Jr.

ATTORNEY

Nov. 20, 1962 H. B. BIEHN 3,064,907

SECONDARY CRUSHER

Filed April 3, 1961

4 Sheets-Sheet 2

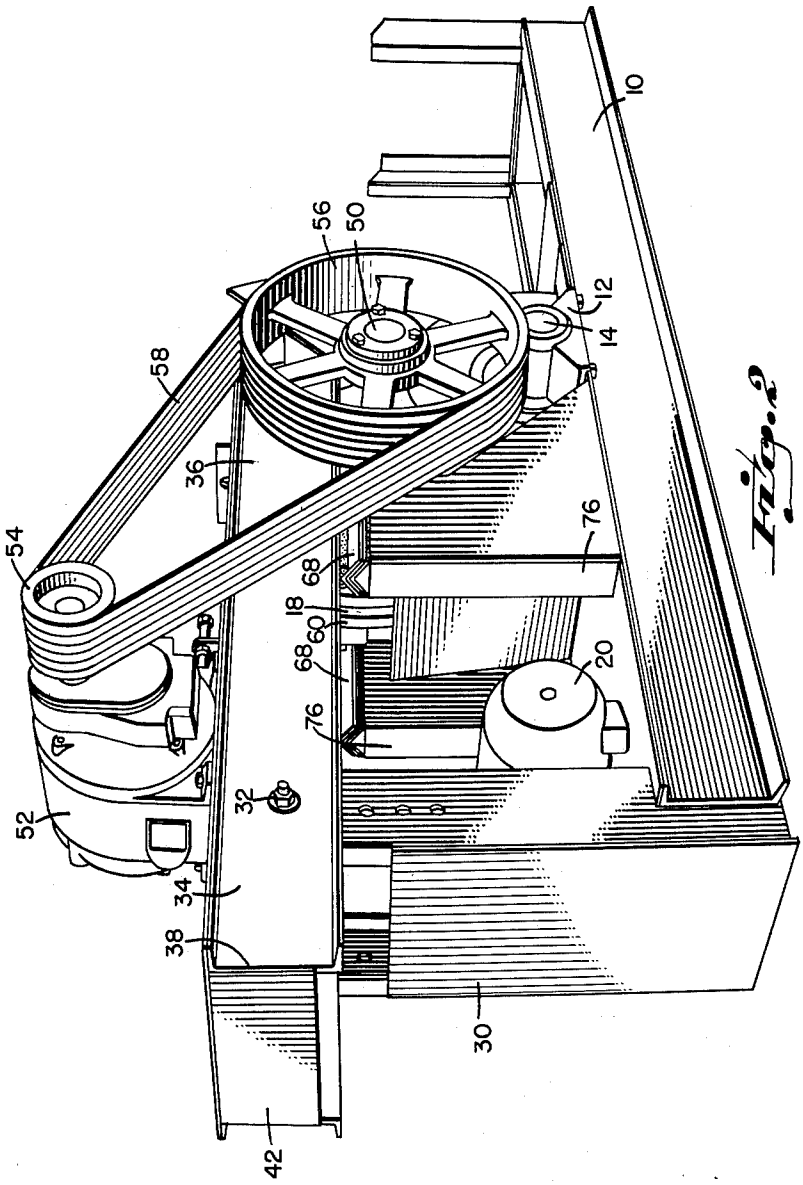


Fig. 2

INVENTOR.

