No. 702,731. Patented June 17, 1902.

F. K. HOOVER & A. J. MASON.

ORE POCKET.

(Application filed June 19, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

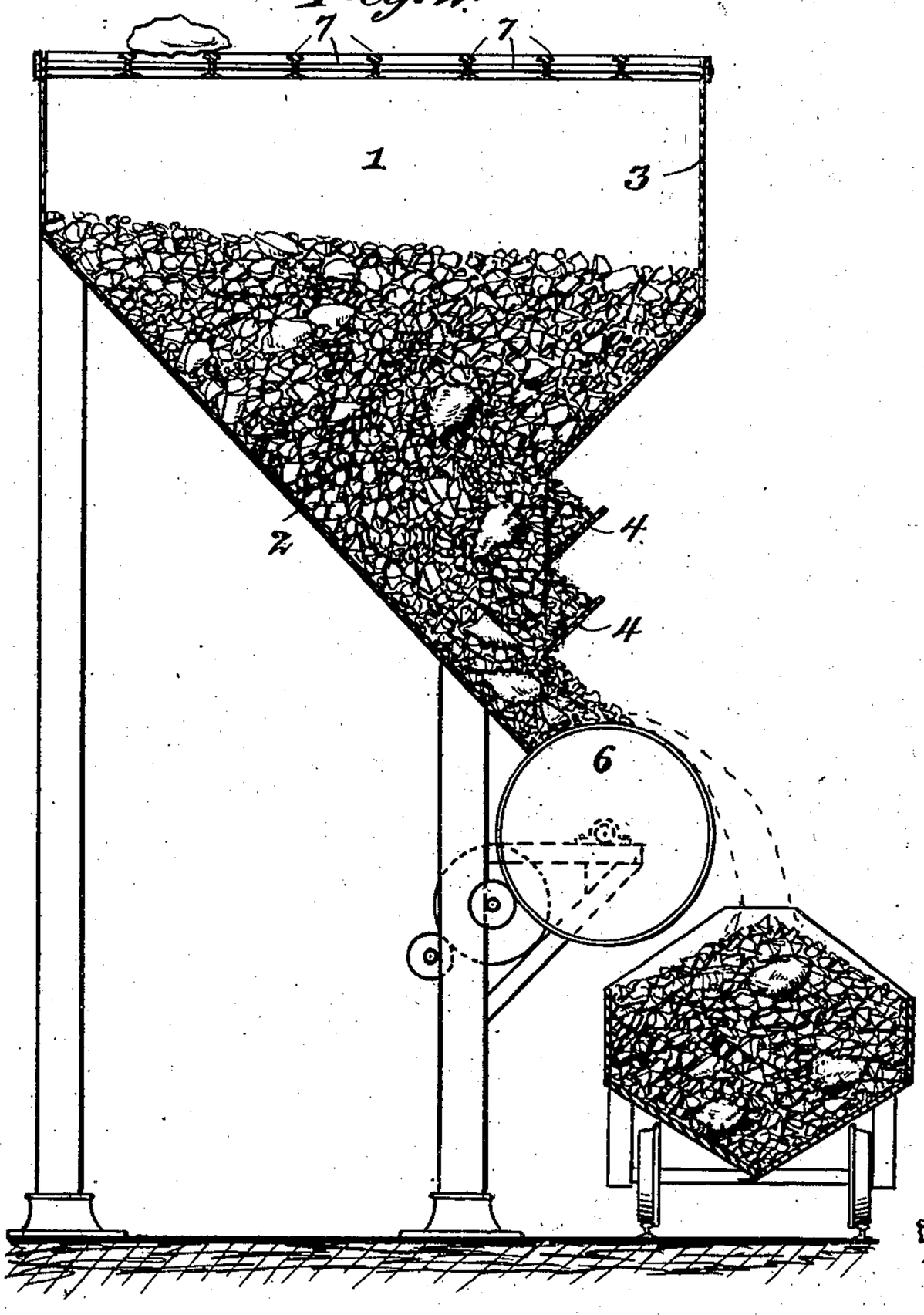
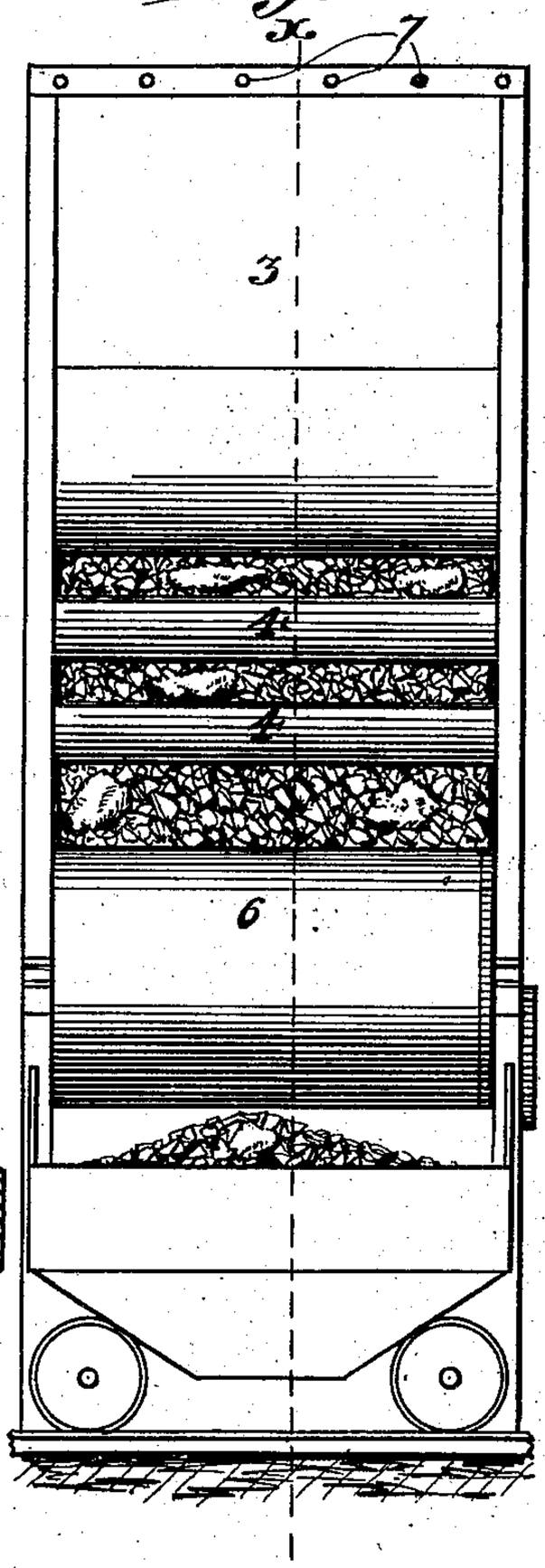


