J. L. HILLER.

ROTARY CRUSHER.

APPLICATION FILED JAN. 25, 1911.

1,135,017.

Patented Apr. 13, 1915.

2 SHEETS—SHEET 1.

Fig 1

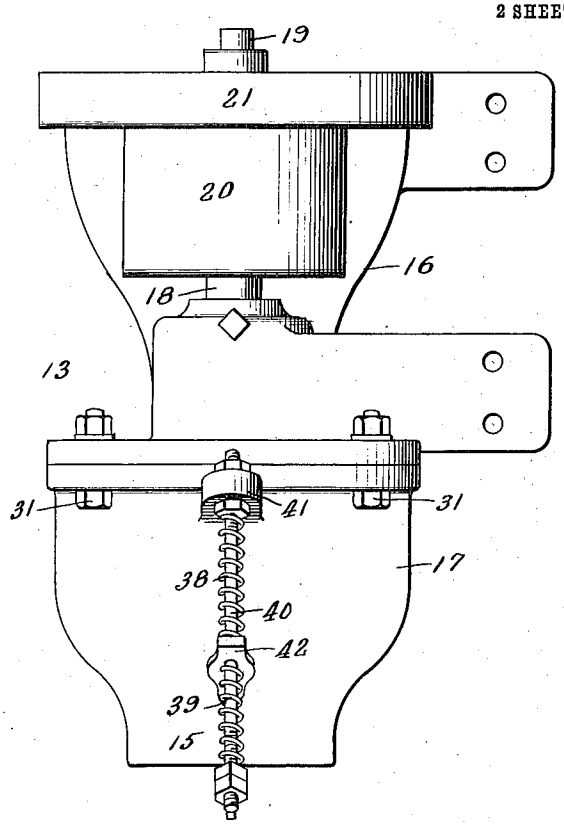
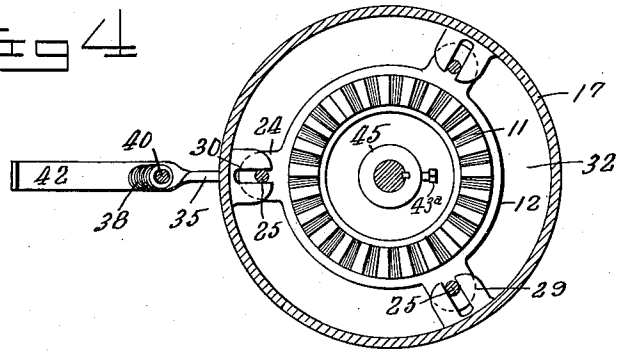


Fig 4



Inventor

Joseph L. Hiller

Witnesses

H. C. Schuette

T. P. Barbas

By Meyers, Cushman & Lea

Attorneys

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2 SHEETS—SHEET 2.

