T. A. EDISON.

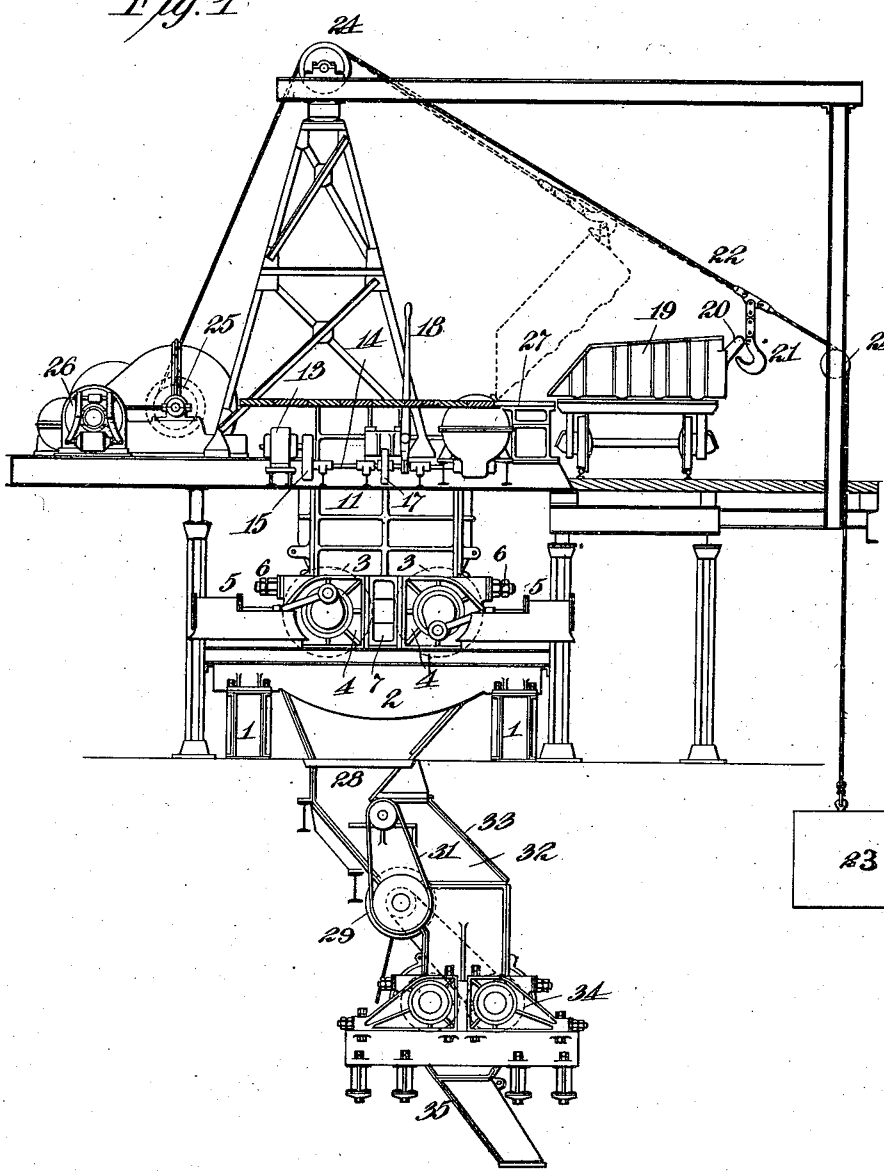
GIANT ROLLS.

APPLICATION FILED JAN. 13, 1903.

1,014,818. Patented Jan. 16, 1912.

