

March 18, 1924.

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T. A. JANNEY

CRUSHING APPARATUS

Filed June 30, 1921

3 Sheets-Sheet 1

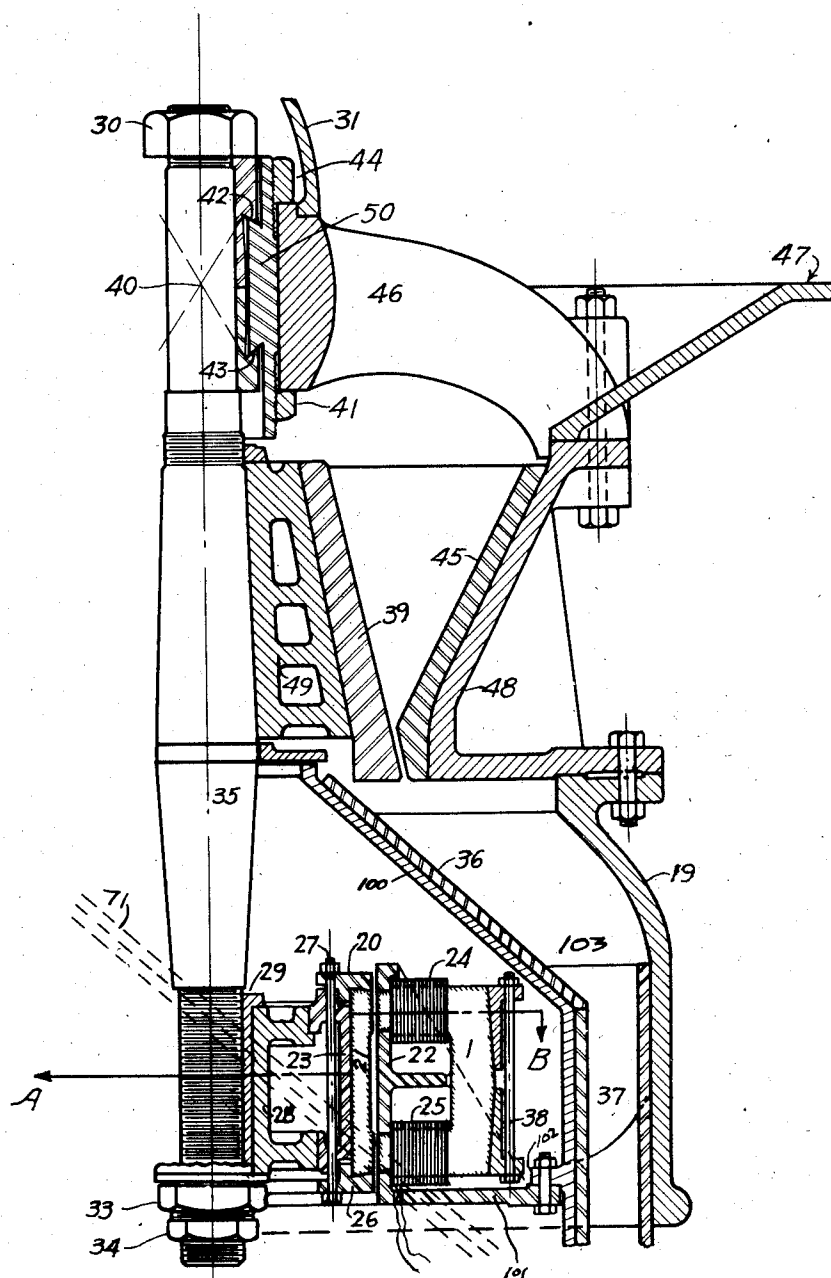


Fig. 1

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3 Sheets-Sheet 2

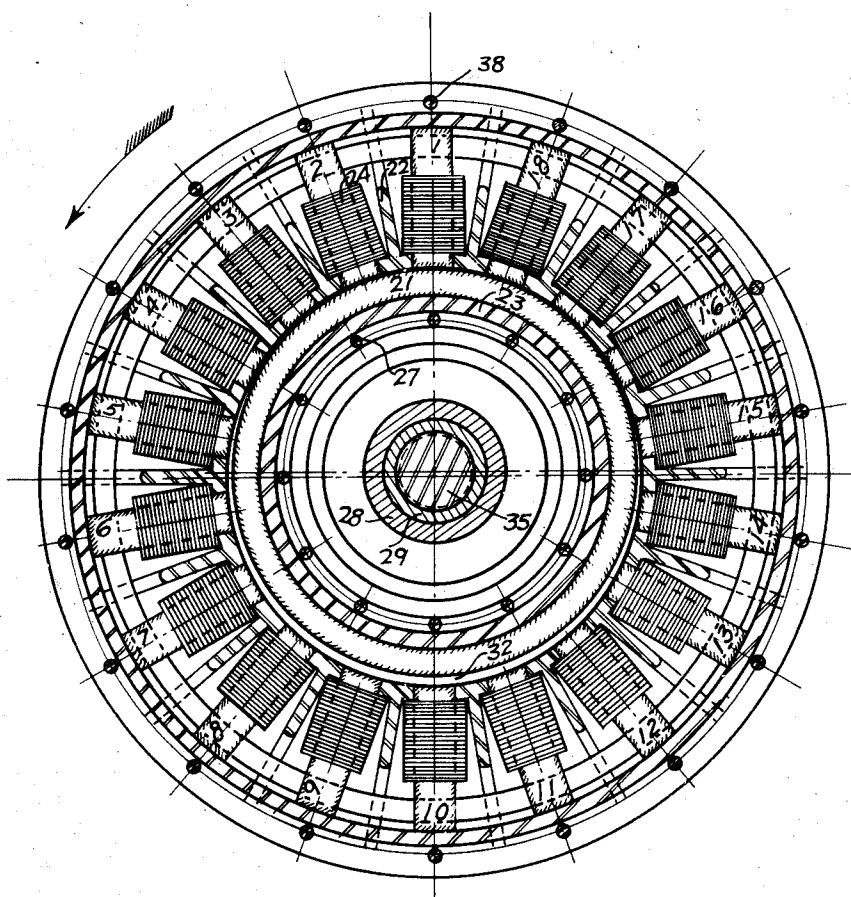


Fig. 2.

