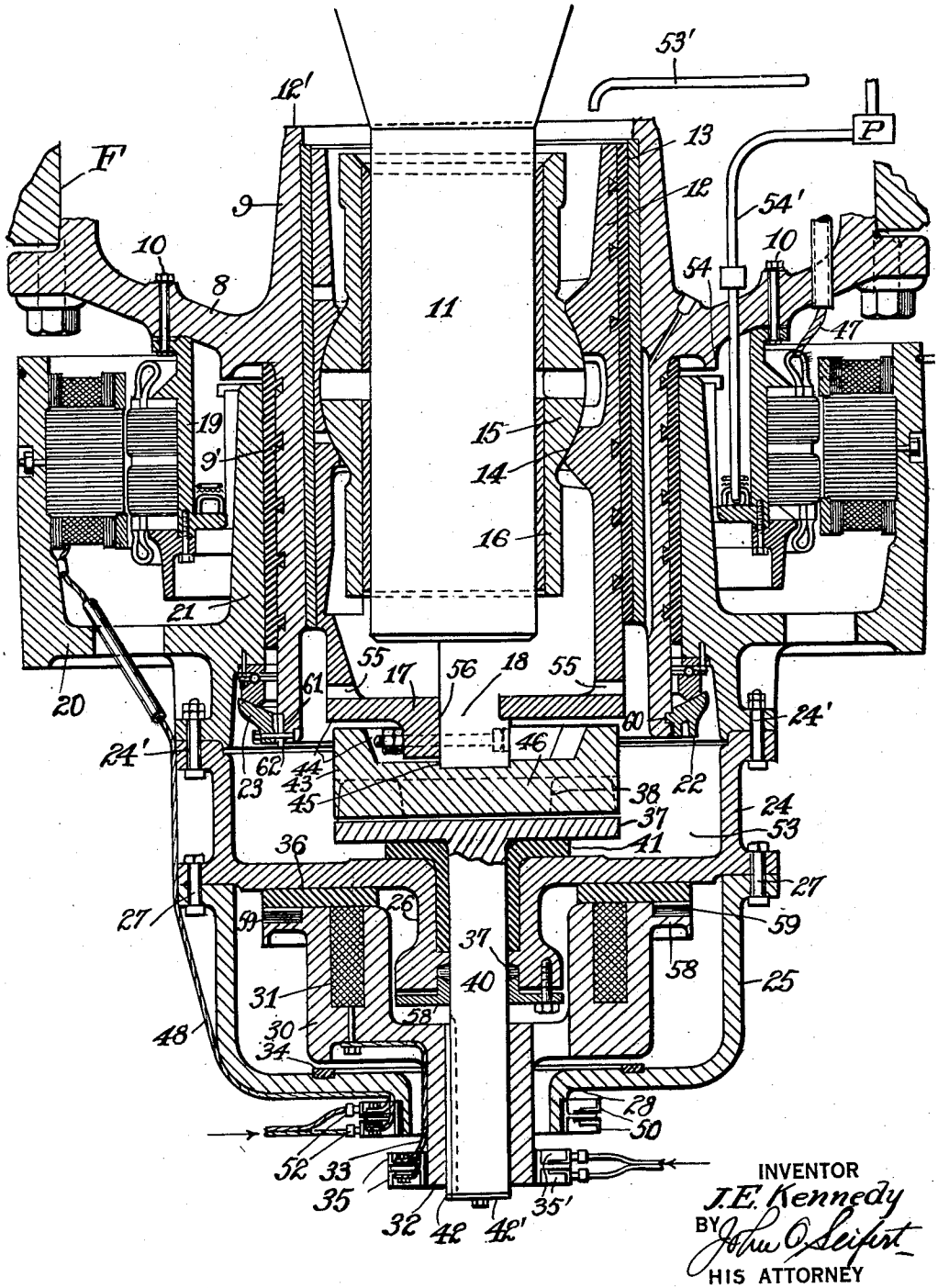
Feb. 25, 1930. J. E. KENNEDY 1,748,484

CRUSHER

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Fig. 1




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CRUSHER

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Fig. 2

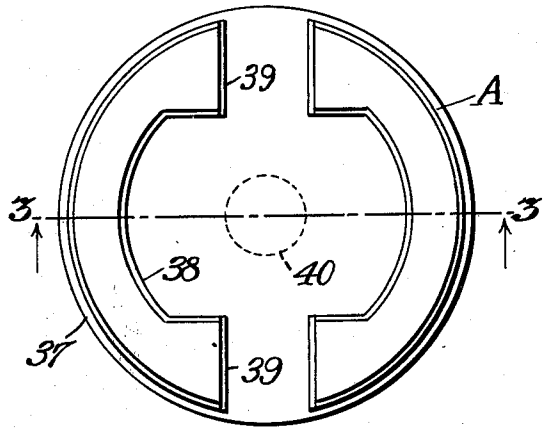



Fig. 3

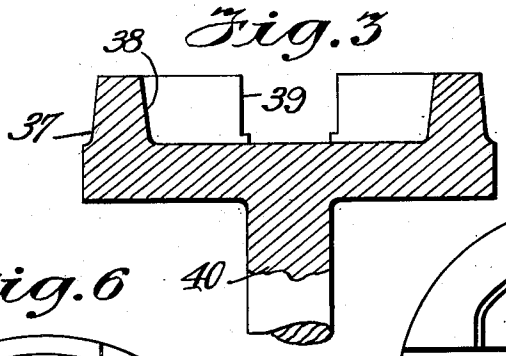



Fig. 4

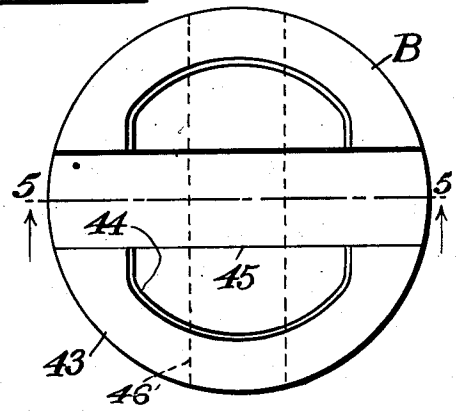



Fig. 6

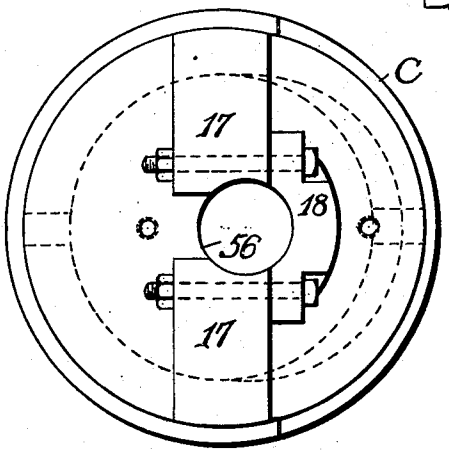
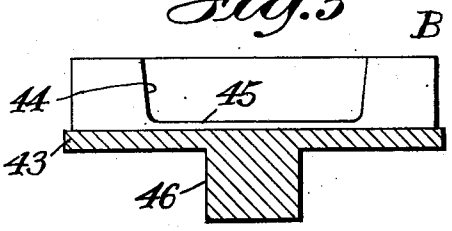



Fig. 5




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# UNITED STATES PATENT OFFICE

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## CRUSHER

Application filed May 21, 1928. Serial No. 279,379.

This invention relates to crusher apparatus for crushing stone, or other material, and relates particularly to crushers known as "gyratory crushers", and it is the object of the invention to provide clutch mechanism for connecting a driver to the crushing member.

In crushers of this type the oil becomes thick and stiff in cold weather, and often in stopping the crusher a piece of the material being crushed becomes wedged between the crushing member and wall of the crushing chamber, placing a great strain on the driver, usually comprising an electric motor, and often overloading the motor so as to burn out the same under burden of the starting load, and it is the object of the invention to overcome this disadvantage by maintaining the crushing member disengaged from the driver and permit starting of the motor with no load applied and then coupling the driver and the crushing member through the clutch when the motor has attained sufficient momentum to overcome the resistance of friction of the hardened lubricant or material wedged between the crushing faces.

It has also been found that when a piece of uncrushable material, such as steel, becomes lodged between the crushing members of the crusher the resisting force of such obstruction to the rotation of the shaft carrying one of the crushing members results in the distorting and often in the breaking of the shaft, and it is a further object of the invention to overcome this disadvantage by providing clutch mechanism which is adapted to relieve the driver of the load of the crushing force when such force exceeds a predetermined value.

In crushers of this type when the crusher has been stopped, due to accident or other cause, while crushing material, all the material in the crushing chamber has to be removed before again starting the crusher due to the inability of the driver to start the crusher while the latter is retarded by the material in the crushing chamber. By the present invention the driver is permitted to attain a predetermined rate of speed before connecting the same with the crushing apparatus, the momentum of the driver increasing the driving force of the driver overcoming the load of the resistance of the material in the crushing chamber.