4 SHEETS—SHEET 1.

Fig. 1



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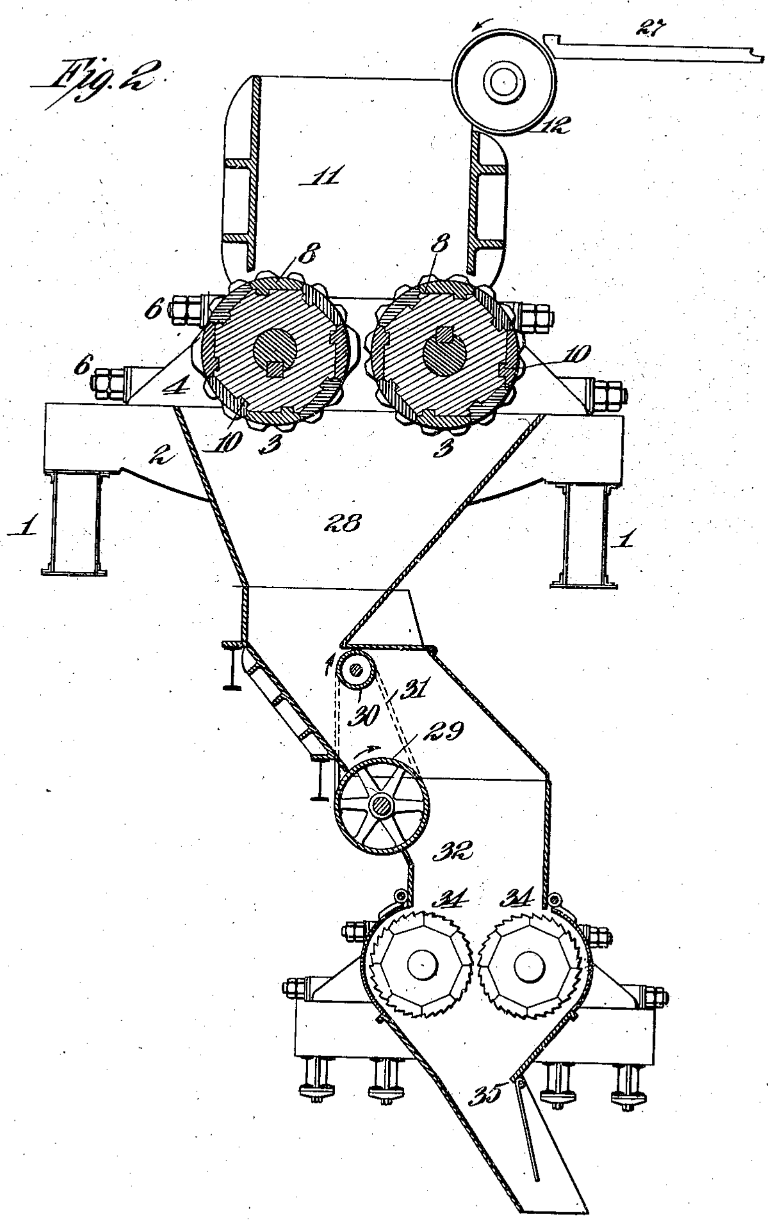
4 SHEETS—SHEET 2.

Fig. 2



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4 SHEETS—SHEET 3.