HAROLD B. BIEHN

BY

J. Warren Kinney, Jr.

ATTORNEY

Nov. 20, 1962 H. B. BIEHN 3,064,907

SECONDARY CRUSHER

Filed April 3, 1961

4 Sheets-Sheet 3

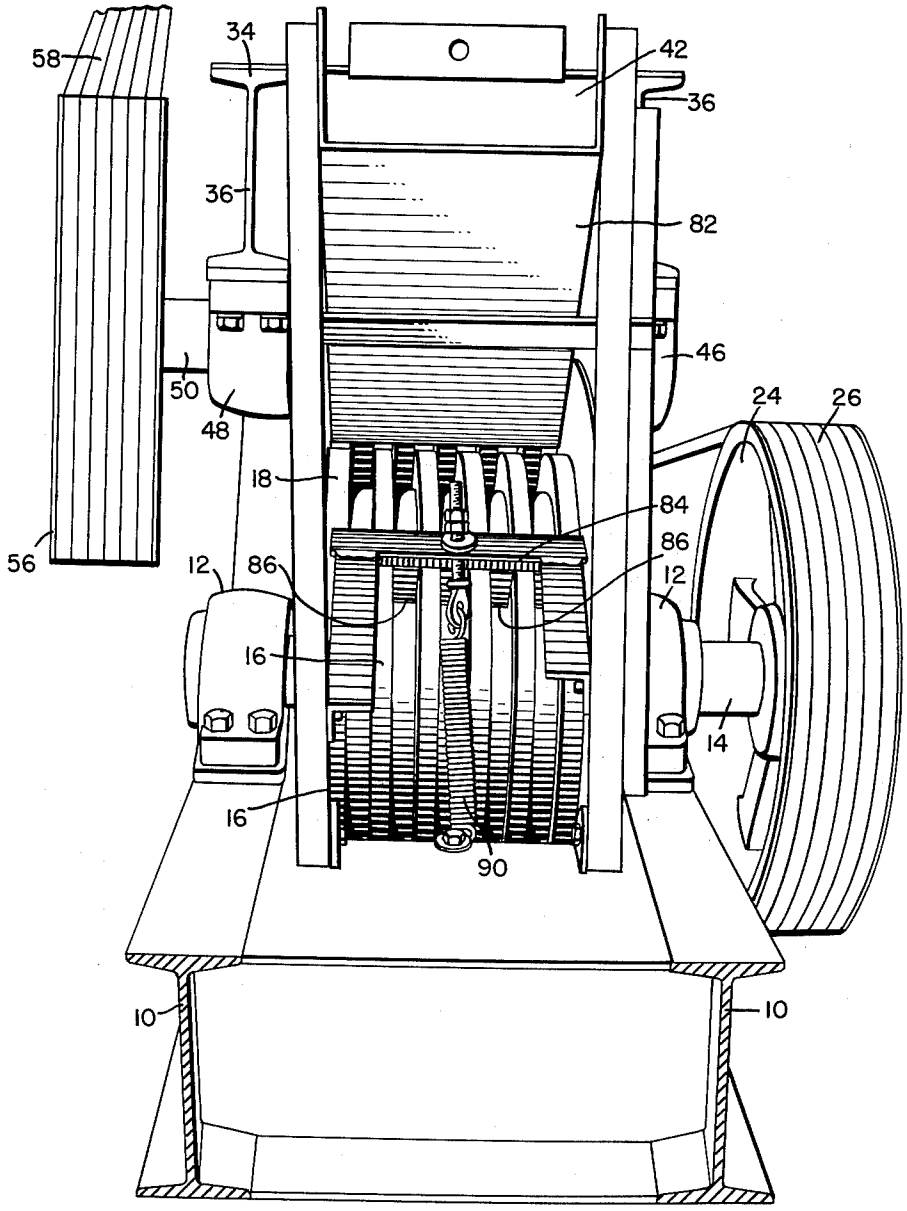


Fig. 3

INVENTOR.
HAROLD B. BIEHN
BY
J. Warren Kinney, Jr.
ATTORNEY

Nov. 20, 1962 H. B. BIEHN 3,064,907

SECONDARY CRUSHER

Filed April 3, 1961

4 Sheets-Sheet 4

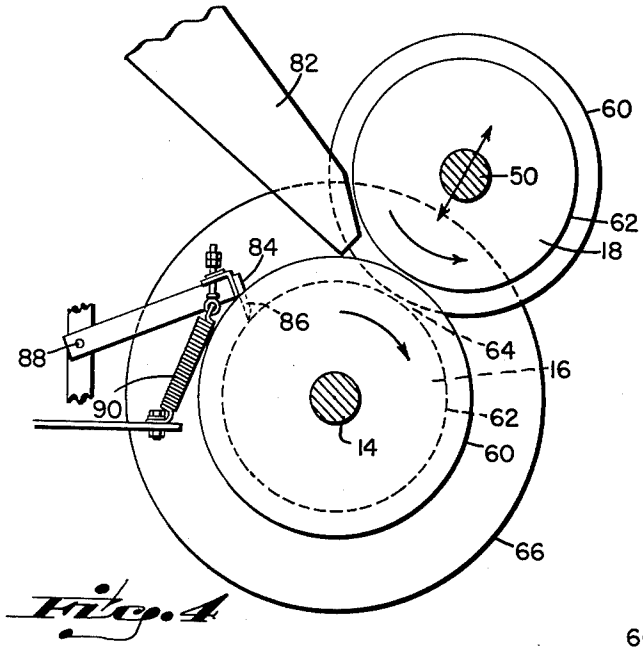


Fig. 4

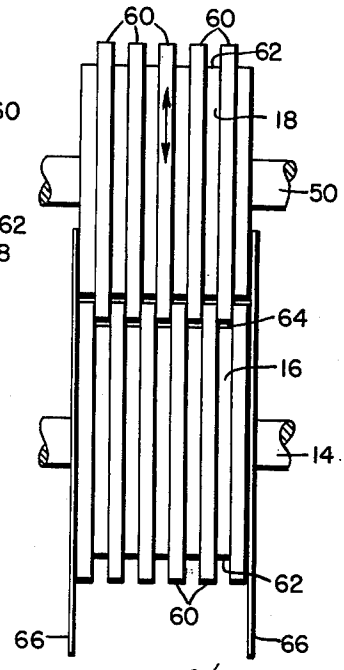


Fig. 5

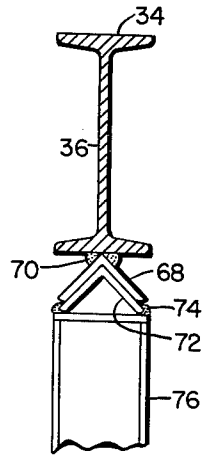


Fig. 6

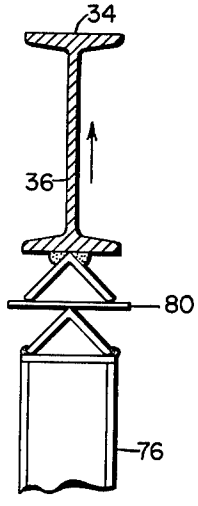


Fig. 7

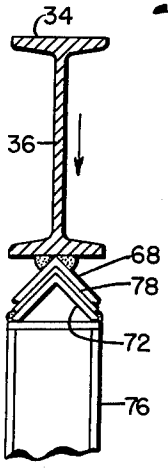


Fig. 8

INVENTOR.

HAROLD B. BIEHN

BY

J. Warren Kinney, Jr.

ATTORNEY

United States Patent Office 3,064,907 Patented Nov. 20, 1962

3,064,907

SECONDARY CRUSHER

Harold B. Biehn, Perry Township, Fayette County, Greenfield, Ohio (Box 110, Washington Court House, Ohio)

Filed Apr. 3, 1961, Ser. No. 100,236
5 Claims. (Cl. 241—232)

This invention relates to a crusher, such as may be used in reducing the size of particles of frangible material including stone, clinker, slag, and the like.

An object of the invention is to provide a crusher of improved construction, which will reduce the size of particles of material at high speed, with a minimum production of waste in the form of powder or dust.

Another object is to provide a high capacity crusher operative at a fraction of the usual expense of power and maintenance costs.

A further object is to provide in a crusher, improved structural features whereby the mechanism thereof performs for unusually long periods of time without need for repairs, replacements, or adjustments, so that down-time is reduced to a practical minimum, with substantial savings of time, labor, and other expense.

Another object of the invention is the production of crushed material, including sand and larger particles, of high quality and great uniformity, at a minimum of cost.

Another object of importance is to very substantially reduce the power requirements of a machine for crushing frangible materials.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

FIG. 1 is an elevational view in perspective, showing one side of the improved crusher.

FIG. 2 is a view similar to FIG. 1, showing the opposite side of the machine.

FIG. 3 is a perspective end elevation, part of the bed being broken away, showing the input end of the machine.

FIG. 4 is a fragmentary side elevation of the crusher rolls, feed chute, and other details of the working parts in the vicinity of the crusher rolls.

FIG. 5 is an end elevation of the crusher rolls, looking from right to left on FIG. 4.