Fig. 1.



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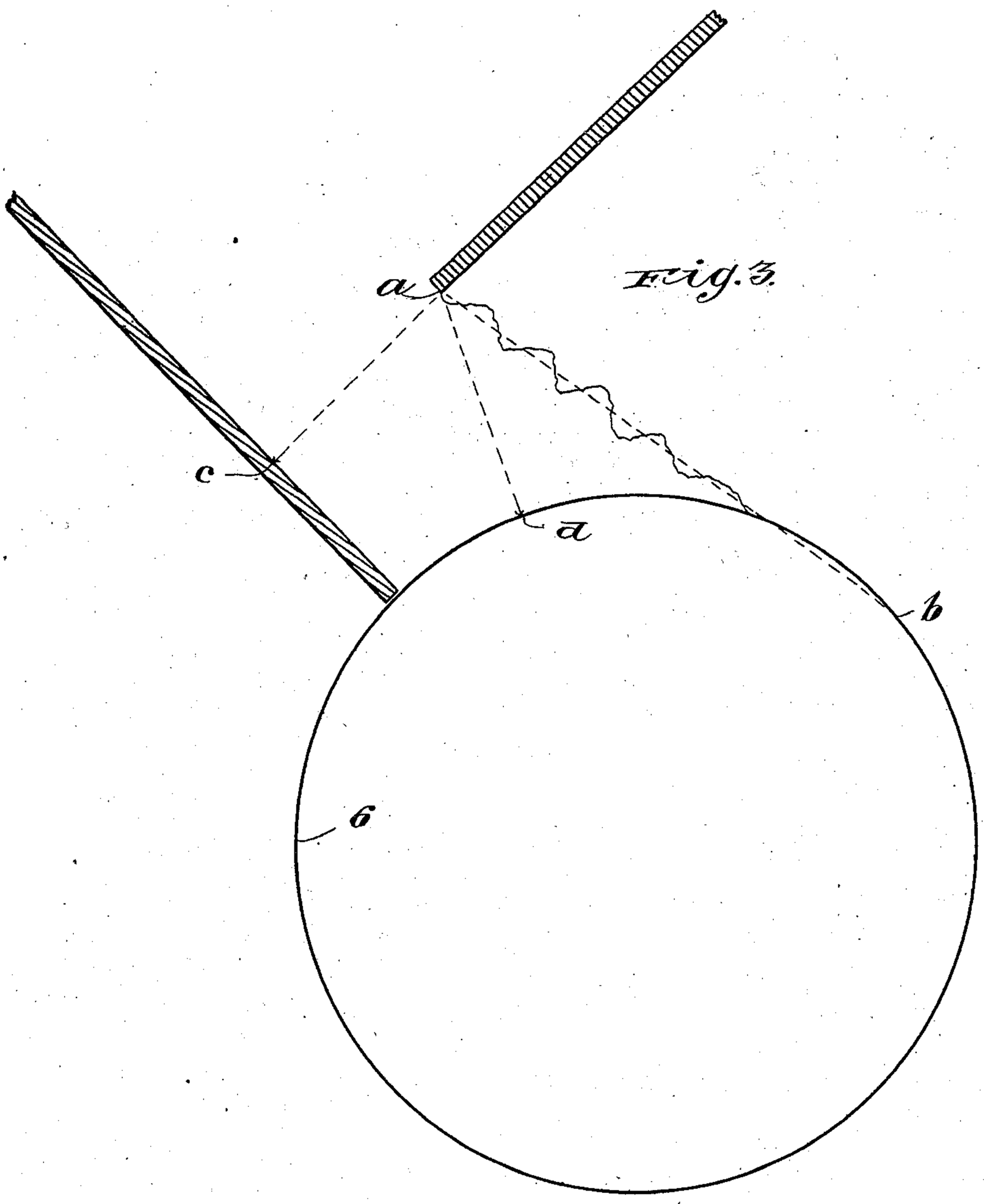

Fig. 3.

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UNITED STATES PATENT OFFICE.

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ORE-POCKET.

SPECIFICATION forming part of Letters Patent No. 702,731, dated June 17, 1902.

Application filed June 19, 1901. Serial No. 65,111. (No model.)

To all whom it may concern:

Be it known that we, FRANK K. HOOVER, of Kansas City, county of Jackson, and State of Missouri, and ARTHUR JOHN MASON, of Chicago, county of Cook, and State of Illinois, citizens of the United States, have invented certain new and useful Improvements in Ore-Pockets, of which the following is a specification.

Our invention relates to improvements in ore-pockets, having regard more particularly to those large pockets or hoppers in which a stock of ore is stored to be withdrawn from time to time in such quantity as occasion may require. These pockets as ordinarily constructed are of large dimensions, having sometimes a capacity of one hundred tons of ore in a coarsely-broken condition, and a serious objection which has hitherto been met with in the practical operation and use of these pockets resides in the difficulty of withdrawing the ore from the lower contracted discharge-opening of the pocket freely and in the desired quantities. This difficulty has arisen primarily through a strong tendency of the ore to choke and refuse to run from the discharge-opening of the pocket in consequence of a tendency of the ore to form an arch over the opening. This arching of the ore is due primarily to the slanting sides of the pocket, which present a resistance which, in conjunction with the great weight of the mass of ore above, causes the ore to pack closely in the form of an arch over the opening, such packing being frequently aggravated by the more or less pasty and sticky condition of some classes of ore, and while the material below the arch is discharged freely the bulk of the material above the arch is supported by the latter, and thereby prevented from being discharged from the pocket. In such case in order to secure a discharge of the ore the arch must be broken through by thrusting a crowbar or similar instrument down through the body of the ore or up through the discharge-opening, either of which is an exceedingly inconvenient operation, involving