Fig 2

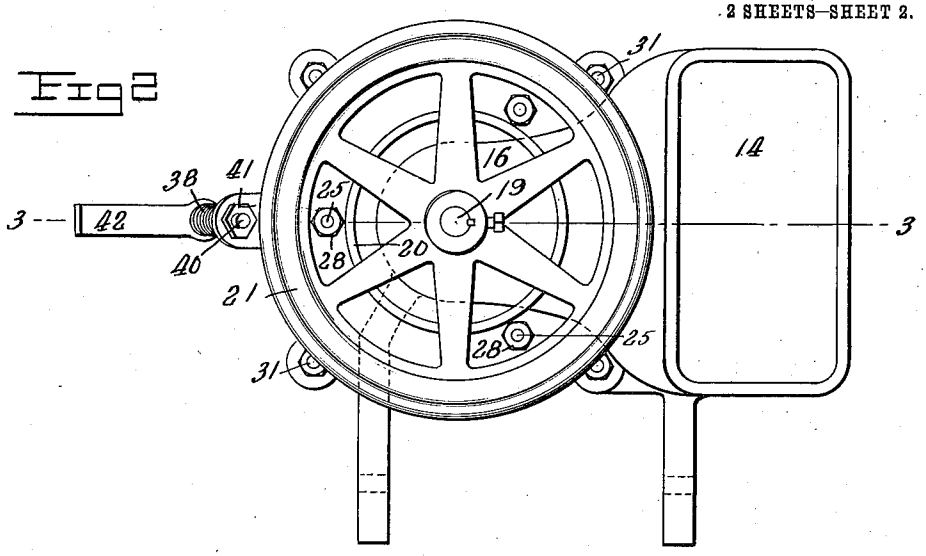
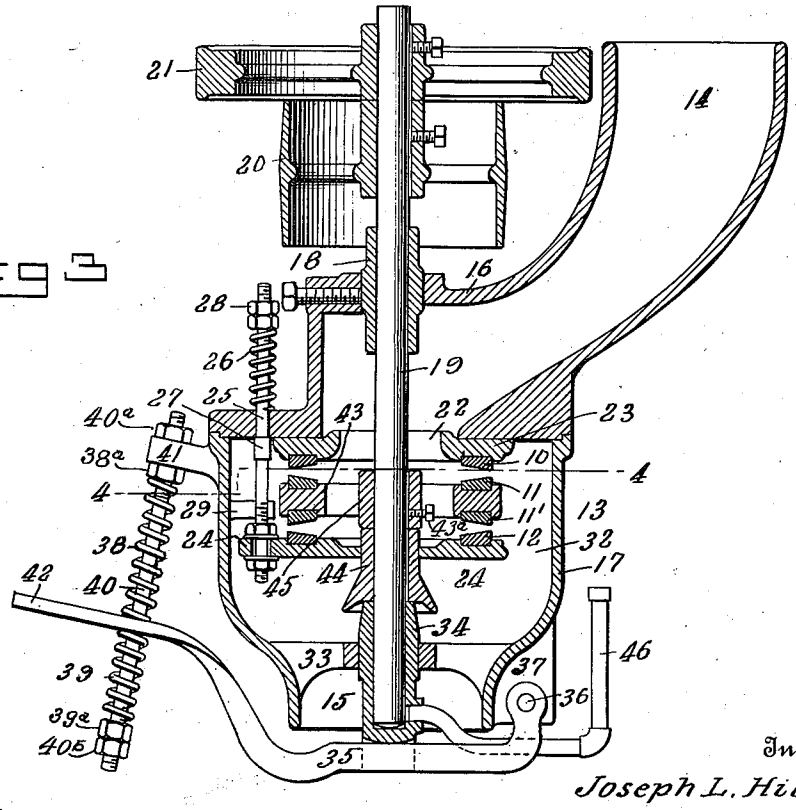


Fig 3



Witnesses

H. C. Pothieta

T. P. Barbat

Inventor

Joseph L. Hiller

By Meyers, Cushman & Rea

Attorneys

UNITED STATES PATENT OFFICE.

JOSEPH L. HILLER, OF MATTAPOISETT, MASSACHUSETTS.

ROTARY CRUSHER.

1,135,017. Specification of Letters Patent. Patented Apr. 13, 1915.

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To all whom it may concern:

Be it known that I, JOSEPH L. HILLER, a citizen of the United States, residing at Mattapoisett, in the county of Plymouth and State of Massachusetts, have invented new and useful Improvements in Rotary Crushers, of which the following is a specification.

The crusher of my invention comprises, in addition to the casing, crushing or grinding members, one or more of which is mounted in a novel manner, so that differential action may occur between two adjacent sets of crushing or grinding surfaces. The capacity of yielding, which is possessed by some at least of the crushing or grinding members, is such that if relatively large and hard bodies pass into the machine with the material to be crushed, the crushing or grinding members separate and allow the same to pass on without injury to any part of the machine. By the novel arrangement and manner of supporting the crushing or grinding members the general efficiency of action of machines of this type is increased.

In the example of my invention shown in the drawing there are two non-rotating grinding members, one, at least, of which is yieldingly mounted so that it may move toward and from the other within a predetermined limit, and a rotating grinding member carrying two opposite grinding or crushing surfaces for coöperation with those of the non-rotating elements is arranged intermediate the latter and is yieldingly mounted.

The invention presents, furthermore, other features of improvement that will be hereinafter set forth and claimed.

In the accompanying drawings I have shown one form of my invention, that form being best known to me.

Of the drawings:—Figure 1 is a front elevation of the machine. Fig. 2 is a top plan view. Fig. 3 is a central, longitudinal section on the line 3—3 of Fig. 2. Fig. 4 is a transverse section on the line 4—4 of Fig. 3.

