Nov. 19, 1935. C. H. MASTELLER 2,021,866

APPARATUS FOR MOVING SOAKING PIT COVERS

Filed Nov. 2, 1934 3 Sheets-Sheet 1

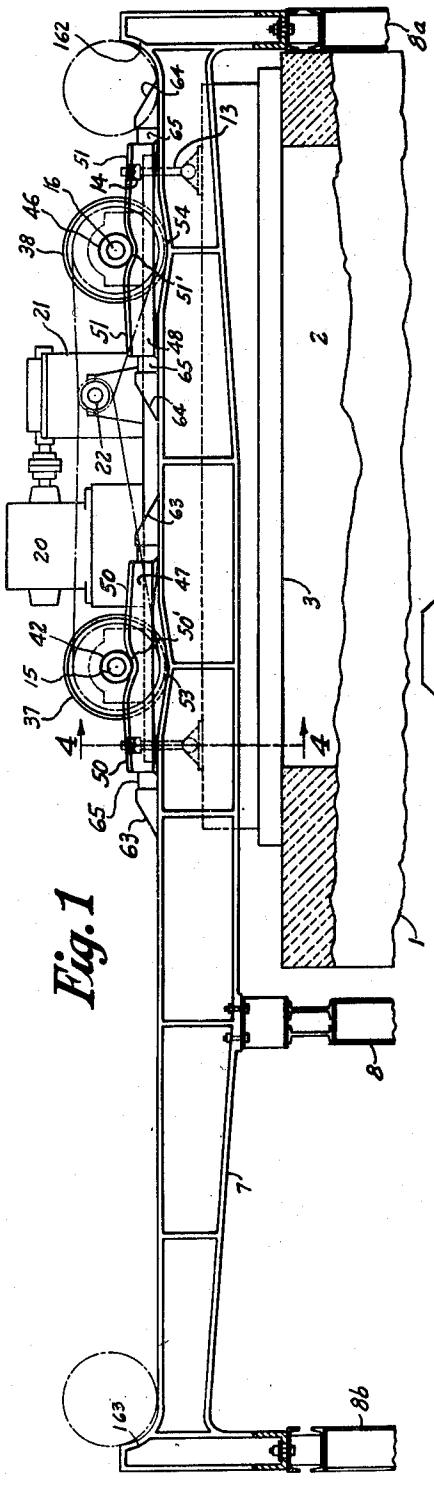