both delay and danger to the operator. The discharge-openings of such pockets are now closed and the discharge controlled by doors, and where such doors are made of such size as to be manageable the openings are limited in dimensions and the liability to choke and clog is great. In order to overcome these objections, we have recognized the necessity of providing a more reliable and effective means than gravity alone for effecting the discharge of the ore, and to this end in carrying out our invention we provide a hopper or ore-pocket with a positively-acting discharging means consisting of a laterally-movable wall arranged in and across the usual discharge-opening, so that the weight of the material contained in the hopper rests upon said movable discharging-wall. In the preferred embodiment of our invention and as shown in the accompanying drawings this movable wall is constituted by the peripheral surface of a roller or cylinder horizontally journaled beneath and across the bottom opening of the hopper, said surface of the cylinder slidingly engaging the lower edge of the rear wall of the hopper and providing between itself and the lower edge of the front wall of the hopper an unobstructed discharge-opening through which the contained material is withdrawn and discharged substantially laterally of the hopper by the combined action of gravity and the friction between the surface of the cylinder and its superincumbent load of material. By reason of this construction and arrangement the material in the base or throat of the hopper is more or less agitated and stirred, and a stratum thereof lying directly upon the moving wall is positively withdrawn by the latter and discharged, its place being continuously taken by more material feeding down thereupon in rear of the discharging material. The location of this cylinder relatively to the discharge-opening of the hopper is such that when the cylinder is at rest the line marking the underlying angle of repose of the material falls just within the cylinder, and the escape of material by gravity is thus checked, while the size of the discharge-opening itself bears a substantially constant relation to the diameter of the discharging-roller. Experience and practical tests have also demonstrated that successful results in an apparatus of this character require a discharge-opening for the hopper of a special formation in

