

Feb. 16, 1965

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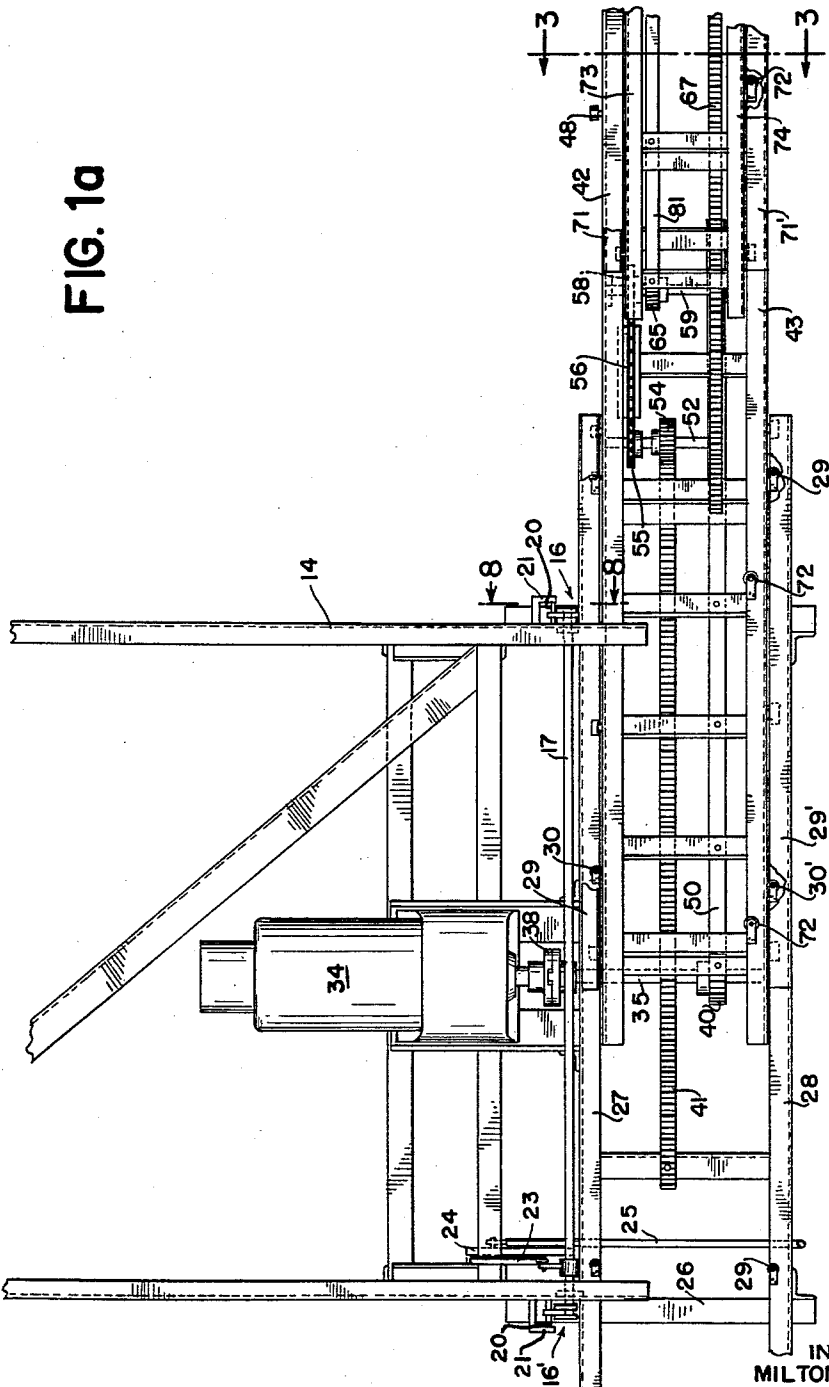
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ROD CHARGING APPARATUS