Fig. 1

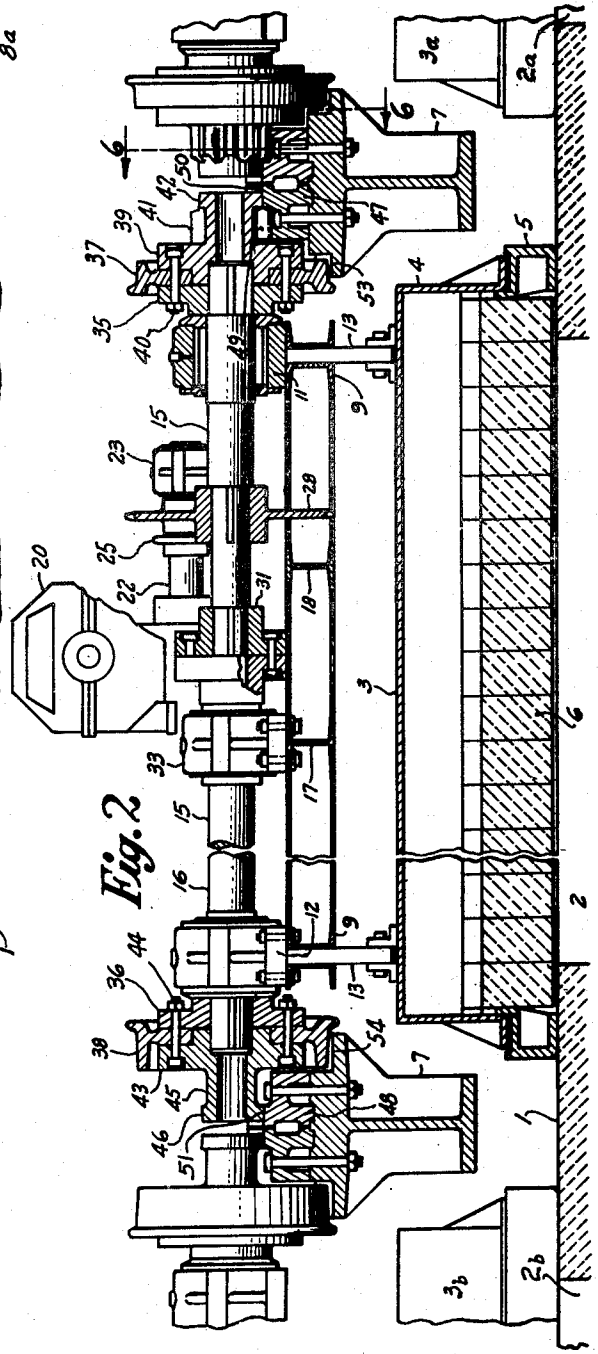


Fig. 2

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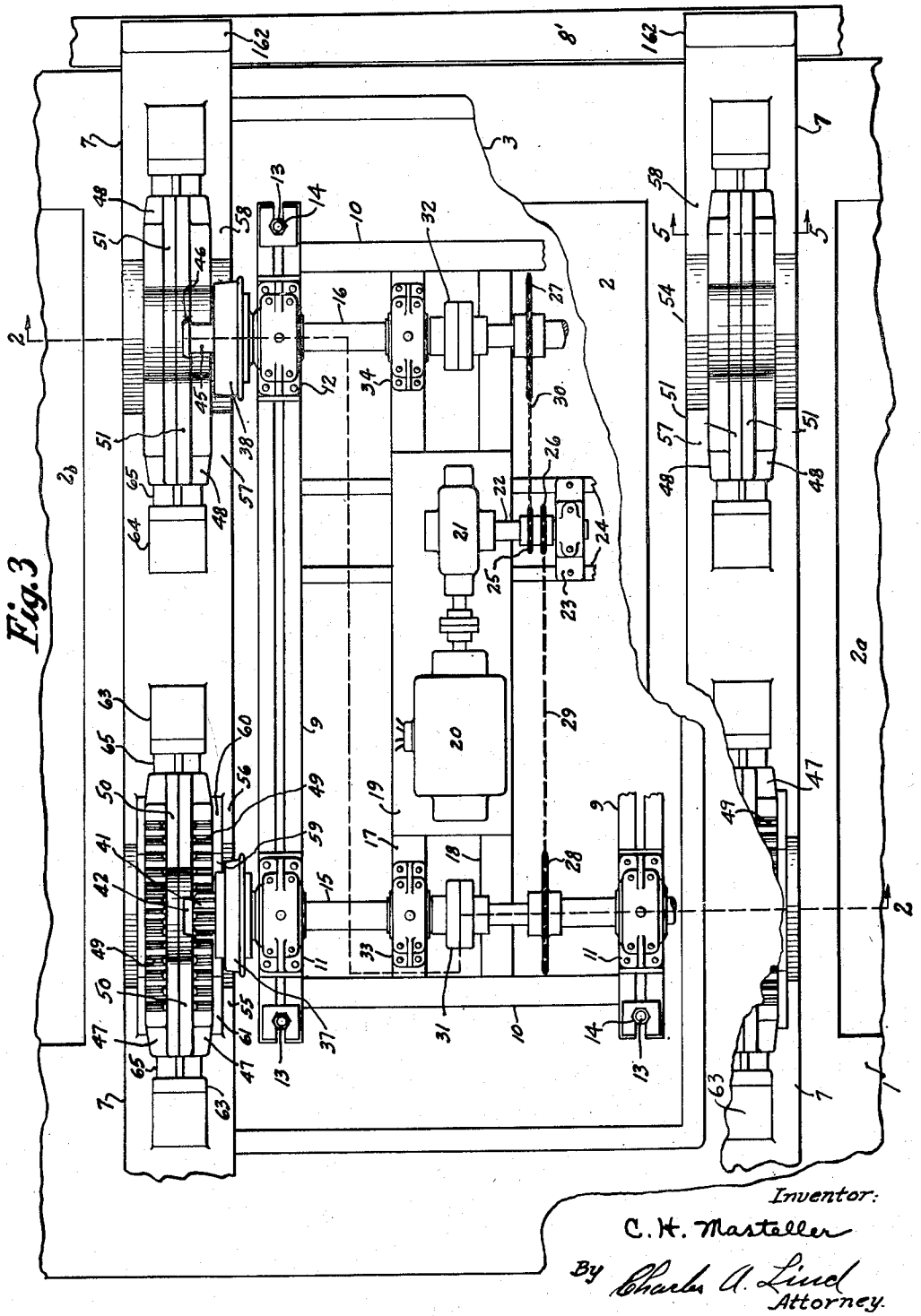