Another object of the invention is to provide clutch mechanism to connect the driver with the gyratory crushing member constructed and arranged to serve as a lubricant carrying chamber and the circulation of lubricant to the moving parts of the crusher.

It is another object of the invention to provide a bearing for supporting the driver, clutch mechanism and crushing member constructed and arranged whereby the stresses and strains of the lateral thrusts of the crushing member are taken up in the framework of the crusher and not transmitted to the driver.

It is a still further object of the invention to provide a flexible coupling member between one of the clutch members and the crushing member to compensate for wear of the parts.

Other objects and advantages will hereinafter appear.

In the drawings accompanying and forming a part of this specification Figure 1 is a longitudinal sectional view showing the mounting of a gyratory crushing member of a crusher, a driver therefor, and clutch mechanism for connecting the driver with the gyratory crushing member embodying my invention.

Figure 2 is a plan view of one member of a coupling for flexibly connecting the driver and crushing member.

Figure 3 is a sectional view taken on the line 3—3 of Figure 2 looking in the direction of the arrows.

Figure 4 is a plan view of another member of the coupling.

Figure 5 is a sectional view taken on the line 5—5 of Figure 4 looking in the direction of the arrows, and

Figure 6 is a plan view looking at the bottom of a bushing which eccentrically carries the gyratory crushing member showing the arrangement thereof for flexibly connecting the same with the coupling member shown in Figures 4 and 5.

In the embodiment of the invention shown in the drawings the operative mechanism is supported by a bottom plate 8 of the framework of the crusher, only so much of the

framework being shown as is essential to an understanding of the invention. The plate 8 is arranged as a support for the bearing for the crushing member, the driver and the connection means of the driver with the crushing member. Concentrically of the plate there is arranged a bearing member or sleeve 9 of cylindrical form with a portion extending above and a portion below the plate. The crushing head carrying shaft 11, only so much of which shaft is shown as is essential to an understanding of the invention, is mounted in said bearing by means of a bushing 12 concentrically mounted to have rotative movement therein with an antifriction material 13 interposed between a portion of the bearing and the bushing wall, as shown in Figure 1. To impart gyratory movement to the shaft 11 the interior of the bushing is provided with a socket portion 14 having a bearing surface eccentric to the axis of the bushing and crusher for rotatable engagement with a ball portion 15 of a sleeve 16 mounted on the shaft 11. The rotation of the bushing 12 through the eccentric mounting thereof in the bushing 12 imparts a gyratory motion to the crushing shaft. To facilitate the assembling of the sleeve 16 in the bushing 12 the bushing is constructed of two longitudinal mating sections connected by bolts passing through rib portions 17 on one section and an abutment 18 on the other section extending transversely of the axis of the bushing and at the end of the shaft 11.

The motive means or driver for the crusher is shown as comprising an electric motor, in the present instance of the synchronous type for a purpose to be hereinafter described, comprising a stator 19 mounted on the frame plate 8 by means of bolts 10 in concentric relation to the axis of the bearing 18 and crusher, and a rotor 20 having a hub portion 25 whereby it is rotatably mounted on the bearing 9 with an interposed anti-friction material 9′, by a ring or collar 22 arranged for interlocking engagement with the end of the bearing 9. To facilitate the rotative movement of the rotor on the ring 22 an anti-friction bearing 23 is interposed between the bottom of the hub portion of the rotor and the bearing support 22.

The rotor of the driver is arranged with separate superposed casings 24, 25 of circular shape. The upper casing 24 is mounted on a flanged portion extending from the hub of the rotor by bolts 24′ and is arranged with a central perforation in a downward extending boss 26. The lower casing 25 is mounted by means of bolts engaged in openings in juxtaposed laterally extended flanges of the casings, as shown at 27, and the bottom is arranged with a central perforation extended through a laterally extending boss 28 of the casing.

To connect the driver with the crushing head carrying shaft electromagnetic clutch mechanism is mounted in the casing 25, comprising an electromagnet having a U-shaped circular core 30 with the sides thereof serving as a housing for an energizing coil 31, the core being arranged with an axially perforated integral hub 32 of less diameter than the opening in the casing boss 28 and extended through said opening and beyond the end of said boss 28. The terminals of the coil 31 of the electromagnet are connected to a source of electricity by means of conductors 33 suitably connected with the terminals of the coil, as at 34, and with collector rings 35 mounted on the magnet hub 32 and insulated therefrom with which brushes connected by conductors with the source of electricity have rubbing contact, as shown at 35′.