Filed March 1, 1961

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FIG. 1a



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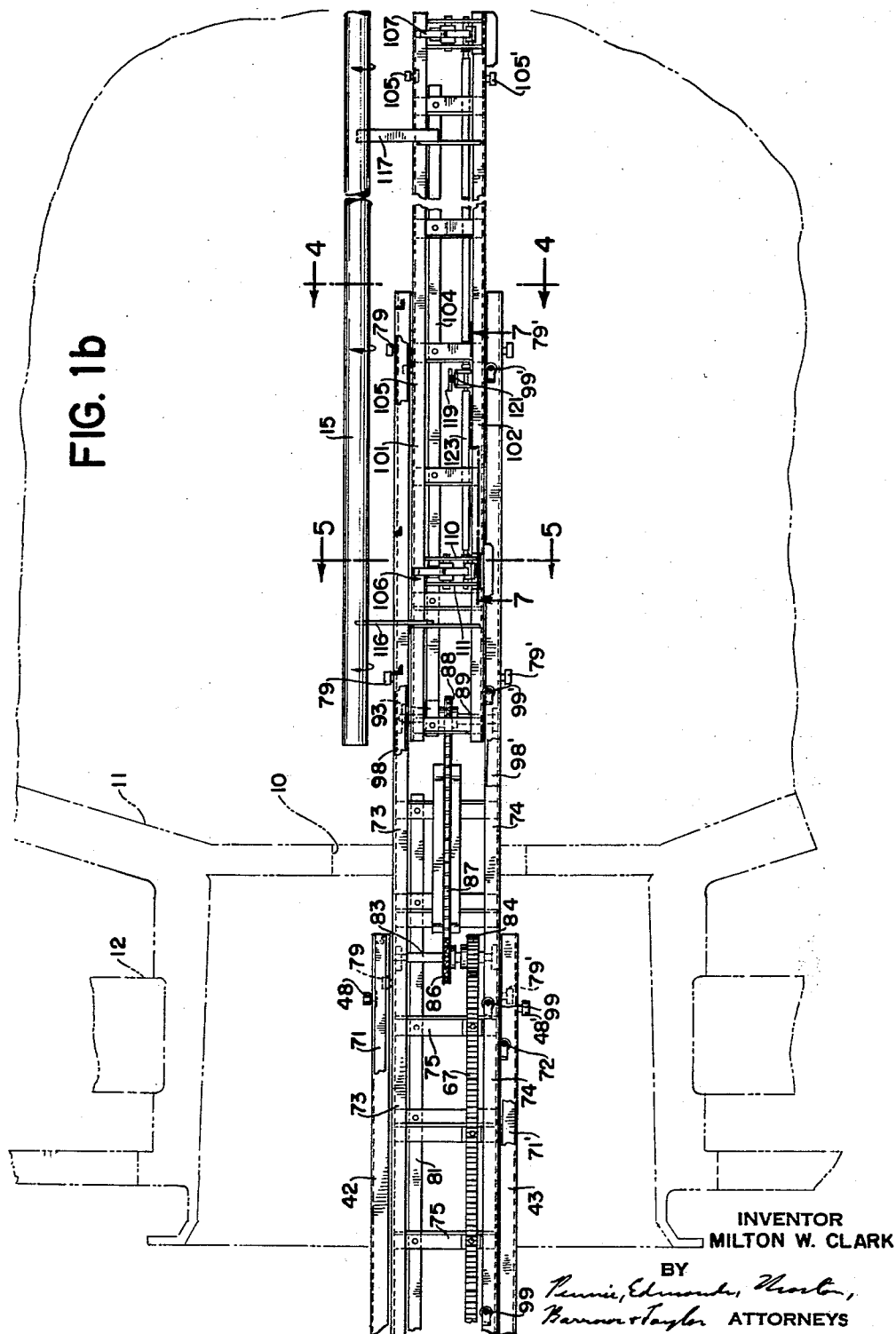
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ROD CHARGING APPARATUS

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ROD CHARGING APPARATUS

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FIG. 2

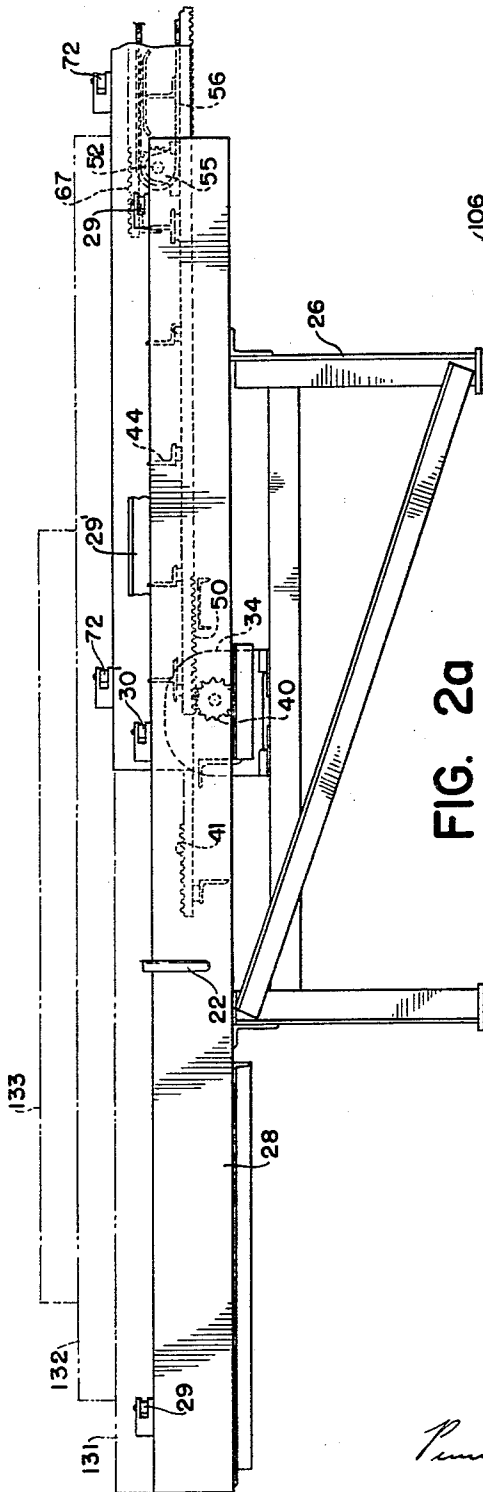


FIG. 2a

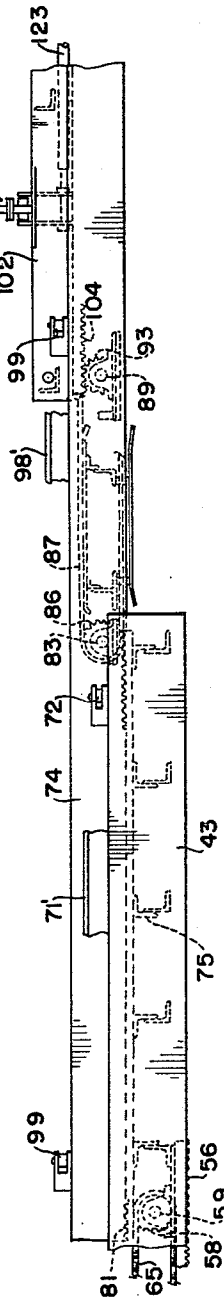
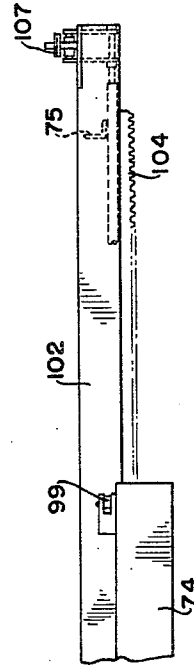