Referring to the drawings, 10, 11, 11′ and 12 designate the active surfaces of crusher-elements mounted within a casing 13 provided with an inlet chute 14 and a discharge opening 15. The surfaces 10 and 12 are non-rotative and 11 and 11′ located between them are rotative and constitute a duplex-runner. The upper part 16 of the casing 13 is formed separately from the lower half 17. This upper part of the casing has a bearing 18 for the shaft 19 which projects vertically upward and carries on its upper end a driving pulley 20 and a fly wheel 21. The fly wheel serves the usual purpose of overcoming sudden strains and equalizing the load on the driving motor. The chute 14 communicates with a central throat 22, concentric with the shaft 19.

The members 10 and 12 are supported by the part 16 of the casing. The member 10 is permanently fixed in position, being secured to a support 23, which is in turn fixedly bolted to the underside of the part 16 of the casing and concentric with the throat opening 22 and the shaft 19. The member 12 is carried by a support 24 opposite but spaced away from the support 10. The support 24 is yieldingly connected to the part 16 of the casing by rods 25 and springs 26. The rods are rigidly but adjustably connected with the support 24 at their lower ends as shown, and yieldingly connected with the casing at their upper ends by springs 26 which surround the rods. Stops 27 on the rods below the casing 16 limit the upward movement of the member 12, which normally occupies a position defined by these stops.

Adjustment of the member 12 may be had by adjustment of the nuts which secure the support 24 to the rods 25. This adjustment enables the grinding element to be so interarranged as to enable the machine to grind with varying degrees of coarseness or fineness, as will be hereinafter more fully stated. Adjustment of pressure of the springs 26 may be had by means of jam-nuts 28 which hold the springs on the rods, which adjustment is desirable in that thereby the yieldability of the member 12 may be regulated according to the character of material being ground or crushed. Rotative movement of the member 12 will be prevented from taking place by the connection to the rods 25, but to avoid danger of bending the rods and to give them greater freedom of movement with respect to the casing, (as binding of the rods in the holes through which they pass would tend to prevent free movement) I have provided a series of guides 29 projecting inwardly from the lower half 17 of the casing and engaging the rods 25 on the sides and near to the support 24. At least one, 30, of these guides is forked in order that backward as well as forward movement may be prevented. Preferably the rods 25 are vertical, radially

equidistant from the shaft and circumferentially equidistant on the circle of the radius distance. By this means an equalization of the action of the yielding connection is secured, and also an equalization of the action of the guides 29, resulting in a central position of the member 12 and prevention of binding of the same on the shaft 19 which passes through the support 24.

The lower half 17 of the casing is removably secured to the upper half by bolts 31. This lower half completely incloses the crushing members as shown in Fig. 2, the diameter of the casing being such as to give ample space 32 between the crushing members and the walls of the casing. The casing is contracted at its lower end, the contraction being made along curved lines, as shown. At its lower end it supports, by means of a spider 33, a movable bearing 34 for the shaft 19. This bearing is vertically movable in the spider 33, and is supported by a lever 35 fulcrumed at 36 on a web 37 outside of the casing and short of the outlet 15. The end of this lever is yieldingly supported by springs 38 and 39, disposed at opposite sides of the end of the lever, on a rod 40, which passes through the end of the lever and is secured at one end to a lug 41 on the part 17 of the casing. The tension of springs 38, 39 is adjustable by means of nuts 38^a, 39^a, and the rod 40 is itself adjustable with respect to the lug 41 by means of the nut 40^a fitted on its screw-threaded end. The tension of the springs 38, 39, can therefore be adjusted, as that of the spring 26, to harmonize with the tension of the latter, dependent, as before stated, upon the characteristics of the material to be ground or crushed, and the position of the runner intermediate or equidistant between elements 10 and 12 may be obtained, within the limit of adjustment permissible for the element 12, as hereinbefore described, through the medium of the lever 35, by raising or lowering the handle 42 thereof and at the same time adjusting the rod 40 with relation to the supporting lug 41, by manipulation of the nut 40^a, and the desired tension of the springs 38 and 39 be secured in the different positions of adjustment of rod 40, by manipulation of the nuts 38^a, 39^a and 40^b. The end of the lever is extended some distance to form a hand grip 42 to facilitate manipulation in adjusting the runner to predetermined normal position. The runner crushing surfaces 11 and 11′ are carried by a member 43 disposed between the non-rotative surfaces 10 and 12. The member 43 is provided with a screw or the like 43^a by which it may be keyed to the shaft 19 to rotate therewith but be adjusted to various desired positions axially of the shaft, intermediate the elements 10 and 12, according to the predetermined degree of fineness or coarseness of grinding or crushing to be accomplished. A sleeve 44 movable on the shaft engages the member 43, and is provided with a flared lower end which is undercut to shroud the upper end of the bearing 34 and prevent the entrance of materials therein. An oil standard 46 communicates with the lower end of the bearing and is of such height as to keep oil in the bearing substantially from the bottom to the top.