Fig. 3

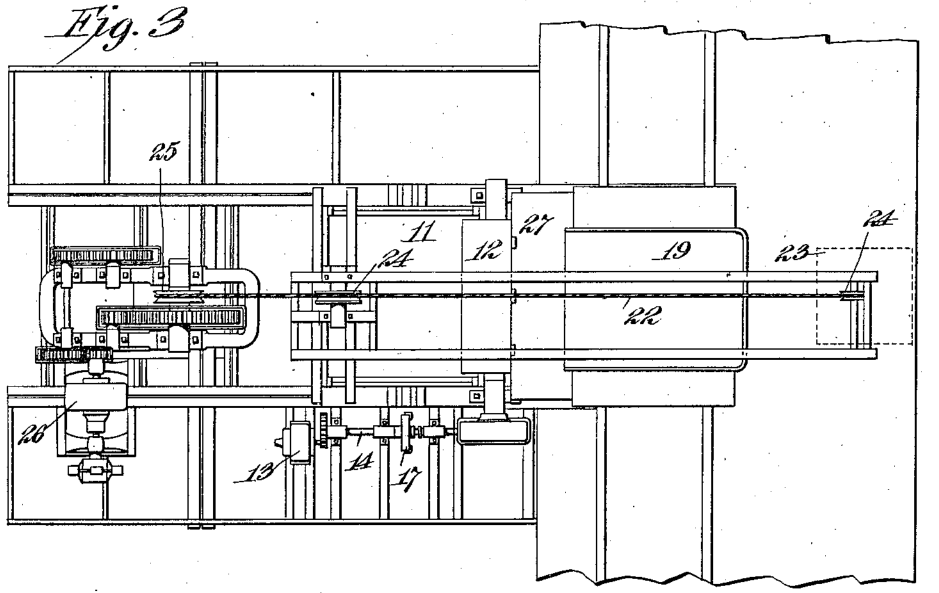
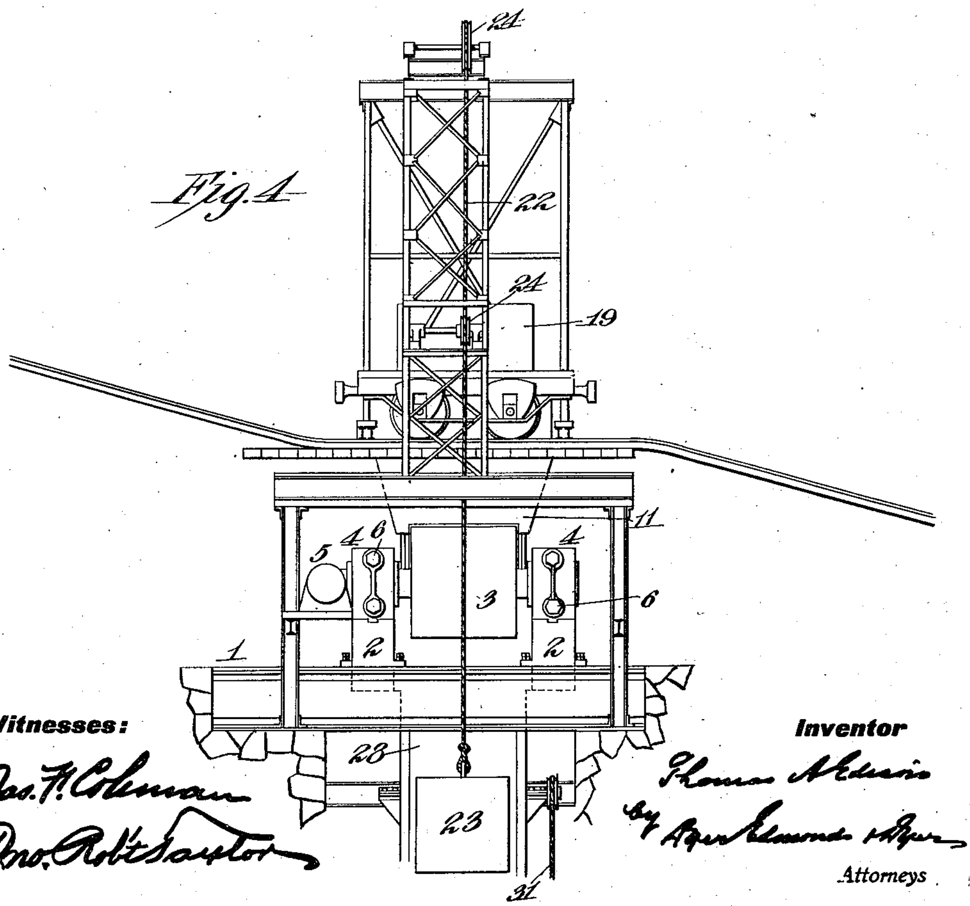


Fig. 4



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4 SHEETS—SHEET 4.

