

Oct. 21, 1924.

1,512,236

P. PHELPS

CRUSHER

Filed Aug. 24, 1921

2 Sheets-Sheet 1

Fig. 1.

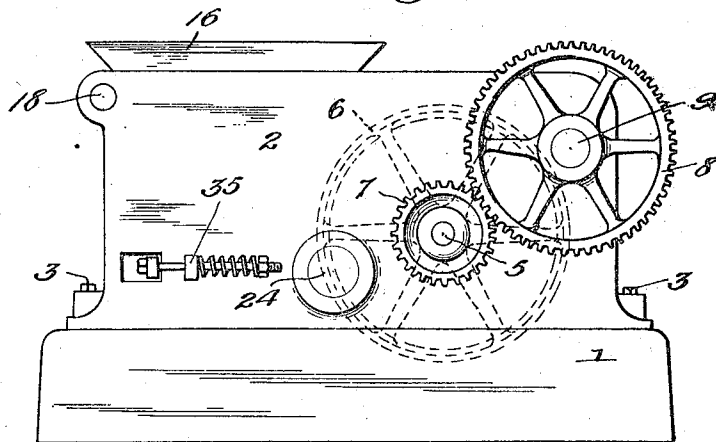


Fig. 2.

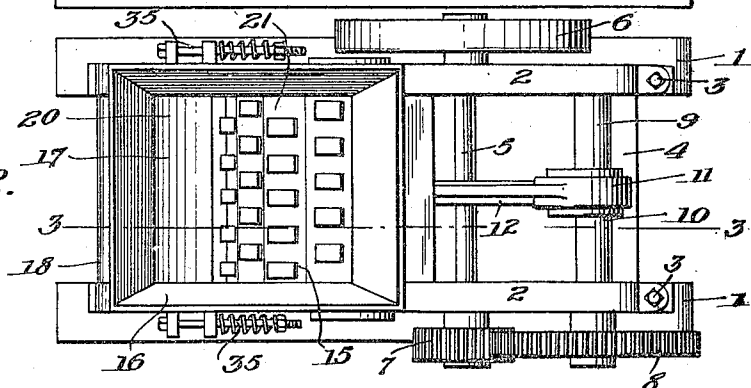
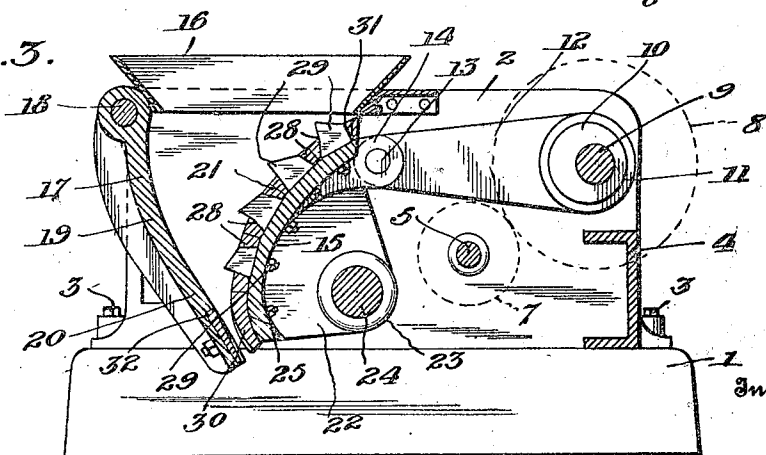


Fig. 3.