The other member of the clutch mechanism is in the form of a ring 36 of magnetizable material fixedly carried on the bottom of the casing 24 within the casing 25 and in opposed relation with the end of the circular magnet core 30 and to have contact therewith and serve as an armature to the electromagnet. The ring 36 may be mounted on the casing in a suitable manner, as by electric welding or otherwise.

To impart the rotative movement of the driver through the clutch mechanism to the clutching member, the clutch member 30 has a flexible connection with the bushing 12 in which the crushing member is eccentrically mounted and comprising a member 37 having a disk shaped portion with one face recessed, as at 38, with a pair of alined slots 39 cut through the recessed wall transversely of the axis of the disk, an integral stud or shaft 40 arranged centrally of and extending from the opposite face of the disk and mounted in the boss 26 of the casing 24 for rotative movement by a flanged bearing 41 carried in said boss. The shaft is extended through the hub portion 32 of the magnet core and has a driving connection therewith by a key engaging in keyways in the shaft and hub of the magnet core, as at 42, whereby the magnet is adapted to rotate with the shaft of said coupling member and have longitudinal movement thereon in the casing 25 limited by the clutch member 36 and the bottom of the casing. The key 42 is held in place by a plate 42′ releasably secured to the end of the shaft. The other member of the coupling means is in the form of a disk 43 having one face recessed, as at 44, similar to the recessed face of the coupling member 37 with a slot cut through the opposite wall portions of the recess to extend transversely and axially of the disk with portions of the slot traversing the entire face of the disk, as at 45, Figures 4 and 5, for the slidable engagement of the ribs 17 of the eccentric bushing 12. The opposite face of the disk 43 has an integral rib 46 extending transversely of the slot 45 for slidable engage-

ment in the slots 39 of disk shaped portion of member 37, thereby providing a flexible connection between the crushing member and the clutch member 30. The weight of the bushing 12 forces the coupling member 37 against the bearing 41 maintaining the shaft 40 in relatively fixed longitudinal position, and the bushing is held against upward movement by the thrust of the magnet 30 as it is moved longitudinally of the stud shaft by the end of the bushing engaging a shoulder in the frame bearing 9, as at 12'.

The driver is connected in electric circuit with a source of electricity by conductors 47, 48 connected to the windings of the stator and rotor, respectively, the conductors 47 leading through the frame, as at 49, to the source of electricity, and the conductors 48 connected to collector rings 50 mounted on and insulated from the boss 28 of the casing 25 and connected to a source of electricity by conductors connected to brushes having rubbing contact with the rings, as at 52.

The casing 24 of the driver serves as a closure for the bottom of the frame bearing 9 forming with said bearing a lubricant carrying housing 53 to which lubricant is fed from a suitable source by gravity through a pipe 53' leading to the top of the eccentric bushing and adapted to be circulated by capillary attraction between the frame bearing and the outer wall of the eccentric bushing and the hub portion 21 of the rotor 20 and from between the latter into a reservoir 54 formed in the stator 19 from which a pipe 54' leads to a pump shown in a conventional manner at P, and by the latter delivered to the source of supply from which the pipe 53' leads. The bushing 12 is arranged with perforations 55 at the bottom to allow the lubricant to flow into the chamber 53. The coupling members 37, 43 are lubricated by the flow of lubricant from the bushing through a perforation 56 centrally of the bushing, as shown in Figure 6. The lubricant is prevented from entering the casing 25 carrying the clutch mechanism by a packing 57 held in a recess in the bore of the boss 26 of the casing 24 about the coupling stud 40 by a plate 58 secured to the end of the boss.