Fig. 5

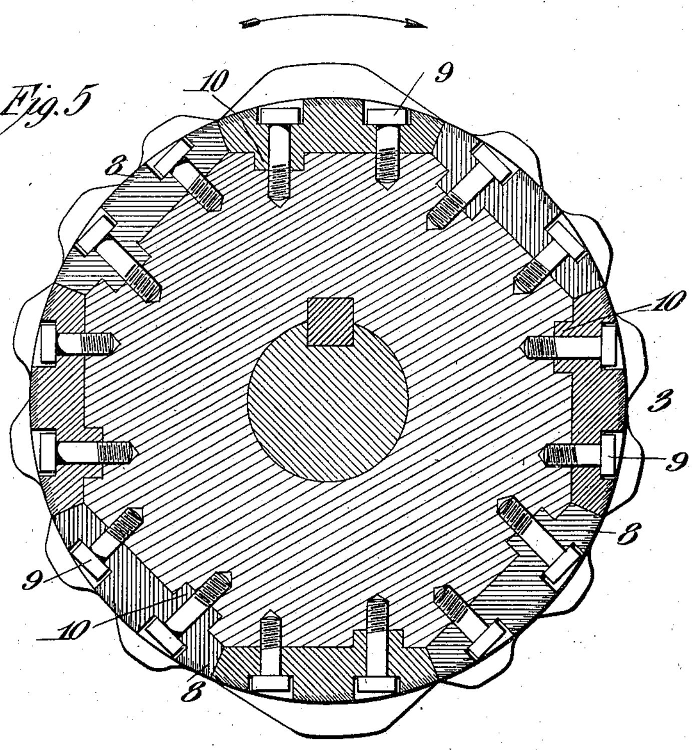
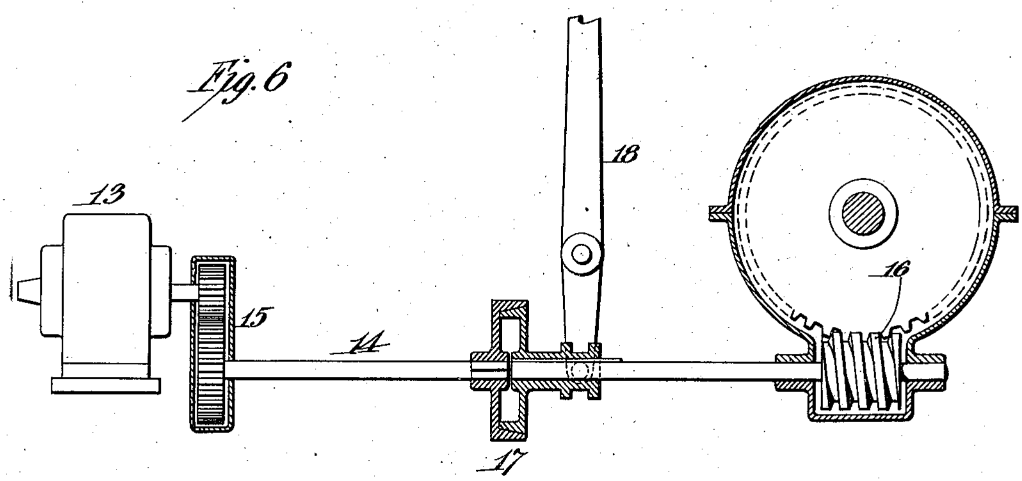


Fig. 6



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, ORANGE, NEW JERSEY.

GIANT ROLLS.

1,014,818. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed January 13, 1903. Serial No. 138,813.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Giant Rolls, of which the following is a specification.

My invention relates to improvements in giant rolls of the type covered by my patents of April 23rd, 1901, numbered 672,616 and 672,617 respectively, in which two rolls of great weight are employed driven independently in opposite directions, with means for feeding charges of rock periodically to the gap between the rolls, whereby the rock is broken by kinetic energy, and my object is to improve the construction and increase the efficiency of apparatus of this type.

The present improvements have been designed especially for the purpose of breaking limestone and cement rock for use in the manufacture of Portland cement, but obviously the apparatus can be utilized in other arts and for the treatment of other materials in bulk, such as iron ore for example.

The present improvements relate, in the first place, to the driving of the rolls by small independent motors which are connected preferably directly to the shafts of the rolls. These motors are preferably steam-engines of relatively low power, since when the rolls are once started they can be very easily driven, but electric or other motors may obviously be employed. Owing to the small size of the driving motors, the sudden reduction in the speed of the rolls which takes place when each charge of rock is being acted upon will not injuriously affect the motors, but the latter will immediately respond when the charge has passed through, to accelerate the rolls to their normal surface speed. This makes a very simple, effective and cheap construction, and does away entirely with the necessity of frictional driving mechanism or other differential connection between the rolls, as heretofore employed.

