Dec. 11, 1951 T. J. GUNDLACH 2,578,540

PAIRED-ROLL CRUSHERS WITH PERIPHERAL SIZING-POCKETS ON EACH ROLL

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FIG. 1.

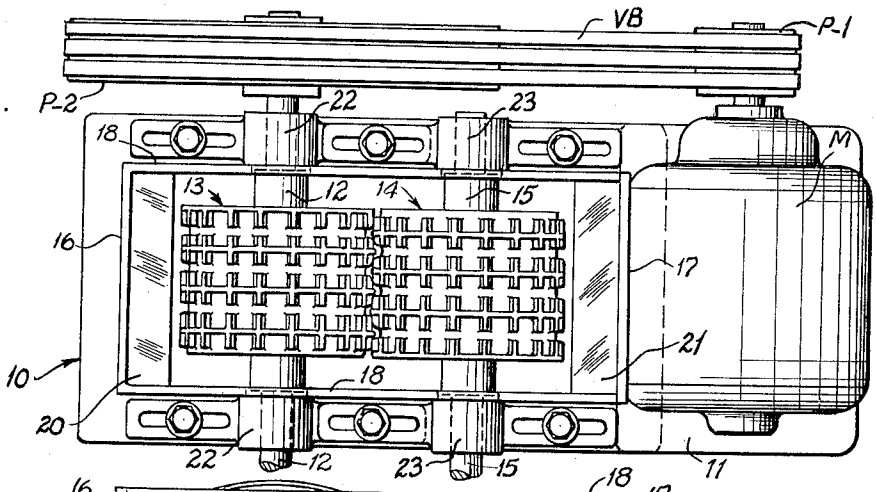

FIG. 2.

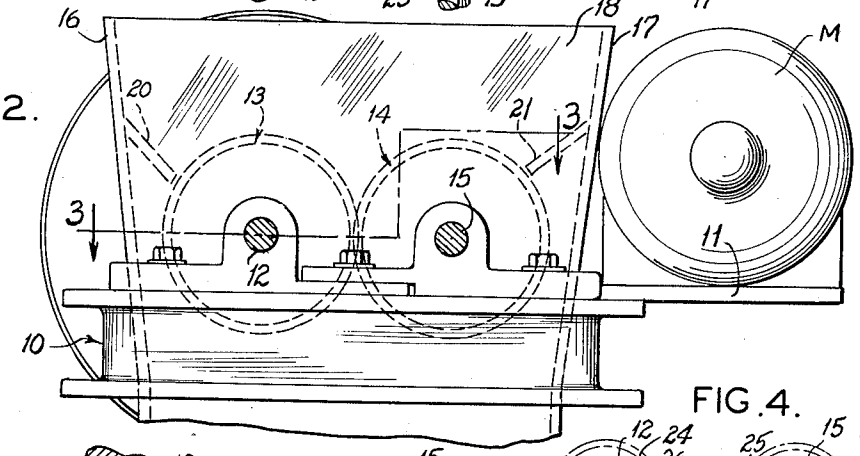

FIG. 4.

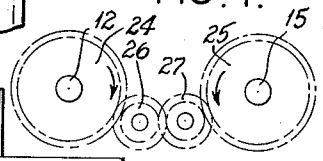

FIG. 3.

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PAIRED-ROLL CRUSHERS WITH PERIPHERAL SIZING POCKETS ON EACH ROLL

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6 Claims. (Cl. 241—236)

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This invention relates to improvements in crushers for coal and the like, and more particularly to an improved formation of crushing rolls for such purposes, the improvements being of such nature as to reduce a substantial proportion of the larger sizes of coal to a size of a smaller more or less definite grading.

By reason of increasing commercial demand for coal of domestic stoker sizes, there has arisen a need for a compact crusher unit of such nature that it may be utilized by wholesale coalyards and others, for sizing mine-run and larger coal, substantially completely to stoker size. Within the knowledge of this applicant, no such device has heretofore been available in satisfactory and efficient type, to need this demand; the realization of a suitable unit for such purpose accordingly constitutes a major objective of the present invention.

The present invention may perhaps best be summarized by reference to the features of a preferred embodiment, currently described, as consisting of a novel pattern of surface ribs and bars on a pair of coacting crusher rolls, such that the ribs and bars define coal-receiving pockets in and close to the crushing zone between the rolls, such pockets being so shaped and dimensioned as to result in the desired size of coal, and importantly, such as to minimize the crushing effect on the coal when once reduced to size, and which otherwise would result in a high percentage of fines, slack and unwanted smaller sizes.