FIG. 2b



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FIG. 3

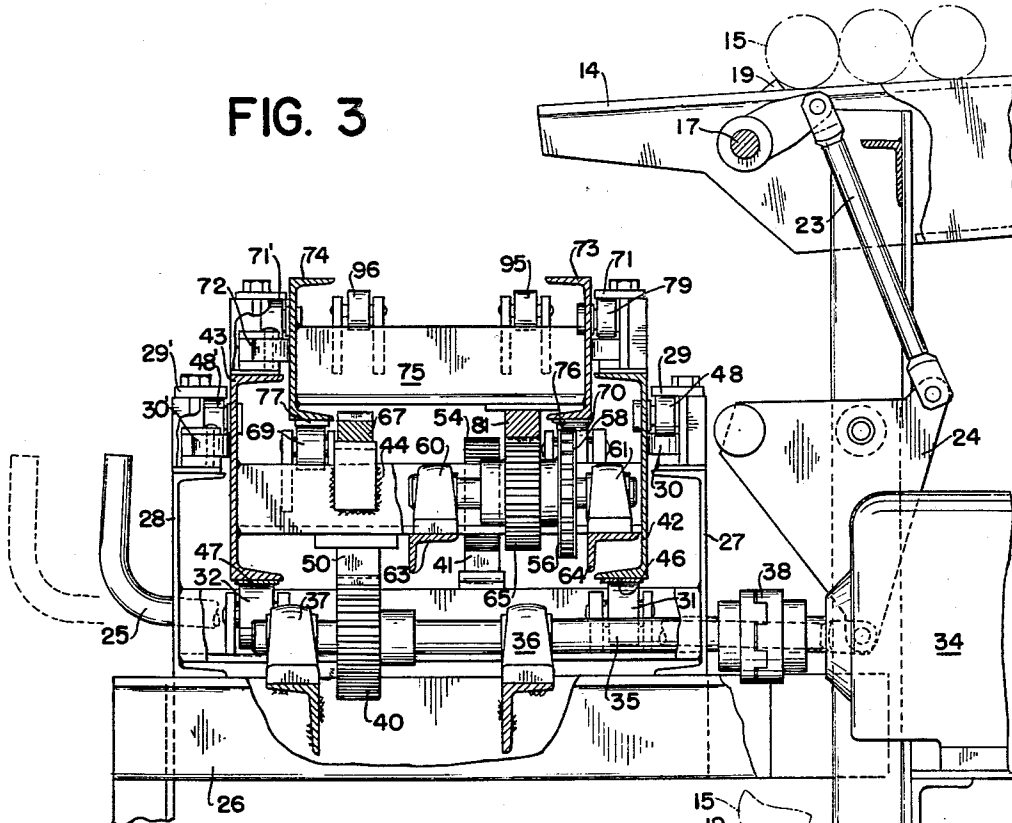
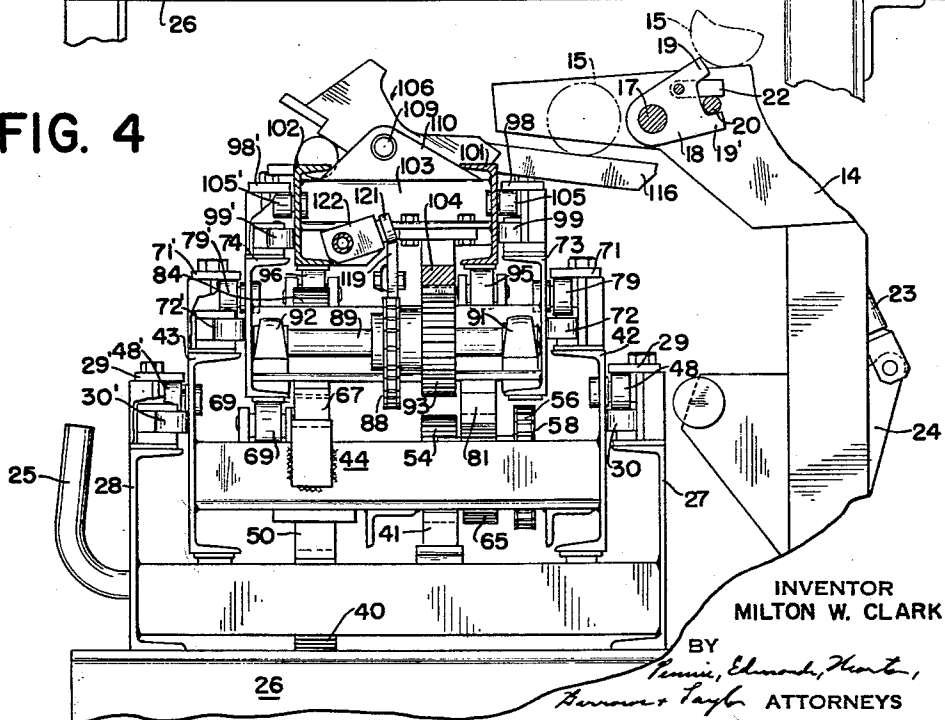