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3 Sheets-Sheet 3

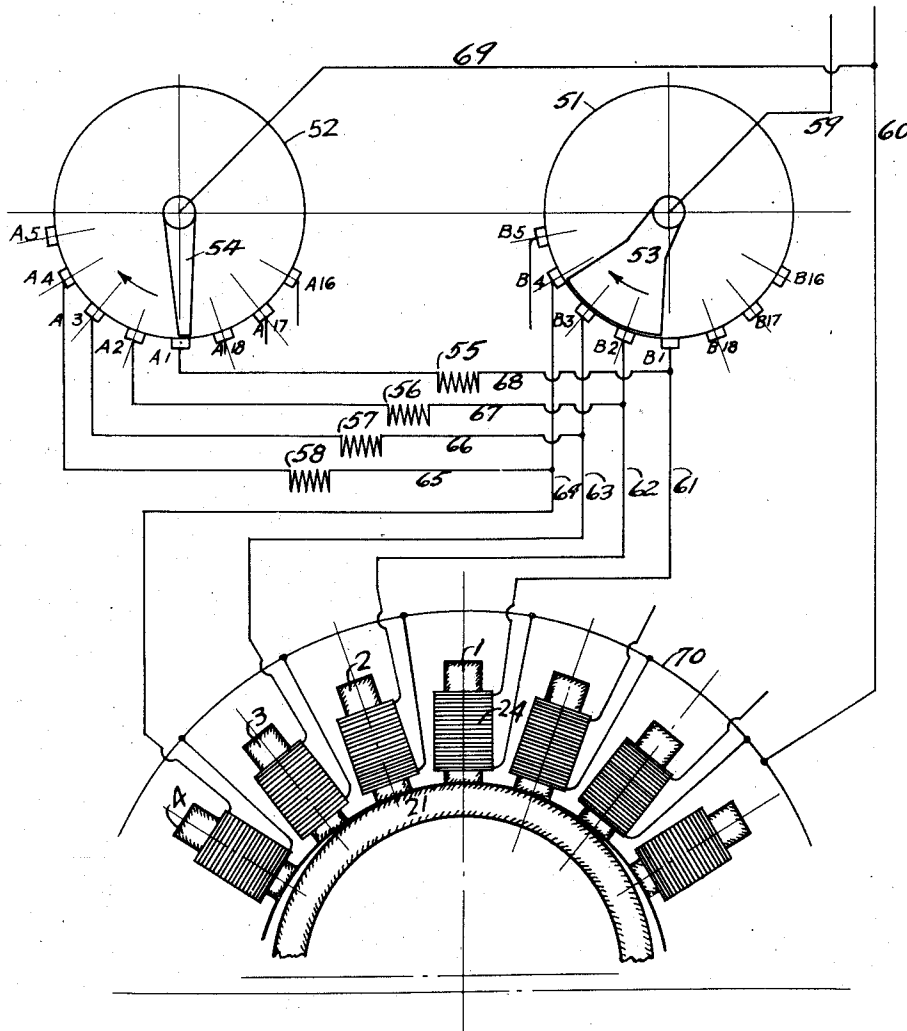


Fig. 3.

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UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

CRUSHING APPARATUS.

Application filed June 30, 1921. Serial No. 481,593.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Crushing Apparatus, of which the following is a specification.

My invention is an improvement in crushing apparatus. Among its principal objects and advantages are the production of the requisite movement of the movable member or members of the apparatus without the use of bearing surfaces subject to great pressure, friction and wear; to avoid the necessity of using the elaborate lubricating systems necessary with crushers of the ordinary type; to dispense with the use of springs or rubber cushions to provide that flexibility of operation which is necessary to prevent damage when pieces of iron or other unyielding objects accidentally get into the feed. Other objects and advantages will be apparent from the following description, such as the elimination of most of the moving parts entering into the construction of crushers of the types in common use, increase of capacity resulting from the possibility of readily increasing and controlling the number of crushing movements per unit of time, and simplification and increase in the efficiency of the driving mechanism.

In the drawings I have illustrated a crusher of the gyratory type. While my invention has particular advantages in crushers of this type, its utility is not confined thereto.

Referring to the drawings—

Figure 1 is a vertical central sectional view of one-half of a gyratory crusher embodying my invention;

Figure 2 is a horizontal section on the line A—B of Figure 1, the magnets and coils being shown complete;

Figure 3 is a diagrammatic view showing part of the annular series of magnets with circuits leading to two timers which control respectively the supply of electrical current to the magnets and surge coil circuits which are closed at the moment the supply circuits to the respective magnets are broken.