Additional objects and advantages of the present developments include a novel formation of crushing ribs and bars on the surfaces of a pair of crushing rolls, such that, whether formed integrally with the rolls or by applied surface sections, the projections on each roll intervene and coact with recess portions on the companion roll to attain the noted result.

A still further and important object of the present invention, is realized in such an arrangement of coal-crushing elements on paired rolls for this purpose, that there results by coaction of the rolls a virtual isolation of the individual sized units or small lumps, from each other and from the remaining coal mass, whereby to preclude an undesirable nature and extent of crushing action on the coal, when once reduced to desired size.

The foregoing and numerous other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment, particularly when considered in connection with the accompanying drawing, in which:

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Fig. 1 is a top or plan view of an assembly embodying the present improvements, together with power drive means therefor;

Fig. 2 is a side elevational view of the assembly shown by Fig. 1;

Fig. 3 is a view taken in staggered, horizontal planes, of paired crusher rolls as same would appear in assembly, Fig. 3 being taken along line 3—3 of Fig. 2, and

Fig. 4 is a diagrammatic view of a train of gearing through which the roll shafts are operatively interconnected in timed relation.

Referring now by characters of reference to the drawing, the assembly is mounted on a stationary base or supporting frame structure generally indicated at 10, and including an extension ledge or bracket 11 for the support of an electric motor M, assuming the unit to be electrically powered. A V-belt pulley P1 of multiple V-belt type is shown as carried by the shaft of motor M, and is operatively connected in speed-reducing relation through a series of multiple V-belts VB to a larger pulley P2 attached to a shaft 12.

The shaft 12 rotatively supports one of a pair of crusher rolls indicated generally at 13, which acts, in a manner which will be described, in conjunction with a companion roll generally indicated at 14, in the reduction of coal or similar frangible solids. The shaft 14 is attached to and rotatively supported by a shaft 15 which, as will appear, is in driven relation to the powered shaft 12, and which bears a definitely timed relation thereto.

Supported as by the base 10 is a hopper or similar structure for receiving the coal prior to sizing or crushing, the hopper being formed in any suitable or conventional manner and includes end walls 16 and 17, and suitable side walls one of which is indicated at 18, together with suitable internal baffles a pair of which are shown at 20 and 21 serving to direct the incoming coal or like material onto the rolls 13 and 14.

Suitable pillow blocks or bearing blocks for the shafts 12 and 15 are indicated at 22 and 23. It is particularly desirable that at least one set, for example the blocks 23, be mounted to permit under extreme stress, a horizontal sliding movement against suitable springs (not shown), or otherwise so mounted that the crushing rolls 13 and 14 may yieldably separate upon encountering an infrangible object, for example a large piece of metal. Such facilities are not illustrated since they form per se, no part of the present improvements directed to the surface formation and contouring of the crusher rolls.

Proceeding now to describe the novel external pattern, configuration or arrangement of crushing elements on the rolls 13 and 14, it may first be noted, as making for brevity of description, that the two rolls are or may be of identical surface formation except by preference being endwise or axially reversed, as will later better appear. Such uniformity of surface formation and other features, makes for economy in production; for example, as is sometimes preferred, the two rolls may each be formed as a single casting, and a single set of patterns will suffice for each. Alternately, it is quite possible to form the crushing elements of each of the rolls in sections or segments each in part cylindrical form, and to attach such sections (not shown) by bolts or screws to a cylindrical body element of the roll. Accordingly, the improvements are to be understood as embracing the claimed arrangement and structure to attain the crushing action, irrespective of the makeup of each of the rolls.

With particular reference first to Fig. 4, being the diagrammatic showing of a gear connection between the paired coacting crusher rolls, it is seen that a gear 24 is attached to shaft 12 and a similar gear 25 secured to shaft 15. Since the gears 24 and 25 must operate toward each other in directing the coal into the crushing zone between the rolls, two intervening drive pinions 26 and 27 are provided, the pinion 26 meshing with gear 24, and in turn engaging pinion 27, and the latter engaging the gear 25 which drives roll 14. Thus when moter M is energized, the V-belt drive pulley P2 will actuate shaft 12 which in turn, through the gearing 24—26—27 and 25, will drive the roll 14 through shaft 15.