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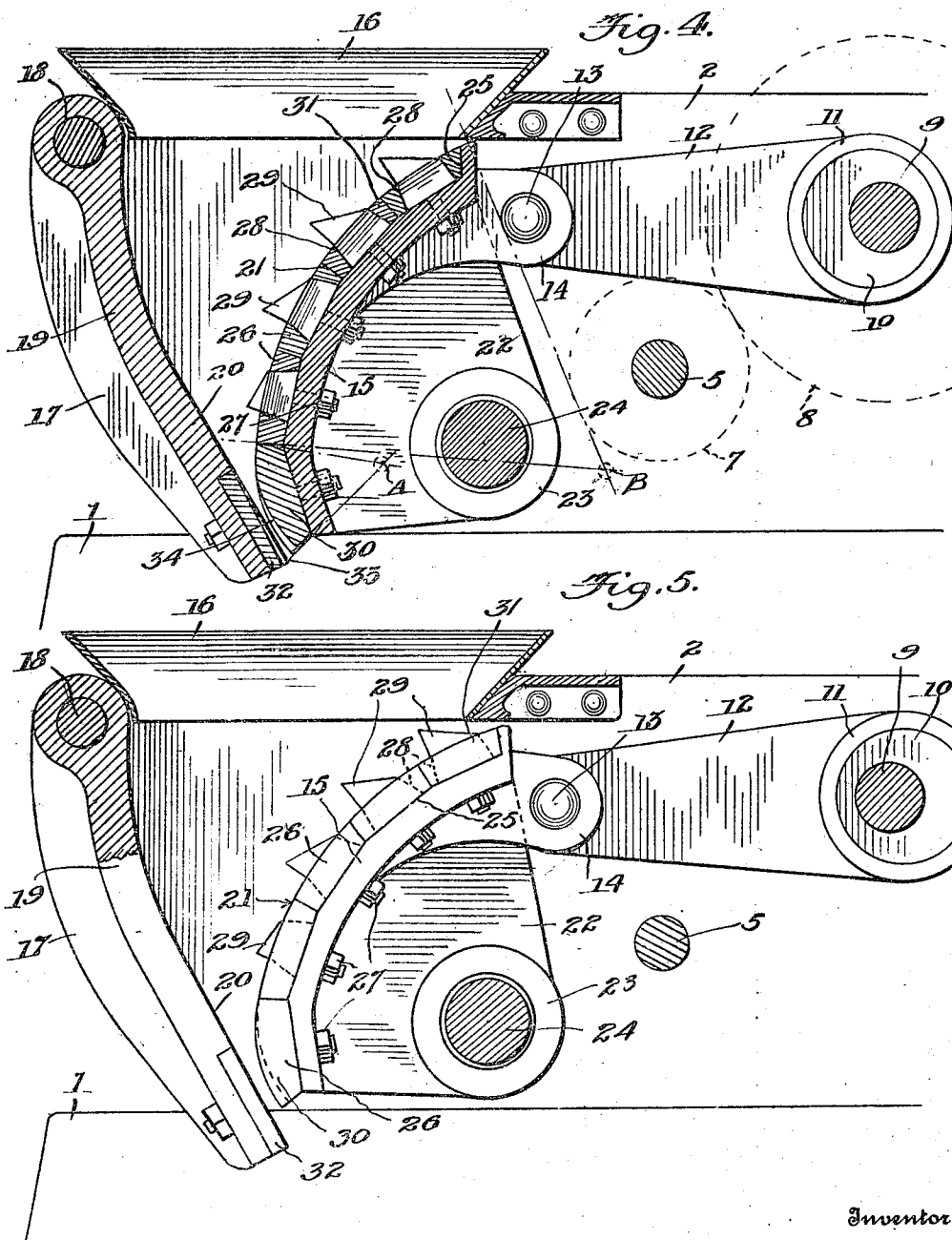
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UNITED STATES PATENT OFFICE.

PAUL PHELPS, OF COLUMBUS, OHIO, ASSIGNOR TO VOGT BROTHERS MFG. CO., OF LOUISVILLE, KENTUCKY, A CORPORATION.

CRUSHER.

Application filed August 24, 1921. Serial No. 495,048.

To all whom it may concern:

Be it known that PAUL PHELPS, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, has invented certain new and useful Improvements in Crushers, of which the following is a specification.