FIG. 4



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[illegible]

A perspective view of a mechanical assembly. It features a main rectangular base plate 101. On the left side, there is a vertical support structure 102 containing a cylindrical component 115. A horizontal arm or bracket 109 extends from the top of the base plate. At its end, there is a circular feature 113. Below this, another circular feature 106 is shown with dashed lines indicating its internal structure. A small pin or screw 114 is located near the top edge of the base plate. On the right side, a horizontal flange or pipe section 116 is attached to the base plate. The bottom of the base plate has several mounting points: a bolt 123 at the front-left corner, a pin 128 near the center, and a pin 131 towards the back-right. A diagonal brace or link 129 connects the bottom of the base plate to the underside of the horizontal arm 109.

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3,169,642

ROD CHARGING APPARATUS

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4 Claims. (Cl. 214—1)

This invention relates to apparatus for charging rod mills and, more particularly, to rod charging apparatus wherein a plurality of elongated carriers are mounted for longitudinal displacement one upon the other and are adapted to advance a rod on the endmost carrier into a mill and to deposit it therewithin.

Rod mills are employed for grinding particulate materials such as the coarse sand which must be finely comminuted in ore processing operations. A typical rod mill includes a large drum rotatably mounted at each end and filled to about one-third or more capacity with many longitudinally disposed steel rods, each of which are few inches in diameter. The sand or other material to be ground is fed into the mill through a relatively small axial opening at one end thereof and is finely comminuted by the tumbling action of the rods as the drum rotates. Since the rods become worn by the abrasive action of the sand after continued use, it is occasionally necessary to insert new rods into the mill through the open end of the drum, and it is for this purpose that rod charging devices are used.

Since the rods are almost as long as the drum (perhaps 15 to 20 feet in length), they are quite heavy and cannot be charged into the mill by hand without great effort and inefficiency. One mechanical means proposed heretofore has been to advance each rod longitudinally on a belt conveyor to the open end of the drum so that the rod tilts off the end of the conveyor and falls into the mill. However, the rod is not fully within the drum when it tilts from the conveyor and it is possible that the trailing end of the rod could strike the periphery of the opening and damage it. Moreover, if the rod is advanced into the mill fast enough to be thrown clear of the rod charging opening, it is likely to strike the opposite end of the mill with sufficient force to damage it. Furthermore, every time charging is necessary the area in front of the mill must be cleared and the unwieldy charging apparatus rolled into position in-line with the drum opening. Then, when charging is completed, the apparatus must be removed to keep the area clear for handling the sand.

It is the major object of this invention to provide new rod mill charging apparatus which departs essentially from known designs and overcomes the disadvantages hitherto encountered in this difficult operation. Relative compactness is a primary characteristic of the new charging apparatus both in operation and while standing idle. Hence, it does not interfere with the operation of the mill when not in use and does not require complete clearance of the area in front of the mill during charging. Since it is compact, the apparatus may easily be mounted on a wheeled carriage adapted to be rolled into aligned position in front of any one of a series of rod mills arranged side-by-side in a row. Alternatively, the new charging apparatus may be permanently positioned in-line with a single mill. Furthermore, the apparatus of the invention achieves rapid and efficient charging without in any way damaging the mill and particularly the drum opening. All of these advantages are provided in a mechanism which is structurally sturdy and easily operable by only one man.

In accordance with the invention, the apparatus comprises a frame and an elongated carrier longitudinally displaceable on the frame. Driving means are included

for displacing the carrier between retracted and extended positions. One end of the carrier provides a rod-supporting section which is adapted to advance fully into the mill upon displacement of the carrier to its extended position. Mounted on the rod-supporting section is a cradle for supporting at least one rod substantially longitudinally thereon. Means are provided for displacing the rod from the cradle when the rod-supporting section is substantially fully advanced.

More specifically, the new rod mill charging apparatus comprises at least one intermediate carrier longitudinally displaceable on a first carrier. The rod-supporting carrier, in turn, is supported for longitudinal displacement on the intermediate carrier. Transmission means actuated by the above-mentioned driving means interconnects the carriers to displace each of them between retracted and extended positions relative to the others. Hence, the rod-supporting carrier advances in a telescopic fashion a cumulative distance equal to the sum of the relative displacements of it with respect to the intermediate carrier, the intermediate carrier with respect to the first carrier, and the first carrier with respect to the frame. The cradle on the rod-supporting carrier may be pivotally mounted and associated with cam means which cause it to pivot and displace the rod therefrom when the rod-supporting carrier is fully within the mill.

Since the cumulative displacement of the rod-supporting carrier is sufficient to advance it fully into the drum, the frame of the new charging apparatus may be positioned a considerable distance away from (though in-line with) the axial opening of the mill and the area around the mill is left clear for effective handling of the sand. In their retracted positions, the carriers are arranged one above the other so that they occupy a space no longer than the length of any one of them. Also, the carriers move toward the mill in the manner of a progressively extending cantilever so that they do not require complete clearance of the floor in front of the drum opening during charging. When the rod supported in the cradle on the endmost carrier is advanced into the drum, it is displaced therefrom to fall directly in place without striking the drum opening.