The invention relates, in the second place, to improvements in devices for feeding to crushing rolls the respective charges from the giant or rock-breaking rolls. If the charges of broken or crushed rock were fed directly from the giant rolls to the crushing or grinding rolls, the latter would obviously become clogged and would either fail to operate at all or else would operate with poor efficiency. It, therefore, becomes necessary to interpose between the giant rolls and the crushing or grinding rolls a feeding device for receiving the charges of rock periodically delivered from the giant rolls and feeding the same continuously to the crushing or grinding rolls. The invention provides for an arrangement of this character which is capable of operating under conditions of the highest efficiency.

The invention relates, in the third place, to improvements in roller-feed mechanisms adapted especially for use intermediate of the giant and crushing rolls, and by means of which clogging or bridging of the material is entirely prevented. I find in practice that if material in large quantities is delivered to a hopper provided with roller-feed devices, the material tends to become clogged in the neck of the hopper immediately above the roller-feed, and this is especially true if the material is at all damp. By the present improvements, such a possibility is entirely overcome.

The improvements relate, in the fourth place, to a new arrangement of breaking plates for use with giant rolls, by which the plates are greatly strengthened and shearing strains imposed in actual use are effectively resisted, while at the same time cost of manufacture is reduced.

The invention relates, in the fifth place, to the use of a roller-feed mechanism above the giant rolls, provided with means by which it may be stopped or started at will. In this way, material is effectively delivered to the rolls, while at the same time the attendant can regulate the feed, so as to stop the supply of material when any very large pieces of rock are being crushed, and thus prevent the possibility of the rolls becoming overloaded.

The invention relates, in the sixth place, to improvements in the mechanism for effectively handling skips containing rock to be broken and for presenting the rock to the action of the breaking rolls.

Finally, the invention relates to improvements in the details of construction and arrangement, all as will be more fully hereinafter described and claimed.

In order that the invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a side elevation of the improved rock-breaking apparatus in its preferred form; Fig. 2, a vertical sectional view; Fig. 3, a plan view showing particularly the skip-handling mechanism; Fig. 4, a rear view of the same, showing also the giant rolls; Fig. 5, a cross-sectional view, on an enlarged scale, through one of the rolls, showing the preferred arrangement and form of wearing plates; and Fig. 6, a detail view illustrating the mechanism for driving and controlling the roller-feed above the giant rolls.

In all of the above views, corresponding parts are represented by the same numerals of reference.

Carried on suitable foundation beams 1, are the side frames 2 of the giant rolls 3, 3, the shafts of the latter being mounted in heavy pillow-blocks 4 secured to, but longitudinally adjustable on, the side frames. Each of the giant rolls is driven by a small auxiliary motor 5, 5, a steam-engine being shown as the preferred example, whose connecting rod is connected directly with the crank on the shaft of each roll. The pillow-blocks 4, 4, are rigidly connected together by tie-bolts 6, and the gap between the rolls is regulated by a spacing block 7 placed between the pillow-blocks. The motors 5, 5, are connected to and are adjustable longitudinally with the pillow-blocks, so that the relation between the motors and the rolls remains unchanged irrespective of the adjustment of the rolls to vary the width of the gap. As shown, each of the giant rolls consists of a heavy solid core carrying removable wearing plates 8 having projections on their outer faces. These plates are held in position by tap-bolts 9 and are formed with ribs or shoulders 10 fitting in recesses in the core of the roll, so that these shoulders receive the shearing strains which are imposed on the plates in use and relieve the tap-bolts of those strains. Preferably the plates are provided with flat bottoms on account of cheapness of construction and finishing, instead of being rounded or concaved as heretofore, and the core is provided with flat faces for receiving the plates, instead of being truly cylindric. The rib 10 on each plate is formed near its rear edge (as determined by the direction of rotation) so that the strains imposed on the plates are received directly on the ribs. If, on the contrary, the ribs were formed on the plates near their forward edges, the strains encountered in practice would tend to raise the ribs out of the recesses, without properly receiving the thrust. Obviously, the tendency of the plates to be stripped off is resisted by the tap-bolts 9.