Now with reference to the arrangement and nature of crushing elements formed on and projecting from the surface of the rolls 13 and 14, it will appear that each of the rolls comprises a plurality, shown for example as four, of circumferential ribs, one of which is designated as 30, being an end rib on the roll, and others indicated at 31, carried intermediately of the ends of the roll. Each of the ribs intersects a plurality of evenly, angularly spaced cross bars including bars 32 which project from the end rib 30, and others shown at 33, each of the latter being centrally intersected by one of the ribs 31 of which it forms a part. The cross bars 32 are of one-half length, while those indicated at 33 are of a length approximating yet slightly less than the axial spacing between the adjacent circumferential ribs. In the assembly on each roll 13 and 14, the same number of cross bars 32 or 33 are provided in connection with each of the circumferential ribs, the cross bars being aligned in rows as will appear from Fig. 3, but with a definite break or interruption as indicated at 34, between the rows of cross bars. The series of spaces 34 result in a groove or channel, which channel serves to receive one of the circumferential ribs of the companion roll of the pair, as clearly appears from Fig. 3.

It is further noted as a preference and as shown, to form each of the cross bars 32 and 33 of a tapered transverse section so that each exhibits a greater section of metal at its base than at its top. Further as a preference, each cross bar is of tapered length, increasing in length from its outer portion toward its inner or base portion (Fig. 3).

It is a preference so to form the crusher rolls that the pattern of ribs and cross bars thereon is asymmetric as to arrangement thereof between the ends of the rolls. While the spacing of the ribs from each other is uniform, this spacing is preferably other than an even small aliquot part of the length of the roll, and from these features results the facility for endwise reversing the rolls, with the interfitting effect shown by Fig. 3, whereby each of the ribs 30—31 of each roll operates in one of the channels or grooves 34 of the companion roll.

By reason of the aforesaid structure, it will appear that the ribs and cross bars of the two rolls coact in the crushing zone therebetween, to form more or less defined pockets 35. These pockets are of a size determined by the size of the desired coal, and their dimensions are, by way of present example, such that each such pocket will receive without further crushing action thereon, a lump of coal of domestic stoker size. The pockets 35 may obviously be reproportioned for example, should coal of nut, egg or other usual trade size be desired.

As the rolls are rotated, the coal is broken and reduced to a size such as will be received in the several pockets between the rolls at their closest point, and will be discharged by gravity from the surface formations of both rolls, in passing below or beyond the crushing zone. The pockets as described are laterally bounded by the circumferentially located ribs 30 and 31, and are endwise bounded by the cross ribs 32 or 33.

It is important to note that the timed relation between the rolls 13 and 14 is such that the cross bars 32 and 33 of each roll, in passing through the crushing zone, fall between the cross bars of the companion roll, and similarly are presented in the crushing zone, between an adjacent pair of the circumferential ribs. This precludes direct impact between corresponding crushing elements of the two rolls and properly defines the pockets 35 as the coal passes through the crushing zone.

The construction of the crushing rolls apart from their novel surface portions, is or may be conventional, but by preference, includes a full length shaft hub or sleeve such as indicated at 36 on the roll 13, and at 37 on the roll 14. Securement may be effected as by a key 47 and keyway (not shown) between each of the hubs and the supporting shaft. The body of each of the rolls is by preference of a heavy-wall, hollow construction, the outer wall of which is indicated at 40, and which is connected in usual manner as by end webs 41 connected to the hub or sleeve, the webs being suitably apertured as at 42.

It will now have appeared that the described formation and arrangement of crushing elements for the purpose noted, will serve fully to attain each of the several objectives hereinabove expressed, as well as purposes and novel results stated and implied in the description. Although the invention has been described by making reference to a single exemplary embodiment, the detail of description should be understood in an instructive rather than in any restrictive sense, numerous variants being possible within the scope of the claims hereunto appended.

I claim as my invention:

1. In a rotary reducing and sizing device for coal or the like, a pair of adjacent coacting rolls, each of said rolls including on its outer surface a series of spaced, circumferential depthwise tapered, continuous ribs, a plurality of spaced cross bars extended laterally on each rib, each rib and the connected cross bars being axially spaced from the adjacent ribs and bars, the two

rolls having similar formations of ribs and bars and being so mounted and operatively interconnected that the ribs of one roll intervene the ribs of the other roll, and the cross bars of each roll are presented, at any given time in the crushing zone, between the cross bars of the opposite roll, the ribs and cross bars of the paired rolls coacting in the zone between the rolls to provide therein substantially wide, coal-sizing pockets, each fully laterally bounded and proportioned to the size of coal to be delivered from the rolls.