It is impossible to start crushers of this type in cold weather due to the stiffening of the lubricant. Furthermore should the crusher be stopped while there is material in the crushing chamber it is almost impossible to start the same without placing such a load upon the motor that there is a possibility of burning out the same. Under such conditions in order to start the crusher in cold weather it is necessary to first render the lubricant fluid, which is usually done by building a fire under the crusher, and when the crusher has been stopped during the crushing of material by removing the material from the crushing chamber. This is overcome by the present invention since the motor may be set in operation independently of the crushing member by rendering the clutch inactive and thereby disconnecting the motor from the crushing member, and allowing the motor with the casings to rotate without imparting movement to the crushing member. When the motor has attained a predetermined rate of speed the electromagnet 31 is energized or rendered active causing the clutch member 30 to be moved by magnetic attraction into contact with the member 36 acting as armature to the magnet and connecting the motor to the bushing 12 through the clutch mechanism and the flexible coupling. When an overload is applied to the motor slowing down the speed of the same, as by a piece of uncrushable material becoming lodged in the crushing chamber and a force exerted on the crusher head carrying shaft to resist the rotation thereof against the force exerted thereon by the motor to rotate the shaft, said opposing forces exert a bending and breaking stress upon the shaft, and to obviate this there is provided a relay switch in the electric circuit of the magnetic clutch operative by the resistance set up by the overloading of the motor to open the circuit of the electromagnet and render it inactive and disconnect the driver from the crushing member, and said switch being operative to again close the circuit of the electromagnet when the obstruction to the rotation of the clutching member is removed and the motor attains a predetermined speed rendering the clutch mechanism active and the connection of the motor with the crushing member.

To increase the frictional contact between the armature ring 36 and the core of the electromagnet 30 the outer leg of the recessed portion of the magnet core is flanged laterally, as at 58, and has a friction material seated in an annular recess in the face thereof, as at 59, in opposed relation to the armature ring. The releasable connection between the rotor support ring 32 and the bar 9 is in the nature of a bayonette joint connection, the outer wall of the bearing being arranged with an annular recess 60 into which are cut slots 61 entering from the end of the bearing, and the supporting ring 32 is arranged with inwardly extending projections to be entered into the slots 61 longitudinally of the bearing and then moved laterally for engagement with the shoulders formed by the recess 60. The supporting ring 22 is held against rotative displacement by the rotation of the rotor by bolts 62.

While I have illustrated and described what I believe to be the preferred embodiment of the invention it will be obvious that various modifications may be made in the construction and arrangement of parts, and that portions of the invention may be used

without others and come within the scope of the invention.

Having thus described my invention I claim:

1. In a gyratory crusher, a gyratory crushing member, a driver rotatably mounted concentrically of the crushing member, and electromagnetic clutch mechanism arranged at one end of and coaxially with the crushing member and driver to operatively connect the driver and crushing member, and embodying an element of magnetizable material and a magnetizing element for the magnetizable element, one of which elements is connected with the driver and the other element connected with the crushing member.

2. A gyratory crusher as claimed in claim 1, wherein the crushing member is eccentrically mounted in a bushing rotatably mounted concentrically of the axis of the crusher frame and to which one element of the clutch is connected, and the driver is mounted concentrically of the crusher frame.

3. In a gyratory crusher, a gyratory crushing member mounted concentrically eccentrically of the axis of the crusher, a driver rotatably mounted on the crusher frame, and electromagnetic clutch mechanism operatively connected with the driver and flexibly coupled with the crushing member.

4. In a gyratory crusher, a gyratory crushing member eccentrically mounted in a bushing rotatably mounted concentrically in the crusher frame, a driver, and clutch mechanism embodying a magnetizable element rotatable with the driver, and an electromagnet to co-operate with the magnetizable element to have releasable connection with the driver and flexibly connected with the bushing.

5. A gyratory crusher as claimed in claim 4, wherein the flexible connection between the electromagnetic clutch mechanism and the bushing comprises a disk having a transverse slot arranged in one face for engagement of a correspondingly formed rib carried by the bushing and the opposite face of the disk having a rib extending in a direction transversely of the slot for engagement with a slot arranged in a second disk having an axial stud upon which the magnet is mounted to rotate therewith and have sliding movement thereon.

6. In a gyratory crusher, a crushing member mounted to have movement eccentrically about the axis of the crusher frame, and an electric motor mounted on the crusher frame comprising a stator fixed to the frame and a rotor rotatably mounted on the frame, and electromagnetic clutch mechanism adapted to have releasable magnetic connection with the rotor and having a flexible connection with the crushing member.

7. In a gyratory crusher, a crushing member eccentrically mounted in a bushing concentrically carried axially in the crusher frame to have rotative movement, a driver rotatably mounted on the frame carrying superposed casings, a coupling rotatably carried in the upper casing and connected with the bushing, and magnetic clutch mechanism in the lower casing operatively connected with the coupling and operative to magnetically connect the driver with the coupling.