In its general outline the crusher illustrated is of a type in common use and I shall therefore only briefly describe those parts of the construction which follow generally accepted practice.

The crushing head 49 is supported on a vertical spindle 35 and is surrounded by a mantle or wear plate 39. The spindle or shaft 35 is supported near its upper end by a ball-joint centered at point 40. The ball joint comprises members 42 and 43 sleeved upon the upper end of the spindle and retained at the bottom by an upwardly directed shoulder on the spindle and at the top by a nut 30. Coacting with members 42 and 43, which in effect form part of the spindle 35, is cylindrical member 50 sleeved inside of a circular opening at the middle of the spider 46 which arches over the top of the crusher as usual. Retaining nuts 41, 44 are threaded over the ends of bearing member 50 and abut against the under and upper surfaces of the spider, thus holding the bearing member in place. A dust cap 31, as usual, rests on the spider and covers the upper end of the spindle.

In crushers of the type illustrated, the crushing movement or gyration is imparted to the spindle 35 by means of an eccentric mounted upon its lower end and driven through bevel gears from a horizontal counter shaft. By the use of my invention I dispense with this mechanism, its attendant bearings, necessity of protection from dust, the massive construction necessary to withstand the heavy pressure upon the bearings and the consequent necessity of an elaborate lubricating system. As will be observed from the drawings, the spindle 35 has no structural or mechanical operating connection with other parts of the crusher other than its suspension upon the ball joint at the center of the spider 46. Other than the ball joint, the only connection of the gyrating crushing member with the fixed part of the crusher or with the operating means is magnetic. The essential elements of this magnetic connection are a ring 21 of highly magnetic material, such as soft iron, mounted on the lower end of the spindle 35 and a surrounding circular series of electro-magnets, 1 to 18, mounted on the frame of the crusher, together with circuits and a timer for successively energizing the magnets and thus setting up a rotating magnetic field.