A preferred embodiment of the invention is described hereinbelow with reference to the accompanying drawings, wherein

FIG. 1a is a fragmentary plan view of the frame and a portion of the first and second carriers in extended position;

FIG. 1b is a continuation, partly broken away, of the plan view of FIG. 1a and shows the rod-supporting carrier extended into the drum and in the process of depositing a rod therewithin;

FIG. 2 is a fragmentary elevation taken from FIG. 1a and showing a portion of the first carrier in extended position;

FIG. 2a is a fragmentary elevation continuing from FIG. 2 and showing a portion of the second and rod-supporting carriers;

FIG. 2b is a fragmentary elevation continuing from FIG. 2a and showing the outermost end of the rod-supporting carrier;

FIG. 3 is a fragmentary section taken along the line 3—3 of FIG. 1a;

FIG. 4 is a fragmentary section taken along the line 4—4 of FIG. 1b;

FIG. 5 is a fragmentary section taken along the line 5—5 of FIG. 1b showing the rod being displaced from the cradle on the rod-supporting carrier;

FIG. 6 is a section similar to that of FIG. 5 showing the cradle returned to its normal position;

FIG. 7 is a fragmentary longitudinal section partly

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broken away and taken along the line 7—7 of FIG. 1b; and

FIGS. 8a and b are fragmentary sections taken along the line 8—8 of FIG. 1a and showing two positions of a feeding mechanism associated with the rod rack.

The new charging apparatus is positioned in-line with an axial opening 10 at one end of a drum 11 of a rod mill shown in dotted lines in FIG. 1b. The rod mill is rotatably mounted at both ends (one of which is shown) on trunnions 12. Alongside the charging apparatus is a slightly sloping rod rack 14, the end of which appears in FIGS. 3 and 4. A plurality of heavy steel rods 15 are mounted thereon and when each of them rolls to the lower end of the sloping rack it drops a short distance onto the charging apparatus.

Feeding devices 16 and 16' are spaced apart on the lowermost end of the rod rack 14 for successively releasing the rods supported thereby onto the charging apparatus. Both feeding devices are actuated by an axially pivotal shaft 17 spanning the rack 14. As shown most clearly in FIGS. 1a, 3, 8a and 8b, each of the devices 16 and 16' includes a stop element 18 affixed to the shaft 17. Projections 19 and 19' are spaced apart at one end of the element 18. A stationary fulcrum bar 20 extending between these projections is affixed at one end to the rack structure and at the other end to a bracket 21 (FIG. 1a). A finger element 22 is pivotally mounted to the stop element 18. By means of the shaft 17, each of the feeding devices 16 and 16' is adapted to be moved between the two positions shown in FIGS. 8a and 8b. In the first position shown in FIG. 8a, the projection 19 on the stop element 18 extends above the plane of the rack to prevent the endmost rod 15 from rolling off the lower end thereof. When pivoted to the position shown in FIG. 8b, the projection 19 on the stop element 18 lowers to release the endmost rod 15 and allows it to roll off the rack onto the charging apparatus. However, as the endmost rod clears the projection 19, the finger element 22 is turned against the bar 20 to project its outer end above the plane of the rack in time to prevent the next rod from following the one just released. Upon returning to the FIG. 8a position, the projection 19 again holds the endmost rod in place and the finger element 22 drops below the plane of the rack 14.

To actuate the shaft 17, a link 23 (FIG. 3) is pivotally connected to an arm extending rigidly from the shaft 17. At the opposite end of the link 23 is a bell-crank 24 pivotally mounted to one of the standards of the rod rack 14. The lower end of the bell-crank 24 is pivotally connected to one end of a manual actuating arm 25 which extends beneath the rod charger to the operator's side of the apparatus.

When the actuating arm 25 is in the solid-line position shown in FIGS. 3 and 4, the supply of rods 15 on the rack 14 is held in place by the projection 19 on the stop element 18. When the operator moves the actuator 25 to the dotted line position shown in FIG. 3, the projection 19 of the stop element moves downwardly to release the endmost rod 15 and the finger element 22 moves upwardly to hold the next rod. Movement of the actuator arm 25 back to the solid-line position causes the finger element 22 to drop and the projection 19 on the stop element 18 to rise. By these means, the operator can selectively release rods of various diameters one at a time onto the charging apparatus simply by pulling the manual actuating arm 25 out and then pushing it in.

Mounted adjacent the lower end of the rod rack 14 in-line with the opening 10 in the rod mill is a frame 26 supporting a pair of relatively large horizontal channel members 27 and 28. These channel members are spaced apart and are parallel at a level beneath the axis of the rod mill opening 10. Along about the forward half of the upper edge of both channel members 27 and 28 nearest the rod mill are raised overhead running plates 29 and 29' respectively which provide roller tracks on their undersides. Also spaced apart along the entire

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upper edge of the channel members 27 and 28 are a plurality of guide rollers 30 and 30' respectively each of which is mounted about a vertical axis. In the sections of FIGS. 3 and 4, the running plate 29' on the left is partly broken away to make the roller 30' behind it visible. (This is also done on all the running plates hereinafter described to the left of the apparatus center line in these sections.) Between the channel members 27 and 28 are two longitudinal rows of supporting rollers 31 and 32 mounted about horizontal axes.

Driving means are provided for the apparatus by a two-directional electric motor 34 which is also mounted on the frame 26. A primary drive shaft 35 extends from the motor 34 through a cutout portion in the channel member 27, and its outer end is supported by a pair of spaced bearings 36 and 37 between the channel members 27 and 28. A coupling 38 is included in the shaft 35. Between the bearings 36 and 37 is a main drive pinion 40 mounted about the shaft 35. Also disposed between the channel members 27 and 28 is a first driving rack gear 41 affixed to the frame 26 and extending longitudinally within the apparatus slightly above the level of the rollers 31 and 32.