8. In a gyratory crusher, a crushing member, a bearing in the frame in which said crushing member is eccentrically mounted, a driver rotatably supported by said bearing, an electromagnet loosely carried by the driver concentrically of the crusher and having an operative connection with the crushing member, a magnetizable element to serve as armature to said magnet fixedly carried by the driver, said driver being adapted to rotate independently of the electromagnet in the inactive condition of the latter and the electromagnet adapted to co-operate with the magnetizable element when rendered active to rotate with the driver and operatively connect the driver with the crushing member.

9. In a gyratory crusher, a crushing member concentrically eccentrically mounted in the crusher frame, a driver mounted for rotation upon the crusher frame, and electromagnetic clutch mechanism carried by the driver, one member of which is fixedly connected with the driver and the other member loosely carried by the driver and operatively coupled with the crushing member and in the inactive condition thereof the driver being adapted to rotate independently of said member and when the clutch is rendered active said member adapted to co-operate with the other clutch member to rotate with the driver and couple the driver with the crushing member.

10. In a gyratory crusher, a crushing member concentrically eccentrically mounted in the crusher frame, a driver mounted upon the crusher frame for rotative movement axially of the crusher, a coupling loosely carried by the driver axially of the crusher having connection with the crushing member to rotate therewith, and electromagnetic clutch mechanism carried by the driver and having an operative connection with the coupling, said clutch mechanism in the inactive condition thereof being adapted to maintain the driver disconnected from the crushing member and when rendered inactive adapted to connect the driver with the coupling and thereby with the crushing member.

11. A gyratory crusher as claimed in claim 10, wherein the crushing member is eccentrically mounted in a bushing and the bushing is rotatably mounted axially of the crusher and through which bushing the crushing member is connected with the coupling for connection with the driver through the electromagnetic clutch.

12. A gyratory crusher as claimed in claim

8, wherein the connection of the electromagnet with the crushing member is by means of a flexible coupling carried by the carrier for the electromagnet and said carrier retaining the coupling member in coupled relation to the crushing member.

13. In a gyratory crusher, a gyratory crushing member, a bearing arranged in the crusher frame eccentrically carrying said crushing member, a motor the stator of which is fixed to the frame and the rotor rotatably supported on the bearing, and electromagnetic clutch mechanism carried by the rotor and operatively connected with the crushing member to operatively connect the rotor with the crushing member.

14. In a gyratory crusher, a crushing member eccentrically mounted in a bushing concentrically mounted in the crusher frame, a driver rotatably supported on the frame concentrically of the crusher, and electromagnetic clutch mechanism, one member of which is mounted on a shaft to rotate therewith and loosely carried by the driver and flexibly coupled with the crushing member, and the other member fixedly carried by the driver and adapted to co-operate with the other clutch member through magnetic attraction when the clutch is energized to connect the driver with the clutching member.

15. In a gyratory crusher, a crushing member concentrically eccentrically mounted in the crusher frame, a driver rotatably mounted on the crusher frame axially thereof and carrying superposed casings arranged at the end of the crusher frame, a shaft loosely carried by one of said casings coupled with the crushing member within said casing and extending into the other casing, and an electromagnetic clutch carried in the other casing operatively connected with the shaft, said clutch when rendered active being adapted to connect the shaft and crushing member with the driver and when rendered inactive to disconnect the shaft and crushing member from the driver.

16. A gyratory crusher as claimed in claim 15, wherein the bushing is rotatably mounted in a bearing in the crusher frame and to which the shaft is coupled to connect the same with the crushing member and the shaft is arranged with a stuffing box in its mounting in the one casing whereby said casing with the bearing is adapted to serve as a lubricant carrying housing for the bushing and shaft coupling.

17. A gyratory crusher as claimed in claim 15, wherein the bushing is rotatably mounted in a bearing in the crusher frame and to which the shaft is coupled to connect the same with the crushing member and said casing member serves to maintain the shaft coupled with the bushing and the bushing in the bearing.

18. In a gyratory crusher as claimed in claim 15, wherein the one member of the electromagnetic clutch comprises an electromagnet embodying a core of U shape in cross section and carrying means therein for energizing the same, said core being arranged with a central hub whereby it is mounted upon the shaft of the coupling and having a key connection with said shaft to rotate with and have movement axially of the shaft, and the hub extending through an opening in the lower casing, and collector rings of conducting material mounted on and insulated from said extended hub for connection of the magnet with a source of electricity.

Signed at the city of New York, in the county of New York and State of New York, this 10th day of May, 1928.

JOSEPH E. KENNEDY.