This invention relates to improvements in crushing machinery, and is particularly directed to a crusher adapted for the purpose of reducing coal in order that the latter material may be rendered adaptable for use by mechanical stokers.

An object of the invention resides in the provision of an improved coal crusher wherein features of construction are provided for the purpose of enabling the material to be reduced to a substantially uniform state and wherein substantially all over-size lumps or particles heretofore secured from similar crushers will be reduced to the desired size, in order that the coal may be efficiently employed by such mechanical stokers.

Other objects of the invention reside in the provision of a crusher which will be of substantial and simple construction and efficient in operation, having a relatively large capacity and capable of operating for extended periods without requiring repairs, adjustments, or other manual attention.

The invention consists primarily in the provision of a crusher wherein is embodied a suitable supporting framework or housing, the latter being adapted to carry a hinged breaker plate and a relatively spaced oscillating crusher plate, the latter having an eccentric crushing surface, whereby when the latter plate is oscillated the eccentric surface thereof will move in a forward and downward direction on its advance stroke and a backward and upward motion on the return stroke. The invention further consists in the provision of means for effecting the oscillation of the plate, the arrangement of parts being such that the material fed between said plates will be subject to a rolling action, thus giving the material an opportunity to shear along natural cleavage planes, rather than requiring it to be crushed by direct compression, and the invention also consists in the release of the crushed material at the point of discharge by the drawing away of the bottom of the

oscillating plate on its return stroke, thereby securing relief from pressure at the point of discharge.

With these and other objects in view, that will appear as the description proceeds, the invention accordingly consists in the novel features of construction, combinations of elements and arrangements of parts, hereinafter to be fully described and particularly pointed out in the appended claims.

In the accompanying drawings forming a part of this specification, and in which similar characters of reference denote like and corresponding parts throughout the several views thereof:

Figure 1 is a side elevation of the improved crushing machine comprising the present invention.

Figure 2 is a top plan view thereof.

Figure 3 is a vertical longitudinal sectional view taken on the plane indicated by the line 3—3 of Figure 2.

Figure 4 is an enlarged vertical sectional view disclosing the oscillating breaker plate in its lowermost position of operation, and,

Figure 5 is a similar view disclosing the said oscillating breaker plate in its uppermost position.

Referring more particularly to the details of construction of the particular embodiment of the invention disclosed in the accompanying drawings, the numeral 1 indicates a suitable base upon which my improved crushing machine may be mounted. Arranged to be mounted stationarily and securely upon the base is the frame of the machine, which in this instance is formed to include spaced longitudinally extending sides 2, which are bolted or otherwise secured as at 3 to the base 1 and may be transversely connected in any suitable manner such, for example, as by means of the strut or tie member 4. Transversely journaled in the frame is a power shaft 5 which may have one of its outer ends equipped with a fly or belt wheel 6, by means of which power from any suitable prime mover may be imparted to the machine. The other end of the shaft 5 is equipped in this instance, with a cog gear 7, which meshes with a larger cog gear 8, fixed to an eccentric shaft 9.

The shaft 9 is transversely mounted within the sides 2 for rotation and is provided

intermediately of its length, in this particular form of the invention, with an eccentric or its equivalent 10 around which is positioned the strap 11 of a longitudinally extending link 12. The forward or other end of the link is pivotally connected as at 13 with spaced ears 14 integrally formed, if desired, upon the upper part of an oscillating crusher plate 15, which is confined for operation between the frame sides 2 and adapted to be situated immediately beneath the receiving mouth or hopper 16 of the machine and form a continuation thereof. Also mounted between the sides 2 and cooperating with the oscillating crusher plate 15 is a normally stationary breaker plate 17 which also forms a continuation of the hopper. The plate 17 has its upper end hinged as at 18 to the forward and upper edges of the sides 2 and is formed with a downwardly and concavely curved portion 19 which terminates in a substantially straight angularly extending portion 20. Said straight portion cooperates with the eccentrically mounted and curved crushing surface 21 of the plate 15. The relative arrangement of the plates is such that the greater space between them will be found immediately beneath the receiving mouth 16, and the narrower space at the lower or discharging ends of the said plates. Attention is also particularly directed to the fact that the portion of the plate 17 which lies nearest to the center of the shaft 24 is at its lowest extremity, and that the plate recedes upwardly from said shaft. As a result of this construction and of the eccentricity of the oscillatory jaw the opening through which the coal escapes from between the jaws increases in size as the oscillatory jaw moves upwardly.