In the particular embodiment of my invention illustrated, a bushing 29 is threaded upon the lower end of spindle 35 and secured by clamp nuts 33 and 34. A hub 28 is revolubly mounted on the bushing 29

and carries ring 23 on its outer periphery. Iron ring 21, which may be solid or laminated, is secured to ring 23 by means of clamp rings 20, 26 and bolts 27.

5 The annular series of electro-magnets is mounted upon a stationary base member which is in the form of an annulus having a central vertical cylindrical part, 22, and a horizontal floor section 101 projecting out-
10 wardly from the lower end of the cylindrical section. The horizontal floor section is bolted at its outer periphery to an annular flange 102 projecting inwardly from the stationary housing 100, which latter in-
15 closes the lower end of the spindle and the magnets and also forms the inner wall of the annular discharge space 103. Inclined plate 71 causes the broken rock discharged into annular space 103 to fall to discharge
20 chute 37. I have shown the annular discharge space and chute provided with liners as indicated at 36. Parts 22, 20, 23 and 26 are preferably made of manganese steel or other relatively non-magnetic material.

25 The form and manner of mounting the electro-magnets is shown in Figure 1, where the magnet, which may be solid or laminated, appears in elevation. The poles of each magnet project through openings in the
30 cylindrical shell 22 and at their ends are flush with the inner surface thereof. It will be observed that the internal diameter of the shell 22 is slightly greater than the external diameter of ring 21, thus permit-
35 ting the spindle 35 to move from side to side upon its center of suspension 40 to the extent of the difference between said diameters.

It will be apparent from the foregoing
40 that energization of any magnet or group of magnets at one side of the circular series will draw the lower end of the spindle 35 and the crushing head in the direction of the energized magnet or magnets and that by
45 successively energizing the magnets in the order of their position about the circle the ring 21 will be caused to roll around the interior of the shell 22 with the result of imparting a gyratory movement to the
50 crusher head.

In Figure 3 I have shown an arrangement of circuits and make and break apparatus 51 for successively energizing the magnets. Current is supplied over the wires 59 and
55 60, the former being connected to rotary arm 53 and the latter to circular conductor 70, which in turn is connected to one terminal of each magnet coil. The other
60 (illustrated in connection with magnets 1 to 4 and their conductors 61 to 64) to one of a circular series of contacts B¹ to B¹⁸ with which the rotary arm 53 successively establishes electrical contact during its revo-
65 lution. As illustrated the outer end of arm

53 is of sufficient width to maintain con-
nection with three contacts simultaneously, thus causing simultaneous energization of three contiguous magnets. By making the
70 outer end of arm 53 narrower or wider the number of magnets simultaneously ener-
gized may be decreased or increased.

Operating synchronously with the make and break apparatus or timer 51 which
75 controls the power circuits, I have shown a second make and break apparatus or timer 52 controlling a series of surge coil circuits, one for each magnet. I have shown surge
80 coils and circuits therefor in connection with magnets 1 to 4. Wires 55 to 58 are connected separately to wires 61 to 64 lead-
85 ing from the contacts of timer 51 to magnets 1 to 4. Rotary arm 54 of timer 52 is connected by conductor 69 to feed wire 60 and the outer end of arm 54 establishes con-
90 tact successively with contacts A¹ to A¹⁸, which are connected separately to the con-
ductors leading from magnet coils 1 to 18 to their respective contacts on the timer 51. The adjustment of the apparatus is such that
95 at the time arm 53 of timer 51 breaks contact with the conductor leading to any mag-
net coil the arm 54 of timer 52 establishes contact with the contact of timer 52 which is
100 connected to the surge coil circuit of that magnet. By this means the surge coils, be-
ing for the moment in a closed circuit which includes the coil of the magnet which has
105 just been disconnected from the source of current, are enabled to absorb the induced
currents resulting from the fall of poten-
110 tial in the magnet coil and thus prevent injurious arcing at the contacts of timer 51.