certain respects, chief of which is a substantial equality in the cross-sectional area of the discharge-openings lying between the bottom edge of the front wall of the hopper and the nearest points on the rear wall of the hopper and the periphery of the roller, respectively.

As auxiliary to the above-described means for facilitating the discharge of ore we preferably construct the pocket on its exit side in louver form, which latter, by presenting a broken surface for the passage of the ore, more or less agitates and breaks up the latter, and also by removing the skewback support of any incipient arch that might otherwise tend to form, facilitates the free passage of the ore through the pocket. The bars of the louver are of course set at such an angle as will produce the effects above mentioned without, however, permitting the ore to be crowded or spilled through the louver itself.

Our invention is illustrated in the accompanying drawings, in which—

Figure 1 represents a front elevation of an ore-pocket embodying our invention. Fig. 2 is a cross-section thereof on the line $x\,x$ of Fig. 1; and Fig. 3 is an enlarged sectional detail, broken away, of the roller and the lower portion of the hopper and illustrating clearly the location of the roller relatively to the discharge-opening of the hopper, and also the relation of the two cross-sectional areas lying between the bottom edge of the front wall of the hopper and the nearest points of the rear wall of the hopper and the periphery of the roller, respectively.

1 represents an ore-pocket constructed in accordance with our invention. Said pocket is constructed on its exit side 3, constituting its front wall, in louver form, as shown, by the employment of one or more bars or leaves 4, which serve to prevent the escape of ore from the pocket at the same time that they break up the disposition of the material to arch and choke over the discharge-opening by removing the skewback support on one side of any incipient arch that may form in the downward passage of the material through the hopper, the end portion of any incipient arch being crowded up into space between the bars 4, and the arch being thereby broken. With this louver form on the exit side of the pocket the opposite side 2, forming the rear wall, is set at an angle somewhat steeper than the natural angle of repose of the material, being in practice set at substantially an angle of forty-five degrees and otherwise so positioned with respect to the roller that the line thereof extended passes through the center or axis of the roller.

To effect the discharge of material from the pocket, as well as to retain the material therein when its discharge is not desired, we employ a roller or cylinder 6, suitably mounted, extending across and adapted to revolve under the discharge-opening. This cylinder or roller forms, in effect, a moving part or wall of the hopper, being located in the base thereof and, in combination with the slanting front and rear walls of the hopper, supporting the weight of the contents. This cylinder 6 has its peripheral surface in sliding contact with the rear wall of the hopper, while a certain space is left between the upper surface of the cylinder and the under edge of the lowermost louver-bar 4, this latter space constituting the discharge-orifice of the hopper. Moreover, the cylinder 6 is preferably so placed with relation to the discharge-opening that a line drawn from the point from which the material starts to drop from the roller to the lower edge of the bottom leaf of the louver or front edge of the hopper will be slightly nearer horizontal than the natural angle of repose of the material to be handled, as more clearly illustrated by the dotted line $a\,b$ in Fig. 3. The purpose of this construction will appear later in the description of the operation. This arrangement of the roller also permits making the end walls of the pocket parallel, and thus eliminates the tendency of the ore to arch and clog in a direction parallel to the axis of the roller. Any usual and convenient means may be employed to operate the roller.