The oscillating breaker plate has its ends provided with longitudinally disposed wings 22 which are provided with bearings 23 for the reception of a substantially stationary shaft 24, which has its ends connected in any suitable manner with the sides 2, the arrangement being such that upon the rotation of the shaft 9 oscillatory motion will be imparted to the crusher plate 15. The curved surface 21, of the crusher plate, which constitutes an important feature of the present invention, is formed to include a pocket 25, in which are seated removable wear plates 26, suitably hardened to resist wear and removably secured to the plate 15 by means of threaded devices or their equivalents 27, which permit the plate 26 to be readily repaired or replaced. The plate 26 is formed to include a plurality of outwardly tapering sockets 28, in which are removably positioned a plurality of crushing teeth 29, the said teeth being of graduated size, the smaller being situated toward the lower end of the plate 15 and the larger toward the upper end thereof, thus providing teeth of a

size to correspond to the size of the material engaged thereby. It will be understood that the base portions of the teeth 29 will conform to the shape of the sockets 28, in order that the said teeth will be firmly held against displacement when the plate is in active operation. It will be observed that the outer surface of the wear plate 26, which in reality constitutes the effective crushing surface of the oscillating crusher plate, is formed by a plurality of radii in order to perform certain functions. The eccentricity of the surface may be observed by reference to the centers A and B. The former is the center from which the lower portion of the plate 15 is struck, such portion being indicated by the numeral 30, and the point B is the center of a circle from which the upper portion 31 of the eccentric surface of the crusher plate is struck. Both of said centers, A and B, are eccentric with respect to the shaft 24, therefore the crushing surface 21 as a whole is eccentric to the center of oscillation determined by the shaft 24, that is, the distance from the center of the shaft 24 to the surface 30 is less than the distance to the surface indicated by the numeral 31.

The eccentricity of the surface 21 as a whole provides a pocket between the plates 15 and 17 into which material to be crushed may be positioned, whereby upon the rotation of the shaft 9, the desired oscillatory motion will be imparted to the plate 15. Then, due to the construction of this plate, the material confined between the movable and stationary plates will be subjected to a rolling action, thus giving the material an opportunity to shear along natural cleavage planes instead of requiring it to be crushed by the direct application of pressure or compression. Since the surface 31 is farther from the center of the shaft 24 than the surface 30, it follows that the greatest amount of movement will be imparted to the breaker plate adjacent to the upper part thereof, and this motion is utilized on the larger lumps of material placed in the mouth of the machine, to reduce the size of such lumps which permits the same to be further reduced or pulverized in the lower part of the crusher. It will be seen that as the coal or other material is crushed into smaller lumps or particles, the said lumps will settle or be fed downwardly in the machine by the crusher action of the oscillating crusher plate, and reduced to the necessary uniform grade such as adapted for stoker purposes. If desired, the breaker plate 17 may be provided with a removable wear strip 32, having corrugations or their equivalents 33 formed in the outer face thereof, and designed for cooperation with similar corrugations 34 provided either horizontally or vertically in the lower portion 30 of the plate 15, said corrugations serving to insure the crushing of