Fig. 3

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Filed Nov. 2, 1934 3 Sheets-Sheet 3

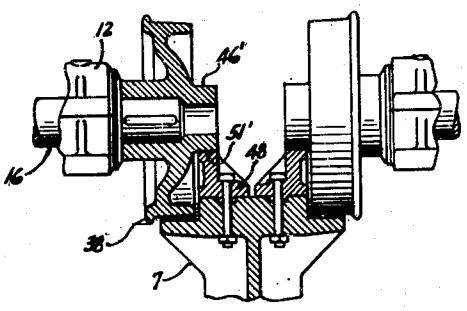


Fig.8

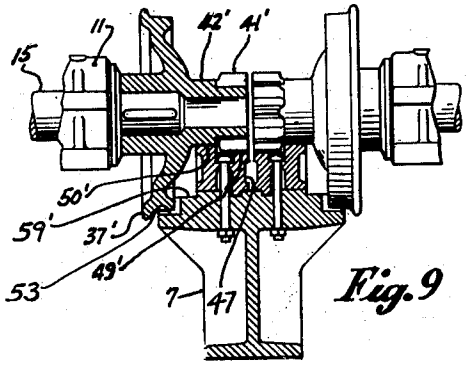


Fig.9

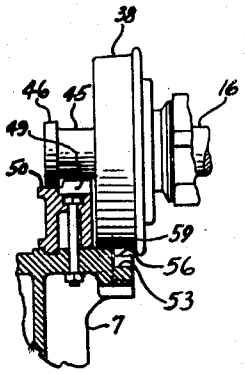


Fig.7

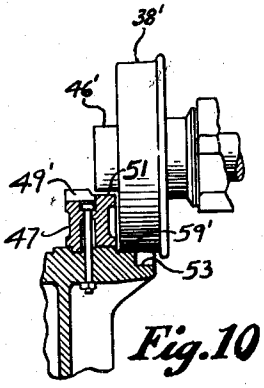


Fig.10

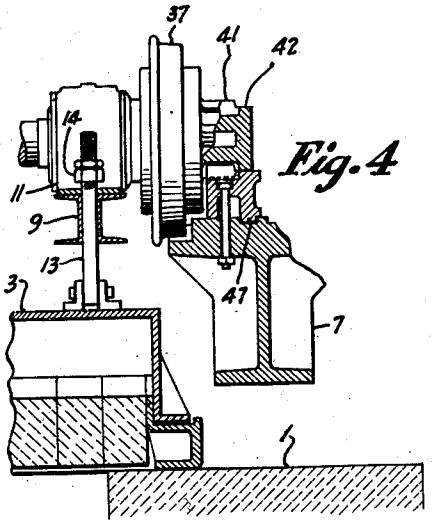


Fig.4

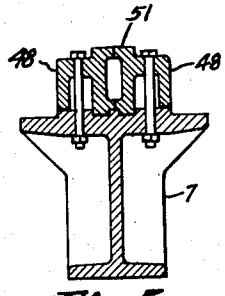


Fig.5

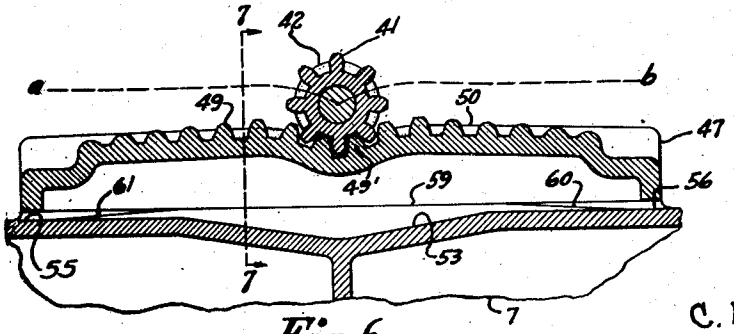


Fig.6

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UNITED STATES PATENT OFFICE

2,021,866

APPARATUS FOR MOVING SOAKING PIT COVERS

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Application November 2, 1934, Serial No. 751,163

6 Claims. (Cl. 268—10)

This invention relates to furnaces of the type used in steel mills for heating ingots. Such furnaces are known as "soaking pits" and are provided with covers for closing the top of the heating chamber or pit.

The invention has for its object to provide a cover moving mechanism which shall permit the cover to be seated on the furnace structure in closing the pit and which shall permit the cover to be elevated from said structure preparatory to moving the cover laterally. The various features of novelty and invention will be more fully explained in the detailed description taken in connection with the accompanying drawings forming part of this specification.

Referring to the drawings wherein the preferred form of the invention is shown.

Fig. 1 shows (in vertical section) a part of the upper portion of a soaking pit with the improved cover operating mechanism (in side elevation) associated therewith;

Fig. 2 is a vertical section on the broken line 2—2 of Fig. 3;

Fig. 3 is a plan view of the apparatus shown in Fig. 1 with some parts omitted to expose otherwise hidden parts;

Fig. 4 is a detail sectional view on line 4—4 of Fig. 1;

Fig. 5 is a detail sectional view on line 5—5 of Fig. 3;

Fig. 6 is a detail sectional view on line 6—6 of Fig. 2;

Fig. 7 illustrates the relationship between certain parts in one position of operation, the part in section corresponding to line 7—7 of Fig. 6;

Figs. 8 and 9 are fragmentary detail views of modified forms of construction, and

Fig. 10 is a view comparable to Fig. 7 except that it is based on the modified form of construction shown in Figs. 8 and 9.