2. In a sizing device for reducing coal or like solids, a pair of coacting, interfitting rotary rolls, each of said rolls including a series of surface projections comprising continuous circumferential ribs and cross bars normal thereto, the ribs and cross bars of the paired rolls forming a series of substantially wide rectangular sizing pockets, each lying in a curved plane, and arranged to be brought successively to the crushing zone between the rolls, the sides of the pockets being uninterruptedly bounded by the circumferential ribs of the opposite rolls, and the ends of pockets continuously bounded by the cross bars of the opposite rolls, as the ribs and bars are brought to a sizing zone between the rolls.

3. in a crusher and sizing device for coal or the like, a pair of coacting, interfitting crusher rolls, each of said rolls being provided with a series of uniformly axially spaced, uninterrupted circumferential ribs, and further provided with a series of uniformly angularly spaced bars intersecting and integral with the ribs, the bars being interrupted between the ribs to form grooves, and the rolls being arranged so that one of the ribs of one roll closely engages a groove therefor in the opposite roll, with the ribs and bars of each roll substantially incompletely penetrating the spaces of the companion roll, and being proportioned and coacting to result in wide, rectangular coal pockets in the crushing zone, proportioned to the final size of coal delivered from the rolls.

4. In a crusher and sizing device for reducing coal or like solids, a pair of coacting crusher rolls, each of said rolls having a series of spaced continuous, circumferential linear flat-top ribs and a series of flat-top cross bars integral with, normal to and intersecting each such rib, each roll having a rib at one of its ends, and provided with a rib-receiving formation at its opposite end, the rolls being endwise reversed such that the end rib of each roll engages a substantial width of the said formation on the end of the opposite roll, and the rolls being operatively interconnected in such timed relation that the cross bars of each roll are presented to the crushing zone in alternation to those of the companion roll, the ribs and cross bars of the paired rolls being so proportioned to their peripheral and axial spacing so to form large, laterally confined coal-sizing pockets in the zone between the rolls.

5. In a crusher for the reduction of size of coal and like solids, a pair of coacting, operatively interconnected, crushing rolls, each characterized by a metal surface formation, such surface formation of each roll consisting of a series of axially spaced, circumferentially linear and continuous ribs, a series of cross bars each consisting of a distinctly angular extension of one of the ribs, the cross bars being arranged substantially evenly angularly spaced about the roll, and in a given series along the several ribs, the

cross bars being formed as extensions of the ribs and arranged on the roll in linear rows, there being a substantial and uniform space between the ends of adjacent cross bars whereby the spaced bars define at their ends, a circumferential groove adapted to receive and closely engage one of the ribs of the companion roll, each of the rolls being provided with a rib at one of its ends, and being characterzied by the absence of the rib at its opposite end, whereby to form on such opposite end a rib-receiving seat, the arrangement of ribs on each roll being asymmetrical so that the ribs and bars of each roll intervene the corresponding elements of the opposite roll, the width and spacing of the continuous ribs and the cross bars being such as to result in a series of pockets for coal of substantial size, remaining in the crushing zone between the rolls, and the rolls being so operatively related and timed that the corresponding cross bars of the opposite rolls are alternately presented to a crushing zone between the rolls; means for feeding the coal to the crushing zone, and means for driving the rolls and operatively conecting same in timed relation.

6. In a crusher for the reduction of size of coal and like solids, a pair of coacting, operatively interconnected, interfitting crushing rolls, each characterized by a metal surface formation, such surface formation of each roll consisting of a series of axially spaced, circumferentially linear and continuous ribs of substantial depth or height, each having a flattened outer surface and of depthwise tapering section, a series of cross bars each consisting of a right angular extension of one of the ribs, the cross bars being arranged parallel to the axis of the roll and substantially evenly angularly spaced about the roll, and in a given series along the several ribs, the cross bars being formed in equal number as extensions of the ribs and arranged on the roll with the corresponding cross bars in mutual axial alignment whereby the cross bars are arranged in linear rows, there being a substantial and uniform space between the ends of adjacent cross bars whereby the spaced bars define at their ends, a circumferential groove adapted to receive and closely engage one of the ribs of the companion roll, each of the rolls being provided with a rib at one of its ends, and being characterized by the absence of the rib at its opposite end, whereby to form on such opposite end a rib-receiving seat, the rolls being relatively endwise reversed in assembly and the arrangement of ribs on each roll being asymmetrical so that the ribs and bars of each roll intervene the corresponding elements of the opposite roll, and the rolls being so operatively related and timed that the corresponding cross bars of the opposite rolls are alternately presented to a crushing zone between the rolls; means for feeding the coal to the crushing zone, and means for driving the rolls and operatively connecting same in timed relation.

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