We have found in practice that the best results in handling the class of material for which our present invention is more especially designed are obtained by providing a discharge-opening, the distance of which from the nearest point on the periphery of the discharging-roller bears a substantially constant ratio to the diameter of the roller itself, and this ratio we have determined by numerous tests should be about as one to three. It will also be observed by an inspection of Fig. 3, which best illustrates this detail of construction, that the material in escaping from the hopper is required to pass through two discharge-openings of minimum cross-sectional area, one of these openings lying between the bottom edge of the front wall of the hopper (indicated at a) and the nearest point (indicated at c) on the opposite rear wall of the hopper and the other lying between the aforesaid bottom edge of the front wall of the hopper and the nearest point (indicated at d) on the periphery of the underlying roller 6. It will be obvious that the opening whose transverse dimension is marked by the line $a\,d$ should be at least as large as the opening whose transverse dimension is indicated by the line $a\,c$. Were it otherwise, individual pieces of ore that might pass through the opening $a\,c$ might be unable to pass between the bottom edge of the front wall and the periphery of the roller through the opening whose transverse dimension is marked by the line $a\,d$. For the free and proper discharge of the material, therefore, we propose to make the transverse dimensions of the openings referred to of such relative sizes that the roller will have no difficulty in discharging any pieces or lumps that are capable of passing through the opening between the bottom edge

of the front wall and the proximate point on the rear wall of the hopper, and this result we find is best secured by making the transverse dimensions of said openings between the points *a c* and *a d*, as already described, equal or as nearly so as can be attained in the practical construction of an actual working apparatus. This insures the free delivery by the roller of any lumps capable of passing between the front and rear walls of the hopper and at the same time secures a substantially even and uniform travel of the body or stream of the material as a whole between the two portions or sections of the discharge-throat, as already indicated.

When a heavy load of material is to be dropped into the hopper, the impact thereof condenses and packs the material already therein. To minimize and relieve from the effect of such impact, bars 7 are provided across the receiving-mouth of the hopper, which take the brunt of the blow and break up and distribute the fall of the load, at the same time acting as a screen to prevent the entrance into the hopper of pieces of ore too large to pass through. These bars, which are spaced apart a distance equal to or slightly less than the minimum transverse dimension of the discharge-throat, serve to prevent the sudden ingress of the mass and cause the material to be delivered into the hopper gradually or slowly, and they also serve to support or retain the masses while being broken up or until they are removed.

The operation of our improved apparatus will be readily understood from the foregoing description of its construction and purpose, but may be briefly described as follows: The hopper being filled or partially filled with ore, and it being desired to withdraw a quantity of ore therefrom, all that is necessary to effect such withdrawal of ore is to cause the roller 6 to rotate with its upper surface moving continuously from the rear to the front of the hopper. By reason of the great weight of the material resting upon the surface of the roller and of the rough and irregular character of its component particles the rotation of the roller therebeneath produces a greater or less agitation or churning of the material, the latter extending for a considerable distance up into the body of the ore, and thereby in a measure preventing the tendency of the latter to clog and arch. The principal function of the roller, however, is that of a combined extractor and conveyer to positively withdraw a stratum of ore lying upon its upper surface and discharge the same over its side into a suitable car or other receptacle.

We have demonstrated by practical experiment that by so positioning the roller with relation to the discharge-orifice of the pocket as that a straight line from the top of the discharge-orifice (marked by the lower edge of the exit side) to that point on the periphery of the roller at which the material falls from the latter shall be nearer the horizontal than a line marking the angle of repose of the material all tendency or disposition of the material to discharge by gravity when the roller is not in operation is obviated. For the purpose of this roller the louvered side of the pocket is not essential; but we prefer to employ the louver feature in combination with the roller, since the latter complements the agitating or churning action of the roller by breaking up the adjacent side of the body of the ore and withdrawing the lateral support of any incipient arch that may tend to form. Moreover, the louver form of the side of the hopper permits ready access with a crowbar or similar tool to the material in the throat of the hopper to destroy any clogging effect that might possibly arise, whether the discharging-roller be employed or not.