A soaking pit usually embodies in one structure a plurality of heating pits or chambers arranged side by side, each pit having its own cover and operating mechanism therefor. In the present case only so much of a soaking pit is shown as will suffice to illustrate the invention. The top of the masonry structure wherein the pit is formed is indicated at 1. One of the pits is indicated at 2 and adjacent pits at 2a and 2b. The cover for the pit 2 is indicated at 3 and those for the adjacent pits at 3a and 3b. The cover itself may be of any preferred construction but as shown it comprises a main frame 4, a peripheral shoe 5 for seating on the top 1 and refractory brick or tile 6 which is suitably supported by the frame 4.

The cover is swingably coupled to an overhead carriage which runs on two track beams 7 disposed above and between adjacent pits, the beams being shown as wide enough crosswise to provide a track for the carriage associated with the adjacent pit. The cover-operating mechanism for each pit is the same and therefore a description of one will suffice for all. The track beams are supported in any preferred manner as on structural steel pillars 8, 8a and 8b, the beams being preferably non-movably secured to one of the pillars 8 and movably secured to the other pillars 8a and 8b respectively, to allow for longitudinal expansion and contraction of the beams.

The carriage from which the cover is suspended comprises a steel frame made up of structural steel shapes welded together to form a rigid unit, the sides of the frame being indicated at 9 and its ends at 10. At one end of the frame are aligned shaft bearings 11 for a shaft 15 and at the other end are aligned bearings 12 for a shaft 16. Depending from the four corners of the carriage are hanger rods 13, their lower ends being pivotally connected to the top side of the cover. At the upper end of each hanger is an adjusting nut 14, the nuts being ordinarily so adjusted that when the cover is seated to cover the pit, each nut is free and clear of the carriage frame (see Fig. 4) for some little distance to insure that the load of the cover is not then supported by the carriage. As will presently appear, the vertical slack thus provided between the cover and carriage is taken up when the carriage is moved upwardly.