Mounted above the giant rolls is a heavy casing 11, through which falls the material to be operated upon. At the top of this casing at one side is a roller-feed 12 operated by a motor 13 illustrated as an electric motor. This motor drives a counter-shaft 14 through gearing 15, and the counter-shaft drives the roller-feed 12 by a worm 16 on the shaft of the roller-feed. The counter-shaft 14 is provided with a clutch 17, operated by a lever 18, and of any approved form, and by means of which the worm may be stopped and started at will to provide for a similar control of the roller-feed. The rock to be broken is contained in skips 19 carried on flat cars running on suitable tracks. Each skip is formed with an eye 20 at its rear end, with which a hook 21 is adapted to engage, the hook being flexibly connected to a cable 22 carrying a weight 23 at its lower end, running over pulleys 24, 24, and extending around a winding-drum 25. This winding-drum is operated by suitable gearing from a motor 26, shown as an electric motor. The run of the cable 22 between the pulleys 24, 24, is so disposed that when the winding-drum is operated the hook will automatically engage the eye 20 on the skip, sliding the skip off of the car along the platform 27, until its forward end engages a projection immediately behind the roller-feed 12 and tilting the skip to the position shown in dotted lines (Fig. 1), so as to discharge its contents onto the roller-feed. The table 27 is made preferably of polished chilled iron, so that the skip will slide freely over the same in the unloading operation.

Below the giant rolls, I form a hopper 28 having a roller-feed 29 operated in any suitable way and movable in the direction of the arrow. This roller-feed is located at the bottom of the discharge from the hopper 28, and at the other side of the discharge therefrom I mount a roller 30 whose function is to prevent the material from clogging or bridging within the hopper. It will, of course, be understood that instead of the roller 30 any other moving device can be employed for the same purpose, as, for instance, a vibrating surface, similar to a shaking grate. The roller 30 turns in the same direction as the roller-feed 29 and may be operated from the latter by a belt 31. A casing 32 is arranged beyond the roller-feed 29 and may be provided with a hinged lid 33, by which its interior may be reached. Below the casing I show a pair of crushing or grinding rolls 34 of any suitable type, discharging into a hopper 35.

In operation the motors 5 independently

drive the giant rolls at a high surface velocity, so that the rolls act practically as enormously heavy fly-wheels. The crushing rolls 34 are operated from any suitable source of power, the roller-feed 29 and roller 30 are also continuously operated, and the roller-feed 12 is operated from the motor 13. A loaded car is now moved up on the track opposite the roller-feed 12 and the motor 26 is started, winding the cable 22 upward, engaging the hook 21 with the eye 20 on the skip, sliding the skip sidewise until its forward end engages the projection at the front of the table 27, and then tilting the skip upward so that its contents are discharged onto the roller-feed. By means of the latter the material is projected into the casing 11 and falls into the gap between the giant rolls. This charge of rock will be operated upon by the rolls, and by reason of the enormous momentum thereof will be forced between the gap, being broken and crushed in its discharge, as I describe in the patents above referred to. The passage of the rock between the giant rolls acts to almost instantaneously reduce the speed of the latter, but owing to the small size of the operating motors 5 these motors accommodate themselves to the changes in speed without injury and when the charge has passed through exert their power to again accelerate the speed of the rolls, so that by the time another charge of rock is presented to the same the rolls will acquire their normal high surface velocity. If a very large piece of rock is being acted upon by the rolls, and the attendant observes that another piece is about to pass the roller-feed 12 to thereby tend to overload the rolls, the clutch lever 18 may be operated to stop the roller-feed until the charge has passed through; whereupon the roller-feed is again started and more material fed out of the tilted skip. This very perfect control of the roller-feed effectively prevents the giant rolls from becoming overloaded. Should the rolls come to rest, due to overloading, and especially if a charge of partially broken material is still in position between them, it is difficult to start them, owing to their great mass. Consequently, the attendant always so regulates the supply of material as not to permit of any considerable average reduction in the speed of the rolls. When the skip has been emptied, the motor 26 is reversed, or if the weight 23 is of sufficient mass power is simply cut off from the motor 26 so that the descent of the weight will reverse the motor, returning the skip to its original position and automatically disengaging the hook from the eye, so that a loaded car can be moved in place and the unloading operations repeated. The broken material from the giant rolls is discharged in the hopper 28 and from the latter continuously fed from the roller-feed 29 to the crushing or grinding rolls 34, by which a further reduction of the material is effected.

