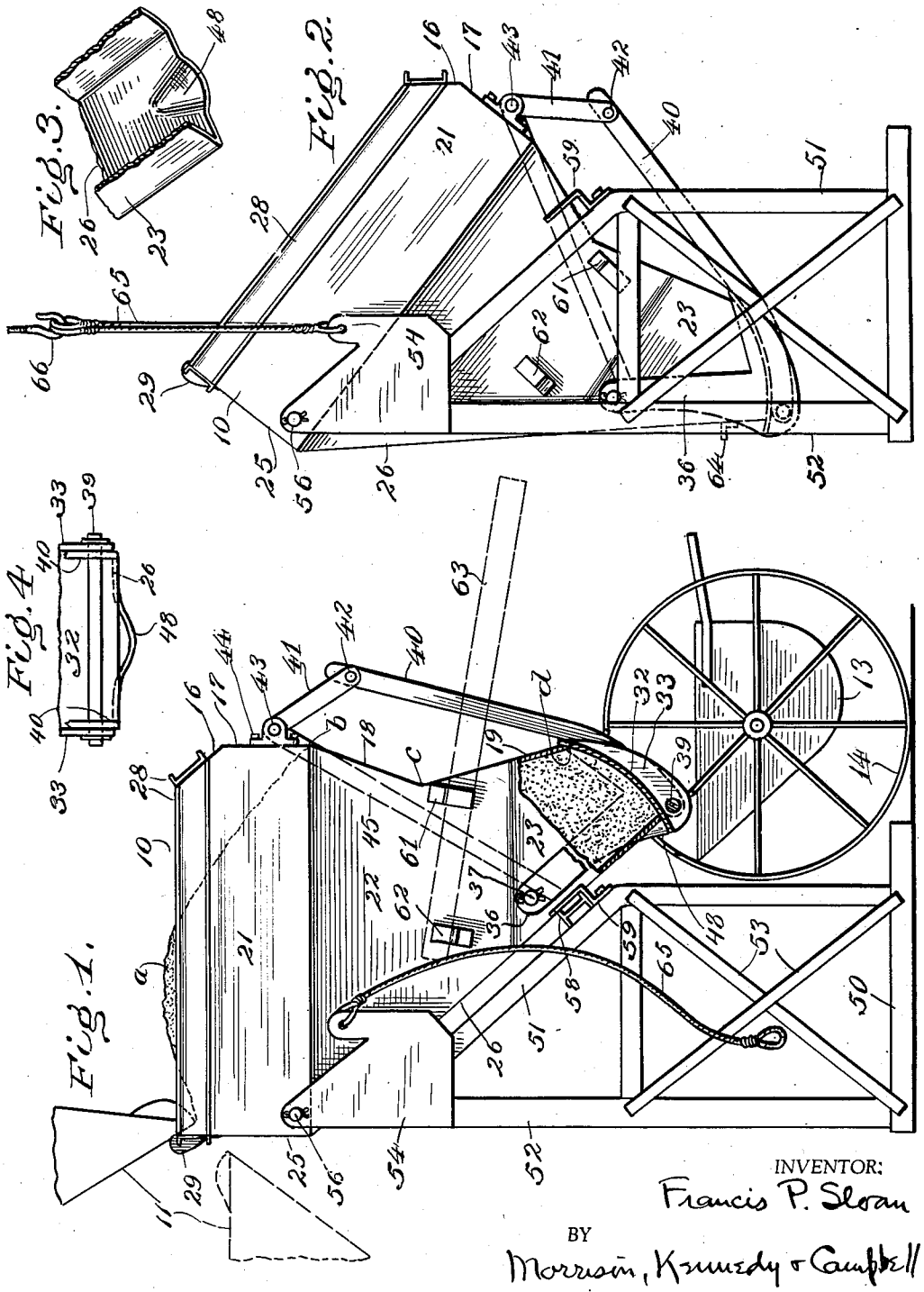
June 14, 1938. F. P. SLOAN 2,120,269

HOPPER

Filed Sept. 11, 1935 2 Sheets-Sheet 1



INVENTOR:
Francis P. Sloan

BY
Morrison, Kennedy & Campbell
ATTORNEYS.

June 14, 1938. F. P. SLOAN 2,120,269

HOPPER

Filed Sept. 11, 1935 2 Sheets-Sheet 2

Fig 5.