FIGS. 6, 7, and 8 are cross-sectional views taken on line 6—6 of FIG. 1, showing a simple and durable adjustment means for maintaining various crusher roll clearances to produce material particles of specified sizes.

FIG. 9 is a perspective view illustrating the typical, sharp edged characteristics of the individual particles produced by the subject device.

In the drawings, 10 indicates a pair of suitable bed members for the machine, which may be in the form of steel I-beams or the like arranged in spaced parallelism, and upon which the working parts of the machine are supported. The bed conveniently may be of welded construction, and disposed substantially horizontally in practice.

At opposite sides thereof, the bed may support a pair of pillow blocks 12 providing heavy bearings for the rotary shaft 14 of the primary crusher roll 16, the shaft being driven in any suitable manner, as by means of an electric motor 20 driving the shaft by means of pulleys 22 and 24, and a belt arrangement 26. The motor is, of course, mounted upon the bed of the machine, preferably with the use of a stationary platform 28. The roll 16 and pulley 24 are fixed upon the shaft 14, and as viewed in FIG. 1, the direction of rotation of shaft 14 is clockwise.

At the rear end of bed 10 is fixedly mounted an upright post or standard 30, the upper end of which carries a transverse rock shaft 32. The rock shaft carries a tiltable beam

or arm 34, movable in a vertical plane under certain conditions, as will be explained.

The beam or arm 34 may be constructed of suitable steel shapes, such as I-beams 36 joined in spaced substantial parallelism at their ends 38 and 40, as by means of struts or plates 42 and 44, respectively, welded or otherwise suitably secured to the ends of the beam members.

At the forward or working end of beam or arm 34 is fixedly mounted a pair of spaced parallel pillow blocks 46 and 48, providing bearings for a rotatable shaft 50 which supports between them the secondary crusher roll 18. An end of shaft 50 is driven in any suitable manner, as by means of an electric motor 52 driving the shaft through the agency of pulleys 54 and 56, and a belt arrangement 58. The direction of rotation of shaft 50 is opposite to the direction of rotation of shaft 14, as indicated upon FIG. 4.

Crusher roll 18 and pulley 56 are fixed upon shaft 50, and the driving motor 52 therefor may be mounted atop the beam or arm 34 to tilt therewith. Motor 52 may be positioned upon the beam at a location between rock shaft 32 and roll shaft 50, to add its weight to that end 38 of the beam which carries the crusher roll 18. Rolls 18 and 16 are to be driven at equal linear speeds, or approximately so, but in opposite directions, with their shafts offset from the vertical.

The working areas of crusher rolls 16 and 18 (FIGS. 4 and 5) carry a series of equally spaced parallel ribs 60 which extend peripherally from the mean face 62 of each roll, the ribs being staggered as to location upon the rolls so that the ribs of one roll interfit between those of the other roll, with a running clearance between. The spaces between ribs may be termed the valleys of the working face of a roll. The valleys of one roll are wider than the interfitting ribs of the other roll, to provide the necessary clearance previously mentioned.

The bight, or the space 64 between the outer peripheral face of one roll rib, and the base of a valley of the cooperative roll, is adjustable by reason of movements of beam 34 about its rock shaft 32. That is, shaft 50 of FIG. 5 may be bodily elevated or lowered to change the bight at 64, where the crushing action occurs.

Crusher roll 16 may be provided with end flanges 66 to close the endmost bights of the rolls.

Means are provided for selectively increasing and decreasing the bights between the crushing rolls 16 and 18, while at the same time permitting the rolls to separate or move apart irrespective of the bight adjustment in the event that any foreign object not readily fracturable finds its way between the rolls. Such foreign objects, for example bolts, horseshoes, railroad spikes and the like, might tend to damage the rolls unless provision is made for passing such objects by relieving the roll pressure.

For the purposes of relievable bight adjustment, the rocking beam members 36 may be provided with inverted V-shaped angle irons or saddles 68 (FIG. 6), welded or otherwise secured to the lower faces of the beam members as at 70, to co-operate with similar V-shaped angle irons or saddles 72 fixed as at 74 upon the upper edges of heavy upright stanchions 76 mounted upon the machine base.