Supported on the carriage, as on beams 17 and 18 and a plate 19, are an electric motor 20 and a speed reducer 21, latter having a stub shaft 22 which is supported at its outer end in a bearing 23 supported on beam 24. Keyed on the shaft 22 are two similar sprockets 25 and 26. The sprocket 25 is connected by a sprocket chain 30 to a sprocket 27 keyed on the shaft 16 and the sprocket 26 is connected by a sprocket chain 29 to a sprocket 28 keyed on the shaft 15. As shown, the shafts 15 and 16 may comprise aligned sections connected by couplings 31 and 32, respectively, and supported intermediate their ends by bearings 33 and 34, respectively.

Keyed on the ends of shaft 15 are coupling members 35; and keyed on the ends of shaft 16 are similar members 36. Bolted to each member 35, as by bolts 40, are a track wheel 37 and a body 39; and bolted to each member 36, as by bolts 44, are a track wheel 38 and a body 43. The wheels 37 and 38 have the same diameter but the wheels 38 have a wider tread than the

wheels 37 for reasons presently appearing Each body 39 comprises a pinion 41 and a small wheel 42 and each body 43 comprises a wrist portion 45 and a small wheel 46. All of the small wheels 42 and 46 have the same diameter and run on tracks as hereinafter described; and they constitute supplemental wheels for taking the load of the carriage at certain times as hereinafter more fully explained.

Mounted on the top of each track beam are two longitudinally spaced bars 47 and 48. These parts are duplicated and are arranged in pairs (Figs. 2 and 3) on the beams that extend between adjacent pits. Each bar 47 comprises a gear rack 49 for coacting with the pinion 41 and a track 50 for coacting with the small wheel 42 associated with the pinion. The bar 48 is like the bar 47 in that it has a track 51 but is unlike it in that it has no gear rack. Both bars have a dip or depression intermediate their ends. The dip in the track 50 is indicated at 50' (Fig. 1) and that in the track 51 at 51'. When the cover 3 is seated to close its pit, the wheels 42 and 46 contact with the bottom of dips 50' and 51', respectively, and the load of the carriage is then supported by said small wheels. When the load of the carriage is thus supported, the flanged wheels 37 and 38 do not rest on any track, the tracks on which they would otherwise rest being provided with depressions or dips 53 and 54, respectively, (Fig. 2) to prevent them from taking the carriage load. Manifestly the tracks might throughout the depressions 53 and 54 be cut away; but such cutting away would be a matter of added and unnecessary expense in fabrication.

Referring to Fig. 3, the track for the wheel 37 at either side of the track dip is indicated at 55 and 56, and the corresponding track for the wheel 38 is indicated at 57 and 58,—all of these tracks being in a common level and being part of the track beams 7.

Referring to Fig. 6, it will be seen that the pinion 41 enters a dip 49' in the gear rack when the small wheel 42 is in its dip in the track 50. As the pinion is turned by the shaft 15, the load of the carriage is eventually transferred from the wheels 42 (and 46) to the wheels 37 (and 38). This transfer of load occurs by reason of the track 50 (and 51) having a down gradient with respect to the level portion of the track on which the wheels 37 (and 38) ride when supporting the load of the carriage (and cover). The line *a*—*b* in Fig. 6 may be taken as showing the path of the pinion in travelling out of its rack dip, it being noted that both the track 50 and rack gradually slope downward from their highest levels. Since the drive shaft 15 (and shaft 16) rotates at a uniform speed it will be readily understood that as soon as the load of the carriage is transferred from the small wheels 42 (and 46) to the large wheels 37 (and 38) there will be a step-up in the rate of movement of the carriage. This is a desirable arrangement since it permits the slack between the carriage and the pit cover to be taken up slowly and with minimum shock; and conversely the cover may be seated to on the pit with minimum shock.

When the cover is to be moved to fully expose its heating pit, it is moved towards the left as viewed in Figs. 1 and 3, the limit of movement of the carriage being the abutments 163 at one end of the beams 7. However, it is sometimes desirable to move the cover a limited distance toward the right as viewed in Figs. 1 and 3 to partially open the pit as for inspection of the ingots therein. The present invention permits such right-hand movement, the limit of movement being the abutments 162 at one end of the beams 7.

