FIG. 5.

FIG. 6.

FIG. 7.

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This invention relates to a crusher, particularly to a crusher of the type that uses a helical screw in the bottom of a hopper.

Although a crusher made according to this invention has been specifically applied to the crushing of block sulphur, it will be evident to those skilled in the art that a crusher made according to this invention can be used on other similar materials. In the mining operations in which a crusher made according to this invention has been used, the sulphur is cooled in large vats, and has to be broken up for convenience in transporting. It soon became evident from practice that hand methods using picks had to be abandoned in favor of mechanical crushing owing to a number of reasons, including the hazard of explosions caused by sparks raised in the course of hand operations by the steel picks striking the steel grids.

It is accordingly an object of this invention to provide a crusher which will take large blocks of sulphur or other mineral or the like and will break up the blocks to a convenient handling size. This and other objects are accomplished in a crusher which is of the hopper type with a combination crusher and feed screw in the bottom of the hopper. The crusher further has a discharge section secured to the hopper, with a discharge gate having openings at the end of the discharge section. A discharge mouth opens outward and downward in the end of the discharge section ahead of the discharge gate. In addition, a plurality of small openings is provided throughout the length of the bottom of the hopper in order to permit small sizes to drop out of the hopper and not require these small sizes to be fed by the screw to the discharge mouth.

A conveyor belt or other convenient conveying means is provided below the hopper and receives the discharged material. The small particles dropping through the holes serve to cushion the belt or other conveying means against the large lumps which may drop out through the discharge mouth or through the discharge openings in the gate.

In the drawings:

Fig. 1 is a top plan view of a crusher made according to this invention.

Fig. 2 is a side elevation view of the crusher shown in Fig. 1.

Fig. 3 is an end elevation view (the motor drive end) of the crusher shown in Fig. 1.

Fig. 4 is a view in section on line 4—4 of Fig. 1.

Fig. 5 is a view in section substantially on line 5—5 of Fig. 4.

Fig. 6 is a view in section on line 6—6 of Fig. 4.

Fig. 7 is a view from the plane 7—7 of Fig. 4 in the direction indicated by the arrows.

A crusher made according to this invention is preferably mounted to be mobile on tracks 2 by means of wheels 4. Any suitable framework may be provided, comprising I-beams, channels, and angles or the like, suitably braced with tubing or other structural material. Inasmuch as the details of the frame do not form any part of this invention, those details will not be described here.

Any suitable conveying means such as a conveyor belt 6, suitably supported beneath the hopper, may be provided to carry away the crushed sulphur or other mineral.

A hopper indicated generally at 8 consists of a plurality of sloping walls and a curved bottom wall. Thus, the hopper is provided with opposed sloping side walls 10 and other opposed sloping end walls 12. As is best seen in Figs. 3, 5 and 7, the two opposed sloping side walls 10 are tangent to the curved bottom wall 14. In fact, the two side walls 10 and the bottom wall 14 are preferably all one piece, either made of one sheet of steel or other suitable sheet material and rolled into shape, or fabricated by welding a number of pieces together, or made in any other suitable manner.

A discharge section indicated generally at 16 is secured to one end of the hopper. The discharge section preferably comprises a substantially tubular shell 18 having substantially the same curvature as the bottom wall 14 and in fact preferably being made integral therewith. A discharge gate 20 having discharge openings 22 therein is secured to the end of the discharge section in any suitable manner, as for example by threaded members 24.

An auxiliary discharge mouth 26, opening downward and outward, is provided in the discharge section ahead of the discharge gate 20. The discharge mouth 26 is provided in the discharge section by means of recesses in the bottom wall portion of the discharge section and in the tubular portion thereof. The recesses consist of a vertical, substantially plane cut 28 in the bottom wall of the discharge section and a horizontal, also substantially plane cut 30 in the tubular shell. Relatively small openings 32 are provided in substantial number in the bottom of the hopper, namely, in the bottom wall throughout the length of the hopper.

The rear of the end walls 12 joins with a vertical plane portion 34 (Fig. 4). Any suitable
bearings 36 and 38 are supported by the vertical plane portion 34 and the discharge gate 20 respectively. Bearings 36 and 38 serve to support a rotatable shaft 48 in the bottom of the hopper and in the discharge section 19. Shaft 48 is connected for rotation by an electric motor 42 through any suitable drive means, as for example, through a gear reduction unit 44 and a chain drive 46.