It will be noted by referring to FIG. 6, that the nesting angle irons 68 and 72 perform two functions, namely, to maintain the beam 34 aligned with stanchion 76, and to establish a minimum bight between rolls 16 and 18. With the beam 34 so aligned with stanchion 76, the ribs 60 of one crusher roll are kept centered in the valleys of the other crusher roll, thereby avoiding frictional contact between the rolls.

When the bight 64 is to be enlarged for the production of larger particles of material between the rolls, one or more additional inverted angle irons, or shims such as 78,

may be interposed between the fixed angle members 68 and 72, according to FIG. 8. As an alternative, plain plates 80 (FIG. 7) may be interposed between the fixed angle irons, to elevate the forward end 38 of beam 34 and thereby effect a greater separation of the crusher rolls.

The adjusting means of FIGS. 6, 7 and 8, will be seen to bodily support the roll end of beam 34, and the weight of its motor 52, without restraining the beam in the event that the roll end tends to raise upward in the presence of a non-fracturable object entering between the rolls by way of chute or hopper 82. Under this arrangement, possible damage to the crusher rolls is largely eliminated.

It may here be pointed out that the adjustment means of FIGS. 6, 7 and 8, is subject to modification within the purview of the invention. For example, the saddles 68 and 72 might be U-shaped, or they might be channel-shaped with the legs of the channels interfitted to prevent lateral displacement of beam 34. Then additional shims in the form of narrow plates or bars might be interposed between the legs of the channels to obtain a desired crusher roll separation. Various other expedients for the purpose will suggest themselves to the skilled designer, in the light of the present disclosure.

With reference to FIGS. 3 and 4, 84 indicates a serrated scraper the extending fingers 86 of which project between the ribs 60 of the primary roll 16 to scrape any adhering crushed materials from the roll valleys. The scraper may be mounted for rocking movement about a pivot shaft 88, and held in yielding contact upon roll 16 by means of an adjustable spring 90. If necessary, both crusher rolls may be equipped with scrapers of the type disclosed, or of any other acceptable type.

The following observations have been made with respect to a crusher constructed as herein disclosed. The primary roll motor 20 requires approximately one-half the amount of electric power as does the secondary motor 52. With a total power consumption of 15 horsepower, the improved machine will crush as much rock as will a hammermill type crusher consuming 100 horsepower. Moreover, the amount of waste produced in the form of powder or dust is very substantially lessened in the improved crusher.

Noteworthy also is the fact that the crusher rolls as designed and arranged herein produce a crushed product having a preponderance of sharp points and edges, which is highly desirable for certain uses. Of particular advantage also is the fact that relatively inexpensive pea gravel, in a single pass through the crusher rolls, will emerge as sharp specification sand of high quality with a low powder content. Operation of the machine is characterized by a minimum of vibration, noise, dust and other waste, all of which contributes to the desirability and economical operation of the machine, with relative freedom from shut-downs and expensive parts replacements and repairs.

It has been determined that the superior results obtained with the improved crusher results largely from the confinement of the crushable material within the spaces between the roll ribs as the particles are subjected to forces which cause the particles to crush one another in the process. By so confining the particles while under pressure, lost motion and slippage of the particles over the roll surfaces are substantially eliminated, with the result that useful work is performed throughout each rotation of the rolls, and the crushing action progresses at the greatest possible rate.

The crusher herein disclosed may be equipped with vibrating means, if desired, to assist in maintaining the desired feed of material and possibly increasing the productive capacity of the apparatus. The size of the bight 64 determines the size of the particles produced, and the reduction attained is approximately two-to-one in a machine whose rolls are about three feet in diameter, with ribs spaced apart about three inches. These dimensions are, of course, subject to alteration.

Various other modifications and changes in structural details may be resorted to, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. Crushing apparatus comprising in combination, an elongate bed, a first crusher roll supported transversely upon the bed for rotation, a second crusher roll, an elongate heavy beam having an end including means to rotatably support the second crusher roll above and in substantial parallelism with the first crusher roll, means near the opposite end of the beam for tiltably supporting the beam above the bed and in approximate parallelism therewith, whereby tilting movement of the beam displaces the second crusher roll relative to the first roll, with gravity acting to urge the second roll toward the first roll due to the end support of the beam, and separate power means on the bed and upon the beam, for driving the crusher rolls in opposite direction of rotation, said crusher rolls each being provided with circumferentially ribbed working faces, the ribs being spaced apart to provide alternate valleys and confining ribs, the ribs of one roll being fitted into the valleys of the other roll with a running clearance, and cooperative means on the bed and the beam for guiding the beam in its tilting movement, to maintain the ribs of one roll substantially centered in the valleys of the other roll, and for selectively varying the depth to which the ribs of one roll enter the valleys of the other roll.