long thin plates of material that might otherwise pass between the jaws of the machine. As the plate 15 advances, a rotary forward and downward motion is simultaneously imparted thereto, which causes the teeth 29 and the eccentric surface 21, as a whole, to engage with the coal to be crushed or broken to a reduced size by such rolling action between the plate, but nevertheless permit the finer particles of the coal to be fed toward the restricted space provided between the lower portions of the plates 15 and 17. The finely or properly crushed materials are discharged from the machine upon the upward and return stroke of the plate 15. This is accomplished by the increased opening upon the return stroke of the plate 15 between the bottom of said plate and the breaker plate 17. This increased opening is brought about by the reason of the relative location of the pivot point of the plate 15 with its shaft 24 and the lowest edge of the plate 15 with reference to the plate 17. By this construction, it will be apparent that it is through the medium of the arcuate formation of the plate 15 that the functions of the present invention are carried out and it is to this element particularly that the invention is addressed. The said arcuate surface serves to produce the desired rolling crushing action upon the down stroke of the plate and the release or rearward movement of the plate upon the upward stroke thereof. It will be understood that the hinged breaker plate may be provided with a suitable spring operating release mechanism 35, which will serve to permit of relative movement of the plate 17 with respect to the plate 15 upon the entering of any substance harder than that calculated for the crushing power of the plates or jaws.

Reduced to its simplest form, the foregoing machine includes the following mechanical elements: a base line (the relatively stationary plate 17), an arcuate member movable adjacent thereto (face of plate 15) having a center at A which is supported by one end of a bell crank having a pivot at 24, the other end being connected to an actuating link 12 at the center 13, see Fig. 4. If it be assumed that face 30 be equidistant from the plate at all times, then the bell crank cannot move or of necessity the center A must coincide with center 24 and not be eccentric thereto. Therefore, when the center A is eccentric to the center 24 and the bell crank is tilted, the curved face 30 must move with respect to the base line or plate 17, and herein since the radius of curvature is less than the radius from face 30 to center 24, the surface 30 moves away from plate 17 upon the upward stroke of the plate 15 or the

clockwise tilting of the bell crank. Upon the reverse tilting, the plate 15 approaches the plate 17 and crushing occurs. From the foregoing it is obvious that the corollary, i. e., when the distance from the center A to the face 30 exceeds the distance from the face to the center 24, the clockwise tilting or upward movement will cause plate 15 to approach the plate 17, and upon the reverse movement, i. e., downward the plate 15 recedes from the plate 17. This recession in each instance constitutes relief of pressure, determinable by the relationship of the centers. The effects hereinbefore stated are equally true if the center A be positioned in the diagonally opposite quadrant.

I do not claim broadly an oscillating crusher plate or jaw since I am aware that similar constructions have heretofore been proposed, but I do claim the following.

What is claimed is:

1. A crusher including an oscillatory crusher plate having a curved crushing surface including two distinct adjacent arcuate surfaces with their respective centers of curvature eccentric to the center of oscillation, said curved surface extending on each side of said center for effecting relief of pressure in the actuation of the crusher.

2. A crusher including a breaker plate, and an oscillatory crusher plate having a curved crushing surface including two distinct adjacent arcuate surfaces, said surfaces extending on each side of the center of oscillation, the arcuate surface adjacent the breaker plate having its center eccentric to the oscillation center and of smaller radius than the other portion of said surface for effecting relief of pressure in the actuation of the crusher.

3. A crusher including a breaker plate, and an oscillatory crusher plate having a curved crushing surface including two distinct adjacent arcuate surfaces, said surfaces extending on each side of said center of oscillation, the arcuate surface adjacent the breaker plate having its center eccentric to the oscillation center and of smaller radius than the other portion of said surface, and said other arcuate surface having its center also eccentric to the oscillation center for effecting a relief of pressure in the actuation of the crusher.

4. In a crusher, an oscillatory crusher plate having a curved surface including two distinct adjacent arcuate surfaces, one of said surfaces having its center of curvature eccentric to the center of oscillation, and the other arcuate surface having a smaller radius than the first arcuate surface.

In testimony whereof I affix my signature.

PAUL PHELPS.