In order to fully expose the heating pit, the rear wheels 38 of the carriage must of necessity travel beyond the rack-and-track bars 47. Provision is therefore made to permit the wrist portion 45 associated with the rear wheels 38 to clear the racks 49 and to prevent said wheels from riding into the depressions 53 (see Fig. 6) between the tracks 55 and 56. In accordance with the form of the invention shown in Figs. 2 and 3, this is accomplished by making the rear wheels 38 of wider tread than the front wheels 37 and by providing an elevated track 59 between the dip 53 and the rack 49 (see Fig. 7). The wheel 38 on approaching the rack 49 travels up a ramp 60 leading to the track 59 and then down a ramp 61 at the other end of said track, it being understood that the track 59 is of sufficient height to permit the wrist portion 45 to clear the rack 49.

Another arrangement for preventing the rear wheels 38 from entering the dips 53 alongside of the rack bars is shown in Figs. 8, 9 and 10. In accordance with this construction, the pinion 41' of each front wheel 37' is at the outer end of the small wheel 42' (the reverse of the arrangement of Figs. 1–7); the rack 49' and track 50' on the bar 47 being correspondingly arranged. The track on which the rear wheel rides in order to avoid entering the dip 53 is indicated at 59' and this track is in the same level as the adjacent tracks 55 and 56 (see Fig. 3). When the pinion arangement is as in Fig. 9, the rear wheel arrangement is as in Fig. 8, that is to say, there is no part corresponding to the wrist portion 45 (see Fig. 7), the small wheel associated with the wheel 38' being next adjacent to the hub of the wheel as indicated at 46', and the track 51' of the bar 48 being correspondingly positioned. Fig. 10 shows the relative position of the parts when the rear wheel 38' passes the track-and-rack bar 47 when the track and rack are arranged as shown in Fig. 9.

As shown in Figs. 1 and 3, the rack bars 47 are shown as located between upstanding abutments 63 and the track bars 48 as between similar abutments 64, these abutments being integral with the track beams 7. Relative longitudinal adjustment of the bars is obtained by spacer blocks 65.

The mode of operation may be briefly restated as follows:

Assuming that the parts are initially in the position shown in Figs. 1 and 3, that is, with the cover in place over the pit. To raise the cover and move it toward the left, the motor 20 is energized with the result that power is applied to the two drive shafts 15 and 16. The pinions 41 being secured to the shaft 15 travel up out of the rack dip, the load of the carriage being meanwhile supported by the supplemental wheels 42 and 46. During the upward movement of the carriage, the slack with hanger bolts 13 is taken up, the cover is raised from the pit, and the load of the cover taken by the carriage. By this time the carriage will have travelled sufficiently far for the wheels 37 and 38 to come into play to take the load of the carriage and cover instead of the supplemental wheels 42 and 46; and each pinion will be sufficiently clear of its rack to permit a step-up in the speed of carriage travel due to the difference in diameter between the wheels 37 and 38 and the smaller wheels 42 and 46. In

the case of the construction shown in Figs. 2 and 3, the rear wheels 38 pass the rack bars 47 and the dips 53 by riding on elevated tracks 59 which by-pass the said dips; whereas, in the case of the construction shown in Fig. 9, they pass the same by riding on tracks 59' in the same level as the tracks on which the wheels normally ride, it being remembered that the rear wheels have a wider tread than the front wheels thus permitting them to ride on the special tracks which by-pass the dips 53. While it is preferred that the hanger rods 13 be so adjusted as to length as entirely to relieve the carriage of the load of the cover when the latter is in position to cover the pit, nevertheless the adjustment may be such that the load of the cover is at all times taken by the carriage.

What I claim as new and desire to secure by Letters Patent is:

1. In apparatus for moving a pit cover, the combination of a carriage from which the cover is suspended, the carriage having two front and two rear main wheels, each of said wheels including a supplemental wheel coaxial with and of less diameter than itself and each of said front wheels also including a pinion coaxial with and of a diameter less than itself, a dipped gear rack for each of the pinions, a dipped track for each of the supplemental wheels, a dipped track for each of said main wheels, said supplemental wheels when in their respective track dips serving to support the carriage at a level which is lower than that in which the carriage is normally supported by the main wheels thereof.