2. Crushing apparatus comprising in combination, an elongate bed, a first crusher roll supported transversely upon the bed for rotation, a second crusher roll, an elongate heavy beam having an end including means to rotatably support the second crusher roll above and in substantial parallelism with the first crusher roll, means near the opposite end of the beam for tiltably supporting the beam above the bed and in a vertical plane which includes the bed and the beam, whereby tilting movement of the beam displaces the second crusher roll relative to the first roll, with gravity acting to urge the second roll toward the first roll due to the end support of the beam, separate power means for driving the crusher rolls in opposite directions of rotation, an upright stanchion on the bed having an upper end located to support the weight of the roll end of the tiltable beam, and bodily insertable and removable individual shim means between the beam and the stanchion, to maintain a selected spacing of the crusher rolls one from the other.

3. Crushing apparatus comprising in combination, an elongate bed, a first crusher roll supported upon the bed for rotation, a second crusher roll, an elongate heavy beam having an end including means to rotatably support the second crusher roll above and in substantial parallelism with the first crusher roll, means near the opposite end of the beam for tiltably supporting the beam above the bed and in a vertical plane which includes the bed and the beam, whereby tilting movement of the beam displaces the second crusher roll relative to the first roll, with gravity acting to urge the second roll toward the first roll due to the end support of the beam, separate power means for driving the crusher rolls in opposite directions of rotation, a series of spaced extending ribs on each roll arranged circumferentially thereon, providing alternate valleys and confining ribs, the ribs of one roll being fitted into the valleys between the ribs of the other roll with a running clearance, an upright stanchion on the bed having an upper end located to support the weight of the roll end of the tiltable beam, and co-operative shim means between the beam and the upper end of the stanchion, to maintain a selected spacing of the crusher rolls one from the other, said shim means being in the form of nestable wedges one fixed to the beam and another fixed to the stanchion, whereby in nesting one with the other, the wedges maintain vertical alignment between the bed and the beam, and uniform spacing of the ribs in the valleys of the crusher rolls.

4. The device as set forth in claim 3, wherein the power

means for rotating the beam-supported crusher roll is approximately twice as powerful as the power means for the bed-supported crusher roll.

5. Crushing apparatus comprising in combination, an elongate bed, a first crusher roll supported transversely upon the bed for rotation, a second crusher roll, an elongate heavy beam having an end including means to rotatably support the second crusher roll above and in substantial parallelism with the first crusher roll, means near the opposite end of the beam for tiltably supporting the beam above the bed and in approximate parallelism therewith, whereby tilting movement of the beam displaces the second crusher roll relative to the first roll, with gravity acting to urge the second roll toward the first roll due to the end support of the beam, and separate power means on the bed and upon the beam, for driving the crusher rolls in opposite directions of rotation, said crusher rolls each being provided with circumferentially ribbed working faces, the ribs being spaced apart to provide alternate valleys and confining ribs, the ribs of one roll being fitted into the valleys of the other roll with a running clearance, and bodily insertable and removable shim means for selectively varying the depth to which the ribs of one roll enter the valleys of the other roll, said shim means being nestable one within another, to maintain alignment of the beam with the bed in an upright plane.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 9,992	Reid	Dec. 27, 1881
376,877	Granger	Jan. 24, 1888
447,711	Hyde	Mar. 3, 1891
554,377	Roger	Feb. 11, 1896
673,768	Fleming	May 7, 1901
988,749	Wall	Apr. 4, 1911

FOREIGN PATENTS

1,207	Italy	Nov. 30, 1884
1,262	Great Britain	Mar. 8, 1883
1,311	Great Britain	June 8, 1855
459,889	France	Sept. 19, 1913
839,011	Great Britain	Jan. 25, 1957
1,207,498	France	Sept. 7, 1959