It will be obvious that by a simple change
105 in the circuits and timers through which the magnets are energized movements other than a regular gyratory movement may be imparted to the spindle and crusher head. For instance, referring to Figure 2 of the
110 drawing, if the order of energization of the magnets be first magnet 1, then magnet 10, followed in order by 18, 9, 17, 8, 16, 7, 15, 6, 14, 5, 13, 4, 12, 3, 11, 2, the result would
115 be to discharge much of the material crushed to size by the energization of any one magnet immediately and without waiting for the
completion of a half-cycle or large part of the gyratory movement to be completed. More particularly, assume that magnet 1, or
120 the group of two or three magnets associated with magnet 1, have just been energized, the spindle and crusher head would thereby be
drawn to that side of the apparatus as shown in Figures 2 and 3, with the result of reduc-
125 ing some of the rock to a size that will permit of its being discharged when the crush-
er head is moved to the diametrically oppo-
site position but too large to be discharged
until the crusher head reaches that position.
130 Material of such size remains in a crusher

having a purely gyratory movement during a half cycle of the gyration after all necessary work on it has been performed, and pieces of rock of smaller size are kept from discharge for shorter periods of time, depending upon the size of discharge opening necessary to permit their escape. This causes a decrease in the rate of flow of rock through the crusher and a material reduction in its working capacity. By this method of operation above described, the crushing movement at any point in the periphery of the crushing head is immediately followed by an interval of maximum opening at that point, thus permitting discharge of a large part of the properly sized material as soon as it is reduced to that size. This has the advantage of increasing the capacity of the crusher, avoiding unnecessarily fine crushing of part of the rock and saving the power that would be consumed by such unnecessarily fine crushing. The particular movement of the crusher head above described is mentioned as an illustration of an indefinite number of variations of movement that may be effected by energizing the magnets in different sequences and as showing the adaptability of the apparatus to the conditions required by different kinds of rock.

It will be understood that the speed of the crusher is controlled by the speed of the timer, and that by driving the timer by means independent of the crusher the speed of the latter may be varied by varying the speed of rotation of the timer. While I have illustrated and described the magnet coils with multiple windings, it will be apparent that they may be wound in series and that when so wound the coils may be energized one at a time or more than one simultaneously, and that any desired order of energization of the magnets may be effected by a suitable arrangement of the timer and operating circuits.

I claim:

1. In a crusher, a crushing element and means for subjecting said element to a succession of magnetic impulses acting in different directions, thereby imparting movement to said element.

2. In a crusher, an actuating mechanism comprising an inner circular element of mag-

netic material, an outer circular element of larger diameter on the inside of which said inner element may roll, and means for setting up a rotating magnetic field extending between said inner and outer elements.

3. In a crusher, an actuating mechanism comprising an inner circular element of magnetic material, an outer circular element of larger diameter on the inside of which said inner element may roll, an annular series of electro-magnets concentric with said outer element and means for successively energizing said magnets.

4. In a device of the class described, a stationary support, a movable member suspended thereon by means of a ball joint, an actuating element of magnetic material upon said movable member, a circular shell of larger diameter than and surrounding said actuating element, and means for successively setting up magnetic fields between said actuating element and said shell at different points in the circumference thereof.

5. In a device of the class described, a stationary support, a spindle suspended adjacent its upper end upon said support by means of a ball joint, a crushing head secured to said spindle and a coacting crushing element adjacent thereto, a circular actuating element of magnetic material secured to said spindle adjacent its lower end, a stationary circular shell larger than and surrounding said actuating element, an annular series of electro-magnets surrounding said shell and having their poles substantially flush with the inner surface thereof.

6. In a gyratory crusher, a crusher head, and means for subjecting said crusher head to electro-magnetic fields acting successively in different directions.

7. In a gyratory crusher, a spindle suspended upon a ball-joint a crusher head secured to said spindle, a coacting crushing element surrounding said crusher head, a magnetic actuating member secured to the lower end of said spindle and means for successively producing a series of magnetic fields acting in different directions upon said actuating element.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.