2. In apparatus for moving a pit cover, the combination of a carriage equipped with two sets of wheels, two sets of tracks, the two sets of wheels and the two sets of tracks adapted to cooperate set with set in carriage travel, the tracks of one set being longer than those of the other and being interrupted in continuity, and the tracks of the other set being arranged adjacent the interruptions in the continuity of the longer tracks, whereby in the range of carriage travel the carriage may alternately at intervals rest upon and be borne by one set of tracks and the other, the shorter set of tracks being dipped at points intermediate their extent and adapted to bring the carriage to a lower level than when resting on the longer rails, and means for impelling the carriage along the rails.

3. In apparatus for moving a pit cover, the combination, with the cover, of a carriage equipped with suspension means adapted to engage the pit cover, such suspension means permitting relative vertical movement within limited range between carriage and cover, the carriage being equipped with a set of wheels, a set of stationary tracks arranged to cooperate with said wheels, the tracks being interrupted in continuity, means arranged adjacent the interruption in the continuity of the tracks and adapted to sustain the carriage and to move it both longitudinally and vertically, such means including a stationary inclined rack, a pinion of less diameter than the wheels of the carriage mounted coaxially and integrally with one of said wheels, and means for powerfully rotating such integrated wheel and pinion, whereby in response to such rotation the cover may be raised and lowered during relatively slow progress of the carriage and sustained in fully raised position during relatively fast progress of the carriage.

4. In apparatus for moving a pit cover, the combination, with the cover, of a carriage equipped with suspension means adapted to engage the pit cover, such suspension means permitting relative vertical movement within limited range between carriage and cover, the carriage being equipped with two sets of coaxially arranged wheels integrated set to set for simultaneous rotation from a single source, the wheels of one set being of greater diameter than those of the other, two sets of stationary tracks arranged to cooperate severally with the two sets of wheels, the tracks of the set that is arranged to cooperate with the wheels of greater diameter being longer than those of the other set and being interrupted in continuity, and the tracks of the other set being arranged adjacent the interruptions in the continuity of the longer tracks and being inclined, and by such inclination adapted to bring the carriage to a lower level than when resting on the longer tracks, a pinion coaxially arranged with and integrated with the wheels of the two sets integrated as aforesaid, an inclined rack with which said pinion is in mesh, and means for powerfully rotating the integrated wheels and pinion, whereby in response to such rotation the cover may be raised from and lowered to a pit mouth during relatively slow progress of the carriage and sustained in fully raised position during relatively fast progress of the carriage.

5. In apparatus for moving a pit cover, the combination of a horizontally movable wheeled carriage from which the cover is suspended and a track on which the carriage runs, means for lowering the carriage with respect to said track comprising supplemental carriage wheels of lesser diameter than the main wheels thereof for taking the load of the carriage in the lower level, a track having a dip wherein the supplemental wheels rest for supporting the carriage at the lower level, the track for the large diameter wheels having a depression alongside of the track for the small diameter wheels, the front large-diameter wheels having a narrower tread than the rear large-diameter wheels, and a track alongside of said depression on which the wide-tread wheels may ride to avoid entering said depression.

6. In apparatus for moving a pit cover, the combination of a carriage from which the cover is suspended, the carriage having two front and two rear main wheels, each of said wheels including a supplemental wheel co-axial with and of less diameter than itself and each of said front wheels also including a pinion co-axial with and of less diameter than itself, a dipped gear rack for each of the pinions, a dipped track for each of the supplemental wheels, a dipped track for each of said main wheels, said supplemental wheels when in their respective track dips serving to support the carriage at a level which is lower than that in which the carriage is normally supported by the main wheels thereof, the main wheels extending into the dips in their respective tracks when the carriage is suspended by the supplemental wheels as said, the rear wheels having a wider tread than the front wheels, and a track on which the rear wheels may ride to pass the dip in the track for the front wheels.

CARL H. MASTELLER.