Longitudinally displaceable on the frame 26 is a first carrier made up of two opposed parallel horizontal channel members 42 and 43 and a plurality of interconnecting cross members 44. Along the lower edge of the channel members 42 and 43 are affixed extended flat wear strips 46 and 47 respectively which are in rolling engagement with the rollers 31 and 32 on the frame. Extending side-wardly from both the channel members 42 and 43 of the first carrier are a plurality of rollers 48 and 48' respectively which extend beneath and are in rolling engagement with the respective running plates 29 and 29' and hold the first carrier down when it is extended. Also, the channel members 42 and 43 are in rolling engagement with the lines of guide rollers 30 and 30' respectively to permit the first carrier from moving sideways. (The rollers 48 and 48', and similar rollers hereinafter to be described, do not interfere with the associated rollers 30 and 30'.) By this construction, the first carrier (i.e., the channel members 42 and 43 with their cross members 44) is supported on the various rollers of the frame for longitudinal displacement relative to the axis of the apparatus.

Affixed to the cross member 44 of the first carrier, is a first driven rack gear 50 extending in a longitudinal direction. The rack gear 50 is in engagement with the main drive pinion 40 mounted on the drive shaft 35. Thus, the two-directional drive motor 34 is adapted to advance and retract the first carrier toward and away from the rod mill by rotating the drive pinion 40 against the rack gear 50.

Extending between the parallel channel members 42 and 43 (as shown in FIG. 1a) is a rotatable shaft 52 which supports a pinion 54 in engagement with the stationary first driving rack gear 41. The shaft 52 also carries a sprocket 55 which drives an endless chain 56. The chain 56 runs over another sprocket 58 which is mounted about a shaft 59 rotatably supported in journal bearings 60 and 61. These bearings are affixed to supports 63 and 64 extending between two adjacent pairs of the cross members 44. Also mounted about the shaft 59 is a pinion 65. The first carrier has a longitudinally arranged second driving rack gear 67 affixed thereto and two longitudinal rows of supporting rollers 69 and 70 mounted thereon about horizontal axes. Along the upper edges of both the channel members 42 and 43 are raised overhead running plates 71 and 71' respectively and rows of guide rollers 72 and 72' respectively. Again, the running plates 71 and 71' extend throughout about the forward half of the first carrier nearest the rod mill whereas the rollers 72 and 72' are spaced over its entire length.

Supported on the set of rollers 69, 70 and 72 is a second elongated carrier made up of parallel channel members 73 and 74 interconnected by cross members 75. Extended

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flat wear strips 76 and 77 are disposed along the lower edges of the channel members 73 and 74 respectively in rolling engagement with the rollers 69 and 70 on the first carrier. Sidewardly extending rollers 79 and 79' respectively on both the channel members 73 and 74 are in rolling engagement with the respective running plates 71 and 71'. Both channel members 73 and 74 are also in rolling engagement with the respective guide rollers 72 and 72'. Thus, the second carrier element is longitudinally displaceable with respect to the first carrier element.

As seen in FIGS. 1b and 3, a second driven rack gear 81 extends longitudinally along the second carrier in engagement with the pinion 65 mounted on the first drive shaft 59. Rotation of the pinion 65 is thus adapted to move the second carrier toward or away from the rod mill depending upon the direction taken by the main drive motor 34.

Referring to FIG. 1b, a lateral shaft 83 is rotatably mounted between the channel members 73 and 74 of the second carrier. The shaft 83 has a pinion 84 mounted thereon which is in engagement with the second driving rack gear 67 affixed to the first carrier. Also mounted about the shaft 83 is a sprocket 86 engaging a chain 87 which extends to another sprocket 88 mounted about the shaft 89. The shaft 89 extends between the channel members 73 and 74 and is rotatably supported at its opposite ends in journal bearings 91 and 92. A pinion 93 is also affixed to the shaft 89. Two longitudinal rows of rollers 95 and 96 are mounted on the first carrier. Along the forward half of both channel members 73 and 74 are running plates 98 and 98' respectively which provide tracks on their undersides. Also spaced along the entire length of the channel members 73 and 74 are guide rollers 99 and 99' respectively.

A third or rod-supporting carrier, made up of two opposed channel members 101 and 102 interconnected by a plurality of cross members 103, is supported on the rollers 95 and 96 of the second carrier. A third driven rack gear 104 is affixed longitudinally to the rod-supporting carrier and is in engagement with the pinion 93 on the second carrier. Hence, rotation of the pinion 93 causes longitudinal displacement of the rod-supporting carrier with respect to the second carrier. Sidewardly extending rollers 105 and 105' on the channel members 101 and 102 are in rolling engagement with the running plates 98 and 98' on the second carrier. Also, both channel members 101 and 102 roll against the respective guide rollers 99 and 99' on the second carrier.

As shown in FIGS. 1b and 5 through 7, the rod-supporting carrier is provided with a cradle formed by two cradle members 106 and 107. Since they are identical, their construction will be described with reference only to the cradle member 106. The cradle member 106 is pivotally mounted about a short shaft 109 extending parallel to the axis of the apparatus between supporting plates 110 and 111 affixed to the channel members 101 and 102 of the rod-supporting carrier. In the normal rod-carrying position of the cradle 106 (as shown in FIG. 6), two arms 113 and 114 extend upwardly therefrom to hold one of the rods 15 (appearing in dotted lines) in position on the rod-supporting carrier. When the cradle member 106 is displaced on its pivotal mounting, however, it assumes the position shown in FIG. 5 and the arm 113 rests on the upper edge of the channel member 101. The rod 15 then rolls in the direction of the arrow. A counter weight 115 is attached to the cradle member 106 to exert a turning force thereon normally urging it in a counterclockwise direction as shown in FIGS. 5 and 6. Short lateral rails 116 and 117 extend rigidly from the rod-supporting carrier so that when the rod rolls from the tilted cradle members it is carried over the rails 116 and 117 and falls free of the rod-supporting carrier.