I find that by employing the roller 30, coöperating with the roller-feed, material is prevented from clogging or bridging within the hopper, since the roller 30 presents a movable abutment against which a bridge of the material cannot be formed. If, on the other hand, the roller 30 or equivalent were not used, there would be great danger of the material clogging and accumulating within the hopper, and particularly if the material was at all damp.

I do not claim herein the improvements relating to means for unloading skips and dumping the same hereinbefore described, but I claim the said improvements in a divisional application hereof, Serial No. 663,399, filed December 1, 1911.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is as follows:—

1. In rock-breaking apparatus of the character described, the combination with a pair of rolls sufficiently massive to break the rock by changes in the kinetic energy thereof when running at normal speed, of a pair of motors, each of power sufficient to bring its roll up to normal speed when running freely, but insufficient to break the rock by the direct application of the power, and positive connections whereby one motor drives one roll, and the other motor drives the other roll, substantially as set forth.

2. In rock-breaking apparatus of the character described, the combination with a pair of rolls sufficiently massive to break the rock by changes in the kinetic energy thereof when running at normal speed, and rotating in opposite directions with a gap between them, of a pair of motors, each of power sufficient to bring its roll up to normal speed when running freely, but insufficient to break the rock by the direct application of the power, and positive connections whereby one motor drives one roll and the other motor drives the other roll, and means for adjusting said rolls to change the width of the gap, substantially as set forth.

3. In rock-breaking apparatus of the character described, the combination with a pair of rolls sufficiently massive to break the rock by changes in the kinetic energy thereof when running at normal speed, said rolls rotating in opposite directions with a gap between them, of a motor connected directly and positively with the shaft of each roll for rotating the same, each said motor being of power sufficient to bring its roll up to normal speed when running freely, but insufficient to break the rock by the direct application of the power, substantially as set forth.

4. In a rock-breaking apparatus of the

class described, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, and means for rotating said rolls, said means being of sufficient power to bring the rolls up to normal working speed when running freely, but being insufficient to break the rock by the direct application of power, of a roller-feed for delivering material to the gap between the rolls, and means for starting and stopping said roller feed independently of the position of the rolls, substantially as set forth.

5. In a rock-breaking apparatus of the class described, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, of pillow-blocks in which said rolls are mounted, one or both of which are adjustable for varying the width of the gap, and independent motors carried by the pillow-blocks for independently driving said rolls, substantially as set forth.

6. In rock-breaking and crushing apparatus, the combination of a pair of massive breaking rolls operating by changes of kinetic energy to effect a first reduction, means for supplying charges of material intermittently to the same, a pair of continuously operating crushing rolls beneath the same, and a hopper between the two sets of rolls, said hopper having an outlet adapted to deliver material to the crushing rolls in a continuous stream and its capacity being sufficient to enable it to maintain its normal discharge rate during the intervals when the breaking rolls are gaining kinetic energy, substantially as set forth.

7. In rock-breaking and crushing apparatus, the combination with a pair of massive breaking rolls rotating in opposite directions with a gap between them and operating by changes of kinetic energy to effect a first reduction, means for supplying material intermittently to said rolls and means for driving said rolls, of crushing rolls for receiving the material delivered by the breaking rolls, and means independent of the breaking and crushing rolls adapted to receive material from the breaking rolls and deliver it to the crushing rolls in a continuous stream, said means having storage capacity sufficient to enable it to maintain its normal discharge rate during the intervals when the breaking rolls are gaining kinetic energy, substantially as set forth.

8. In a rock-breaking and crushing apparatus of the class described, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, means for supplying material intermittently to said rolls, and means for driving said rolls, of crushing rolls for receiving the material delivered by the breaking rolls, and means comprising a roller-feed independent of the breaking and crushing rolls for feeding in a continuous stream to the crushing rolls material intermittently delivered from the breaking rolls when operating at or near their full capacity, substantially as set forth.