It will be observed that the member 12 of the non-rotative members is moved axially both in respect of predetermined or initial adjustment and yieldability with respect to the member 10, which is fixed. The extent of movement toward the member 10 is limited by the stops 27. The runner 11 and 11′ is movable toward and from both the members 10 and 12, in respect of predetermined or initial adjustment and yieldability.

Very material advantages result from the described arrangement, support and capacity of adjustment of the grinding members.

First, the yielding mounting permits readily the passage of relatively hard foreign substances which may be in the material crushed.

Secondly, the grinding forces of the machine are equalized, through the relative position of the surfaces and the differential action. The crushing pressure defined by the pressure of the springs 26, 38, and 39, is exerted through the entire line or series of the crushing members 12, 11′, 11 and 10 in order. Thus the crushing or grinding strains between the members 10 and 11 is balanced by the same strains between the members 11′ and 12, as 11 and 11′ are yieldingly movable toward and from both surfaces 10 and 12. The result is an operation of the machine with minimum wear and tear, and with most efficient crushing action.

Thirdly, the several grinding surfaces may be adjusted with relation to each other to grind or crush material to different degrees of fineness or coarseness.

Fourthly, the yieldability of at least one of the rotative grinding surfaces and of the runner allows hard, ungrindable or uncrushable material to pass without injuring the grinders or machine.

Fifthly, by properly adjusting the tension of the springs 26, 38 and 39 the grinders may be supported in the desired manner to crush material of varying degrees of friability, and still have the yielding qualities and advantages referred to in the event of less friable material passing therebetween.

The machine is intended particularly, though not exclusively, for use in grinding coal, and is particularly valuable for use

on what is known as wet material. The coal is fed down the chute together with a suitable volume of water which aids in the feeding of the machine and at the same time prevents the objectionable rise of dust. Coal frequently contains foreign substances, and some grades contain a great deal of iron pyrites in lumps, slate and other material. These hard bodies pass through without injuring the machine. The good coal usually varies from the impurities in degree of friability and the yielding feature of the crushing members is efficacious in intensifying the natural relative tendency to resist crushing so that very friable material is crushed more finely and the refractory material is crushed more coarsely than the average product, (or that reduced by rigid grinding members), thus preparing the material in good condition for separating the good material from the objectionable material in a subsequent operation. The water which is fed with the coal may, after the discharge, be used for washing it, whereby the sulphur and other washable and dissolvable materials are carried away and the relatively large bodies of pyrites and other matters are separated out.

While I have described the best form of my invention now known to me, I desire to have it understood that changes and modifications may be made without departing in anyway from the generic spirit of my invention. I therefore desire to cover in the annexed claims all such modifications, and, of course, claim the invention for all the uses for which it is applicable.

Having thus described my invention what I claim is:—

1. A rotary crusher comprising two opposite non-rotary crushing members, an intermediate runner, means for supporting the runner in predetermined normal operative position yieldable from such normal position toward and from each of said non-rotary crushing members.

2. A rotary crusher comprising two opposed non-rotary crushing members, one of which is movable rectilinearly toward and from the other, means pressing that one of them toward the other yieldably, and an intermediate yieldably mounted runner movable toward and from each non-rotary member and bearing crushing surfaces opposed one to each non-rotary member.

3. A rotary crusher comprising two opposed non-rotating crushing members, one of which is movable toward and from the other recilinearly, an intermediate yieldably mounted runner having crushing surfaces opposed to each of the said members, and movable toward and from each non-rotating member, and means yieldably holding said runner to a position approximately midway between the non-rotating members.