In our device the roller may be said to have in all four functions, the first being to agitate and churn the material in the throat of the hopper, the second being to positively extract or withdraw a stratum of the material from the hopper through frictional engagement therewith, the third (which is an extension of the second) being to convey the material thus withdrawn to a suitable receptacle, and the fourth being to close the discharge-mouth of the hopper against the discharge of material therefrom when the roller is not in action, thereby dispensing with the necessity of employing doors, &c.

While the arrangement and proportion of the parts may vary, it is essential that the transverse diameter of the pocket taken in any plane above the louver-opening must be such in relation to the coarseness or fineness of the particular material that the material will not arch above such opening, and the louver must be so arranged with relation to the opposite side wall, the roller, and the discharge-outlet as to tend to break up or prevent the formation of an arch between the upper edges of the louver and the discharge-outlet. The louver prevents arching, because it removes support or skewback for the base of the arch, allows the material to expand into the louver-opening, and disturbs the balance of forces tending to arch formation by presenting a broken surface to one side of the mass of moving material, thus reducing friction or resistance upon that side, and thereby tending to cause the material to feed faster on the louver side.

Our invention is designed, primarily, for use in that class of pockets or hoppers through which large masses of material of a fragmentary or granular nature having particles of irregular size and shape and which contain more or less moisture and frequently such a percentage of moisture as renders the mass pasty or sticky are intended to be delivered. In handling material of this character the tendency to clog and arch over the opening is much more pronounced than where the particles are of uniform size and free or comparatively free from moisture. There are

many kinds and classes of material other than ore the handling of which involves the difficulties presented in the handling of ore, and it is to the handling of these more difficult materials that our invention is particularly addressed, although it is not limited in any sense specifically to the handling of ore. In the ores which are delivered through the pockets of our invention there are frequently found masses weighing several hundred pounds, and these are intermingled with particles of smaller size and with granular and finer material in powdered and sometimes pasty condition.

We claim as our invention—

1. An ore pocket or hopper having converging front and rear walls, in combination with a roller journaled below the same and forming a movable bottom wall for the discharge-outlet, the rear wall of the hopper extending substantially into contact with the periphery of the roller, and the front wall terminating above the roller below the line marking the natural angle of repose of the material operated upon and at a distance from the nearest point on the periphery of the roller which is substantially equal to the distance between such lower termination of the front wall and the nearest point on the opposite rear wall, substantially as described.

2. An ore pocket or hopper having front and rear walls converging to a discharge-outlet, in combination with a roller journaled below the same and forming a movable bottom wall for the hopper, the rear wall of the hopper extending substantially into contact with the periphery of the roller and the front wall terminating above the roller and at a minimum distance from the periphery thereof which is approximately equal to one-third the diameter of the roller, and which is also substantially equal to the transverse dimension of the opening between such lower termination of the front wall and the nearest point on the opposite rear wall, substantially as described.

3. An ore pocket or hopper having front and rear walls converging to a discharge-outlet, in combination with a roller forming a bottom wall for said hopper, the rear wall of the hopper extending substantially into contact with the upper face of the roller, and the front wall terminating at a distance above the roller such as to provide discharge-openings of substantially equal cross-sectional area between the bottom of the front wall and the nearest points on the rear wall and roller, respectively, substantially as described.

4. An ore pocket or hopper having converging front and rear walls and a lateral discharge, one of said walls being provided above the discharge-outlet with a louver, said louver being located at such point in the wall above the discharge-outlet as to prevent the arching of the material within the hopper, substantially as described.

5. An ore pocket or hopper having a discharge-outlet at its bottom and a louver opening in one of its walls above the discharge-outlet and a movable wall forming a bottom wall for the discharge-outlet, adapted when at rest to retain the material within the hopper and when in motion to withdraw the material from the hopper and to discharge it laterally through said outlet, substantially as described.

6. An ore pocket or hopper having a discharge-outlet at its bottom and a louver opening extending across the discharge side above said opening and a roller located in and forming the bottom wall of the outlet and upon which the material rests and adapted when moved to withdraw the material from the hopper and discharge it laterally through said outlet, substantially as described.

7. An ore pocket or hopper having formed at its lower contracted end a discharge-outlet and means for effecting the discharge of material therethrough, in combination with a series of bars disposed over the mouth of the hopper and serving to break the impact of material delivered to the hopper, to prevent the admission thereto of any masses of material too large to pass through the discharge-outlet and to retain the same thereon until broken up or removed, substantially as described.

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