9. In rock-breaking and crushing apparatus of the class described, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, means for supplying material intermittently to said rolls, and means for driving the rolls, of a pair of crushing rolls located beneath the breaking rolls for receiving the material delivered from the breaking rolls, a hopper between the two sets of rolls, a roller-feed at one side of the discharge from said hopper for continuously feeding to the crushing rolls the material intermittently delivered from the breaking rolls, and a continuously moving device at the other side of the discharge and coöperating therewith for preventing bridging of material above the roller-feed, as and for the purposes set forth.

10. In rock-breaking apparatus of the class described, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, and means for driving said rolls, of a hopper beneath said rolls having a roller feed, the capacities of the rolls, hopper and roller feed being so proportioned that intermittent charges of material fed to the rolls when operating at or near their full capacity will be fed from the hopper in a continuous stream, and an independent roller coöperating with the roller feed and driven in the same direction for preventing bridging of the material, the material passing between the roller feed and said roller, substantially as set forth.

11. In apparatus of the class described for breaking rock, the combination with a pair of massive rolls rotating in opposite directions with a gap between them, and means for driving said rolls, of a hopper below the breaking rolls, a roller feed at one side of the discharge from the hopper, and a roller at the other side of the discharge from the hopper rotating in the same direction as the roller-feed, as and for the purposes set forth.

12. In rock-breaking apparatus of the class described, the combination with a pair of rolls having a gap between them and sufficiently massive to break the rock by changes in the kinetic energy thereof, and means for bringing said rolls up to high speed between rock-breaking intervals whereby kinetic energy is stored up, of a roller feed for delivering material to the gap between the rolls, and means for starting and stopping said roller feed at the will of the operator independently of the position of the rolls, substantially as set forth.

13. In apparatus for breaking rock by kinetic energy, the combination of a pair of

disconnected rolls having roughened or irregular surfaces and sufficiently massive to break rock by changes in the kinetic energy thereof when running at normal speed, a pair of motors, and connections whereby one motor drives one roll and the other motor drives the other roll, the power of each motor being sufficient to bring its roll up to normal speed when started from a state of rest and when no rock is in the rolls, but insufficient to break the rock by the direct application of the power, substantially as described.

14. In apparatus for breaking rock by kinetic energy, the combination of a pair of disconnected rolls having roughened or irregular surfaces and sufficiently massive to break rock by changes in the kinetic energy thereof when running at normal speed, a pair of motors, connections whereby one motor drives one roll and the other motor drives the other roll, the power of each motor being sufficient to bring its roll up to normal speed when started from a state of rest and when no rock is in the rolls, but insufficient to break the rock by the direct application of the power, and means for periodically delivering charges of rock to such rolls at sufficiently infrequent intervals to permit the rolls to recover sufficient speed to effect the successive breaking operations, substantially as described.

15. In apparatus for breaking rock by kinetic energy, the combination of a pair of disconnected rolls sufficiently massive to break rock by changes in the kinetic energy thereof when running at normal speed, knobs of substantially uniform height on the rolls for catching the rock and subjecting it to a rolling action, larger and higher knobs on one of the rolls for sledging large pieces of rock and reducing them to a size small enough to be subjected to the rolling action, a pair of motors and connections whereby one motor drives one roll and the other motor drives the other roll, the power of each motor being sufficient to bring its roll up to normal speed when started from a state of rest and when no rock is in the rolls, but insufficient to break the rock by the direct application of the power, substantially as described.

16. In apparatus for breaking rock by kinetic energy, the combination of a pair of disconnected rolls sufficiently massive to break rock by changes in the kinetic energy thereof when running at normal speed, knobs of substantially uniform height on the rolls for catching the rock and subjecting it to a rolling action, larger and higher knobs on one of the rolls for sledging large pieces of rock and reducing them to a size small enough to be subjected to the rolling action, a pair of motors, connections whereby one motor drives one roll and the other motor drives the other roll, the power of each motor being sufficient to bring its roll up to normal speed when started from a state of rest and when no rock is in the rolls, but insufficient to break the rock by the direct application of the power, and means for periodically delivering charges of rock to such rolls at sufficiently infrequent intervals to permit the rolls to recover sufficient speed to effect the successive breaking operation, substantially as described.

This specification signed and witnessed this 18 day of Dec. 1902.

THOMAS A. EDISON.

Witnesses:

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