As shown particularly in FIG. 7, means are provided for automatically displacing the cradle members 106 and 107 when the rod-supporting carrier reaches its extended

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position. These include a cam 119 affixed to the second carrier. (The cam 119 appears in solid lines in FIGS. 4 and 7 and in dotted lines in FIG. 5.) Rotatably mounted on the rod-supporting carrier is a trip element 121. The position of the cam 119 on the second carrier and the trip element 121 on the rod-supporting carrier are such that the trip element engages and rides up on the cam 119 when the rod-supporting carrier is in its extended position relative to the second carrier.

As shown in FIG. 7, the trip element 121 rotates on a bracket 122 mounted on a shaft 123 extending substantially the length of the rod-supporting carrier. The shaft 123 is linked to the cradle members 106 and 107 in the same manner at both its ends, thus only its connection with the cradle element 106 need be described. The end of the shaft adjacent the cradle member is supported in journal bearings 125 and 126 in brackets which are mounted on the supporting plates 110 and 111 respectively. Connecting the end of the shaft 123 with the cradle member 106 is a toggle mechanism made up of two cojoined links 128 and 129, the former being keyed to the shaft 123. In the normal position of the cradle member 106 (shown in FIG. 6), the toggle is relatively straight and the links 128 and 129 rest against a stop 131. The rod 15 exerts a turning force on the cradle member 106 at all times tending to rotate it in a clockwise direction as shown in FIG. 6. When the trip element 121 rides up on the cam 119, however, the shaft 123 is rotated (in a counterclockwise direction as shown in FIGS. 5 and 6) and the toggle mechanism passes over its dead-center position. This permits the weight of the rod 15 to carry the links 128 and 129 through to the angular position shown in FIG. 5 and the rod proceeds to roll from the cradle member 106. Therefore, as the rod 15 rolls from the cradle, the trip element 121 is displaced upwardly off the cam 119. However, when the rod 15 carries off the end of the arm 113, the counter weight 115 causes the cradle member 106 to turn back toward its normal position. Full normal position is returned to when the trip element 121 is displaced off of the cam 119.

The operation of this new rod-charging apparatus is as follows: Initially, the first, second and rod-supporting carriers are in their retracted position (as shown by the numerals 131, 132 and 133 respectively in dotted lines in FIG. 2). One is substantially over the other alongside the rod rack 14 and in-line with but spaced considerably from the opening 10 of the rod mill. By manual actuation of the arm 25, one of the rods 15 on the rod rack 14 is freed to roll off onto the cradle members 106 and 107 of the rod-supporting carrier.

The drive motor 34 is then actuated in a direction such that the drive pinion 40 moves the first driven rack gear 50 toward the viewer as shown in FIG. 3. This causes the first carrier element to move on the frame 26 toward the opening 10 in the rod mill. The pinion 54 on the first carrier element thereby rolls along the first driving rack gear 41 on the frame 26. Hence, by means of the shaft 52, sprocket 55, and chain 56, the second driving gear 65 on the first carrier element is rotated. This, in turn, urges the second driven rack gear on the second carrier element toward the viewer as shown in FIG. 3 and causes the second carrier to move relative to the first carrier element toward the mill. This movement between the first and second carrier elements causes the pinion 84 on the second carrier element to roll along the second driving rack gear 67 on the first carrier element. Through the shaft 83, sprocket 86 and chain 88, the pinion 93 on the second carrier element is thereby displaced. Hence, the third driven rack gear 104 on the rod-supporting carrier moves toward the viewer as shown in FIG. 4 and the rod-supporting carrier thereby moves relative to the second carrier toward the mill.

This chain of motion is continued by further activation of the driving motor 34 until the trip element 121 on the rod-supporting carrier reaches the cam 119 on the

second carrier. At that point, the rod-supporting carrier has reached its maximum extended position. Since each of the carriers is displaced relative to the one beneath it, the total longitudinal displacement of the rod-supporting carrier is equal to the sum of the relative displacements of each carrier. This cumulative movement should be sufficient to advance the rod-supporting carrier fully into the drum 11 of the rod mill in its extended position as shown in FIG. 1b.

As noted previously, the cam 119 is positioned on the second carrier and the trip element 121 is positioned on the rod-supporting carrier such that when the rod-supporting carrier is fully extended the trip element engages the cam. Therefore, at this stage of the operation, the trip element 121 has ridden up on the cam 119 as shown in FIG. 7. This causes rotation of the shaft 123 in a counterclockwise direction as shown in FIGS. 5 and 6. Consequently, the link 128 of the toggle mechanism is lifted off of the stop 131 and, when the toggle passes dead-center, the weight of the rod 15 carries the cradle member 106 into the position shown in FIG. 5. The rod 15 in the cradle therefore rolls toward the end of the arm 113, onto the rails 116 and 117, and drops into place within the drum 11 of the mill. As soon as the rod 15 clears the end of the arm 113 of the cradle, the counterweight 115 returns the cradle to its position shown in FIG. 6.