The screw of a crusher made according to this invention comprises the abovedescribed shaft 40 and two screw ribbons 39 and 50 of different diameters mounted on the shaft 40. Thus, the screw ribbon 39 has a radius such as to provide a small clearance between the screw periphery and the hopper bottom, and the second screw ribbon 50 has a substantially smaller radius than that of the screw 40. Both screw ribbons preferably extend the whole length of the shaft—i.e., that portion of the length of the shaft which is inside the hopper bottom, including the discharge section 19. This is accomplished by having the convolutions of the second screw 50 lie between the convolutions of the first screw 39. The two screw ribbons are preferably 180° apart.

To facilitate the crushing operation, breaker projections 52 and 54 are provided on a breaker plate 56 and on the discharge gate 20 respectively. The breaker projections are preferably in the form of small triangular pyramids, although it will be understood by those skilled in the art that other forms may be used. Breaker plate 56 is secured to the side walls 18 (Fig. 9) immediately below end wall 12 (Fig. 4) in a position corresponding to vertical plane portion 35; however, plate 56 has a centrally located arcuate opening of the same curvature as bottom wall 14.

An auxiliary or extension hopper 58 is secured to the top of main hopper 8 by means of a flange 68, and a grid made of crossed rods 62 is secured to the top of auxiliary hopper 58.

Operation

It may be pointed out here that this crusher will operate choke-loaded without stalling. It may also be choke-loaded before starting and can be started even though thus loaded.

Large blocks, even blocks having a maximum dimension of four feet, of any size or material are dumped by any suitable means into the auxiliary hopper 59, falling through the grid formed by rods 52. The large blocks of mineral to be crushed pass down into the main hopper 8 and are crushed by the large and small screw ribbons against the breaker projections 52 and 54. Small particles (two inches or less) pass through openings 22 onto the belt 6, which moves in the direction of the arrow V. The small particles on the belt serve to cushion the blow of the large particles falling out through the mouth 25 and being discharged through the openings 22.

It will be apparent to those skilled in the art that this invention provides a crusher of simple design and construction capable of handling large blocks of mineral expeditiously and reducing those large blocks to smaller blocks of convenient handling sizes.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

We claim:

1. In a crusher, a hopper, a discharge section secured to the hopper at one end, a combination feed and crushing screw rotatably mounted in the hopper and discharge section, the discharge section being provided with a mouth opening downward and radially outward from said screw, and a discharge gate at the end of the discharge section and opening axially outward from the end of the screw.

2. In a crusher, a hopper, a discharge section secured to the hopper at one end, a combination feed and crushing screw rotatably mounted in the hopper and discharge section, a discharge gate at the end of the discharge section, said gate having discharge openings therein, and an auxiliary discharge mouth ahead of said gate, said mouth being formed by a recess provided in the bottom and end of the discharge section.

3. A crusher as in claim 2, and breaker projections in the hopper and in the discharge section.

4. A crusher as in claim 2, in which the hopper bottom is provided throughout its length with a plurality of small openings.

5. A crusher as in claim 4, in which said screw comprises a shaft, and two screw ribbons of different diameters on said shaft.

6. A crusher as in claim 5, in which both screw ribbons extend the whole length of the shaft.

7. In combination, a material-receiving hopper having side walls and a bottom wall, a combination feed and crushing screw rotatably mounted in the hopper adjacent the bottom, means adjacent one end of the hopper to permit egress of coarse crushed material, additional means in the bottom of the hopper to permit the passage of relatively fine crushed material, and conveyor means below the hopper movable in the direction from said adjacent means to said adjacent means.

8. The combination of claim 7, in which the adjacent means includes a discharge section provided with discharge openings and with a discharge mouth ahead of said openings, said mouth opening in the aforesaid direction.

9. The combination of claim 8, in which said adjacent means consists of a plurality of holes materially smaller than said openings and said mouth.

10. The combination of claim 7, in which said additional means consists of a plurality of holes materially smaller than said openings and said mouth.

11. In a crusher, a hopper having sloping walls and a curved bottom wall, at least two of the sloping walls being opposed and being formed by substantially unbroken planes which are tangent to the hopper bottom wall, a discharge section secured to the hopper, a shaft rotatable in the hopper bottom and in the discharge section, a pair of screw ribbons of materially different diameters on the shaft extending throughout the length of the shaft, the convolutions of the one ribbon being between the convolutions of the other, a discharge gate on the discharge section and having discharge openings therein, and an auxiliary discharge mouth ahead of said gate.

12. In a crusher, a hopper having sloping walls and a curved bottom wall, at least two of the sloping walls being opposed and being formed by substantially unbroken planes which are tangent to the hopper bottom wall, a discharge section...
secured to the hopper, a shaft rotatable in the hopper bottom and in the discharge section, a pair of screw ribbons of materially different diameters on the shaft, a discharge gate on the discharge section and having discharge openings therein, and an auxiliary discharge mouth ahead of said gate.

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References Cited in the file of this patent

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