4. A rotary crusher comprising two opposed non-rotating crushing members, an intermediate runner movable toward and from each non-rotary member and carrying two crushing surfaces opposed one to each non-rotary member, a lever supporting said rotary member, a fixed part, and means on the fixed part engaging with the lever for yieldingly supporting the latter.

5. In a rotary crusher, a pair of opposed non-rotary crushing members, an intermediate runner having working faces opposed to the non-rotary members, a lever supporting the rotary member between the non-rotary members, and resilient means supporting opposite sides of the lever to permit the same and the rotary member yielding in either direction.

6. A rotary crusher comprising a rigid non-rotary crushing member, a second non-rotary crushing member yieldingly movable toward and from the rigid member, an intermediate runner having working faces opposed to the non-rotary members, and supporting means for the rotary member for yieldingly holding the same between the rigid and the movable non-rotary members.

7. A rotary crusher comprising two opposed non-rotary crushing members, one of which is movable rectilinearly toward and from the other, means pressing that one of them toward the other yieldingly, an intermediate yieldably mounted runner movable toward and from each non-rotary member, and bearing crushing surfaces opposed one to each non-rotary member, and supporting means for the rectilinearly movable member yieldingly holding the same in spaced relation from the opposite non-rotary member, and being adapted to preserve the alinement of the movable member.

8. A rotary crusher comprising two opposed non-rotary crushing members, an intermediate runner movable toward and from each non-rotary member and carrying two crushing surfaces, one opposed to each non-rotary crushing member, a thrust bearing for said runner, a movable support for the bearing, and yielding means connecting said support with a fixed part, said yielding means being adapted to maintain said runner in a defined normal position approximately midway between the two opposed non-rotary members.

9. A rotary crusher comprising two opposed non-rotary crushing members, an intermediate runner movable toward and from each non-rotary member and carrying two crushing surfaces opposed one to each non-rotary member, a lever supporting said runner, a fixed part, and springs bearing on opposite sides of said lever and engaging said fixed part.

10. A rotary crusher comprising two opposed non-rotary crushing members, an in-

termediate runner movable toward and from each non-rotary member and carrying two crushing surfaces opposed one to each non-rotary member, a lever supporting said runner, a fixed part, springs bearing on opposite sides of said lever and engaging said fixed part, and means for adjusting the tension of said springs.

11. A rotary crusher comprising two opposed non-rotary crushing members, an intermediate runner movable toward and from each non-rotary member and carrying two crushing members, one opposed to each non-rotary member, a casing inclosing said members, a lever fulcrumed at one end on said casing and connected with said runner to support the same, said lever projecting at its outer end beyond the periphery of the casing, a lug on the periphery of the casing, a bolt passing through the lug and through the lever, a fixed attachment to the lug, and springs confined on said bolt, one on each side of said lever.

12. In a crushing machine, the combination with two non-rotary crushing elements one of which at least is yieldably and resiliently supported, of a runner interposed between and coöperatively arranged with relation to said non-rotary crushing elements, and means for yieldably supporting said runner to permit movement thereof away from either non-rotating element.

13. In a crushing machine, the combination with two non-rotary crushing elements one of which at least is yieldably and resiliently supported, of a runner interposed between and coöperatively arranged with relation to said non-rotary crushing elements, and means independent of that of the non-rotary crushing elements for yieldably supporting said runner to permit movement thereof away from either non-rotating element.

14. In a crushing machine, the combination with non-rotary crushing elements, a yieldable resilient support for at least one of said crushing elements to permit said element moving to and from the other, and means for regulating the yieldability of said support, and a runner interposed between said non-rotary crushing elements.

15. In a crushing machine, the combination with non-rotary crushing elements, and a resiliently supported runner yieldably interposed between the same, of independent means for yieldingly supporting at least one of said non-rotary crushing elements and the runner to permit temporary separation between said runner and either or both crushing elements.

16. In a crushing machine, the combination with non-rotary crushing elements and a runner interposed between the same, of independent means for yieldingly and resiliently supporting at least one of said non-rotary crushing elements and the runner to permit temporary separation between said runner and either or both crushing members, and means for regulating the yieldability of said supports.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOSEPH L. HILLER.

Witnesses:
JOHN PARKER,
G. W. BORTOY.