The main drive motor 34 is then activated in the opposite direction and through all of the various pinions, rack gears, sprockets and chains, each of the carriers moves relative to the one beneath it back to its initial retracted position as shown in dotted lines in FIG. 2. If desired, automatically actuated switches may be mounted on the elements of the apparatus to start, stop and reverse the drive motor.

It should be noted that the use of sprocket and chain transmission means between the carriers is not absolutely necessary in all cases. Their function, of course, is to permit each carrier to be displaced an additional distance relative to that beneath it during the operation of the apparatus. (If only racks and pinions are used the total displacement of the rod-supporting carrier is somewhat less than when the sprocket chain drives are employed.) However, if the rod mill is not positioned too far from the charging apparatus and if the drum opening is large enough to perhaps receive both the rod-supporting carrier and the outer end of the carrier therebeneath, then it is not necessary that the chain drives be used to extend the reach of the apparatus.

I claim:

1. Rod mill charging apparatus comprising a frame, an elongated carrier longitudinally displaceable on said frame, driving means for displacing said carrier between retracted and extended positions, a rod-supporting section at one end of said carrier adapted to advance fully into said mill upon displacement of said carrier to its extended position, a pivotal cradle on said rod-supporting section for supporting at least one rod substantially longitudinally thereon, a cam mounted independently of said rod-supporting section, a trip element positioned on said rod-supporting section to engage said cam when said carrier is in its extended position, and a linkage connecting said trip element with said cradle for pivoting said cradle and displacing said rod therefrom when said trip element engages said cam.

2. Rod mill charging apparatus comprising a frame, an elongated first carrier longitudinally displaceable on said frame, driving means for displacing said first carrier between retracted and extended positions, at least one intermediate carrier longitudinally displaceable on said first carrier, a rod-supporting carrier longitudinally displaceable on said intermediate carrier, transmission means between said carriers actuated by said driving means for displacing each of them between retracted and extended positions relative to the others, said rod-supporting car-

rier being adapted to advance fully into said mill upon displacement of said carriers to their extended positions, a pivotally mounted cradle on said rod-supporting carrier for normally supporting a rod longitudinally thereon, a cam affixed to the intermediate carrier supporting said rod-supporting carrier, a trip element positioned on said rod-supporting carrier to engage said cam when said rod-supporting carrier is in its extended position, and a linkage connecting said trip element with said cradle for pivoting said cradle and displacing said rod therefrom when said trip element engages said cam.

3. Rod mill charging apparatus comprising a frame, a first elongated carrier supported on said frame for longitudinal displacement thereon, a first driven rack gear affixed longitudinally to said first carrier, driving means geared to said first driven rack gear for displacing said first carrier between retracted and extended positions, a first driving rack gear affixed longitudinally to said frame, and a first rotatable shaft on said first carrier driven by said first driving rack gear; a second elongated carrier supported on said first carrier for longitudinal displacement thereon, a second driven rack gear affixed longitudinally to said second carrier, first transmission means driven by said first rotatable shaft and driving said second driven rack gear for displacing said second carrier between retracted and extended positions, a second driving rack gear affixed longitudinally to said first carrier, and a second rotatable shaft on said second carrier driven by said second driving rack gear; an elongated rod-supporting carrier supported on said second carrier for longitudinal displacement thereon, a third driven rack gear affixed longitudinally to said rod-supporting carrier, second transmission means driven by said second rotatable shaft and driving said third driven rack gear for displacing said rod-supporting carrier between retracted and extended positions, said rod-supporting carrier being adapted to advance fully into said mill upon displacement of each of said carriers to their extended positions; a pivotal cradle on said rod-supporting carrier for supporting at least one rod substantially longitudinally thereon, and cam means for pivoting said cradle and displacing said rod therefrom when said rod-supporting carrier is fully within said mill.

4. Rod mill charging apparatus comprising a stationary frame, a first set of rollers mounted on said frame, a first elongated carrier supported on said first rollers for longitudinal displacement thereon, a first driven rack gear affixed longitudinally to said first carrier, driving means geared to said first driven rack gear for displacing said first carrier between retracted and extended positions, a first driving rack gear affixed longitudinally to said frame, and a first rotatable shaft on said first carrier driven by said first driving rack gear; a second set of rollers on said first carrier, a second elongated carrier supported on said second rollers for longitudinal displacement thereon, a second driven rack gear affixed longitudinally to said second carrier, first sprocket and chain means driven by said first rotatable shaft and driving said second driven rack gear for displacing said second carrier between retracted and extended positions, a second driving rack gear affixed longitudinally to said first carrier, and a second rotatable shaft on said second carrier driven by said second driving rack gear; a third set of rollers on said second carrier, an elongated rod-supporting carrier supported on said third rollers for longitudinal displacement thereon, a third driven rack gear affixed longitudinally to said rod-supporting carrier, second sprocket and chain means driven by said second rotatable shaft and driving said third driven rack gear for displacing said rod-supporting carrier between retracted and extended positions, said rod-supporting carrier being adapted to advance fully into said mill upon displacement of each of said carriers to their extended positions; a pivotally mounted cradle on said rod-supporting carrier for normally supporting a rod longitudinally thereon, a cam affixed to said second carrier, a trip ele-

ment positioned on said rod-supporting carrier to engage
 said cam when said rod-supporting carrier is in its ex-
 tended position, and a linkage connecting said trip ele-
 ment with said cradle for pivoting said cradle and dis-
 placing said rod therefrom when said trip engages said
 cam. 5

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