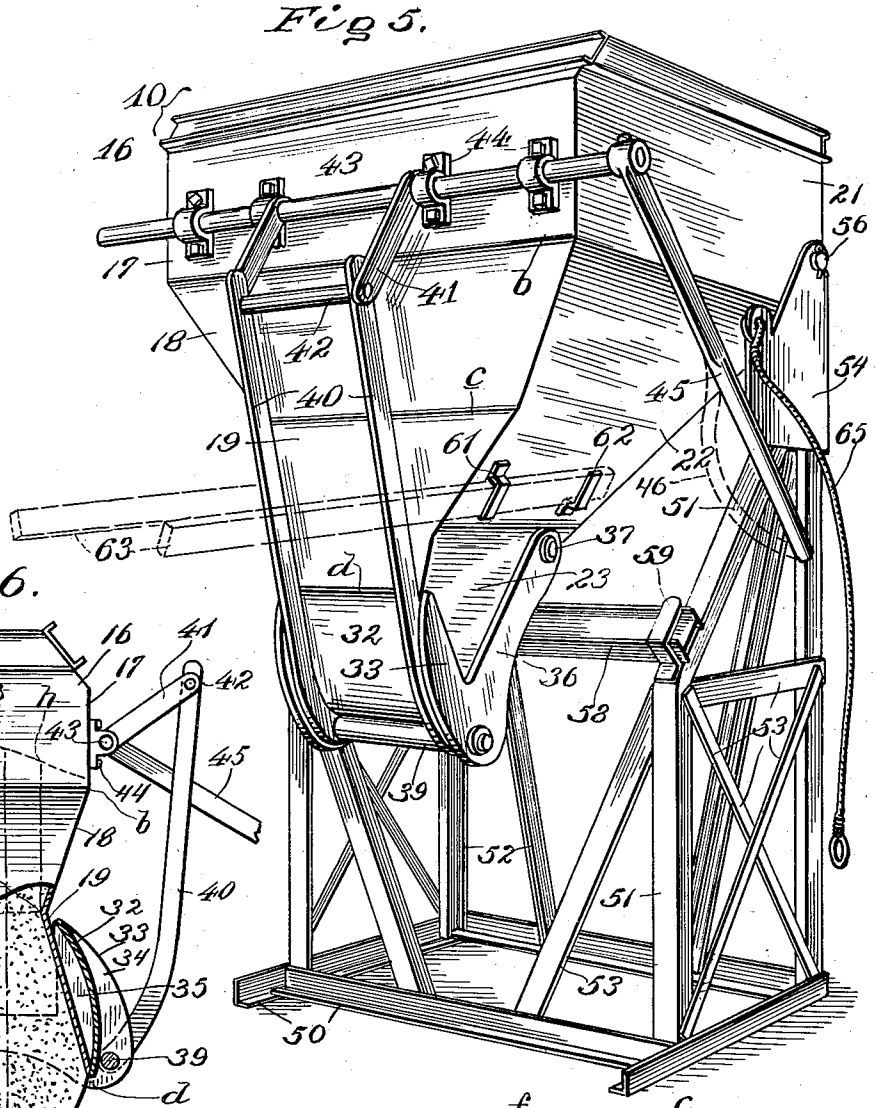


Fig. 6.

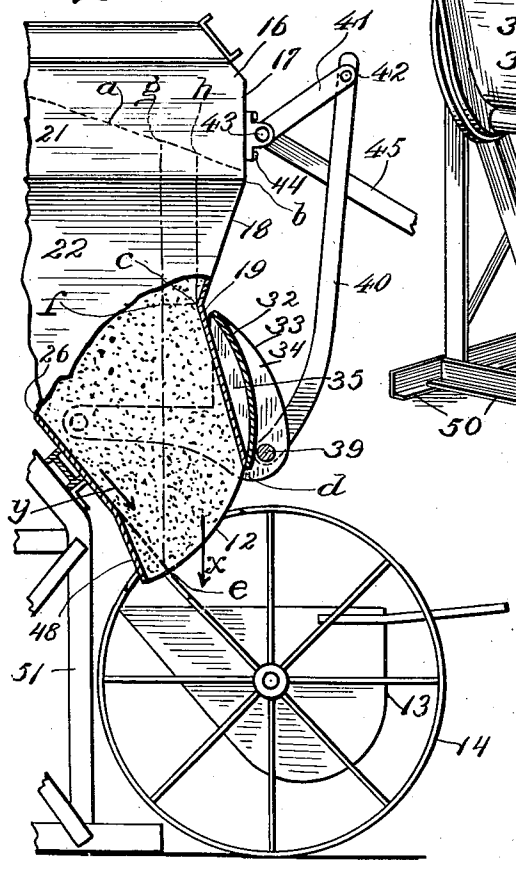
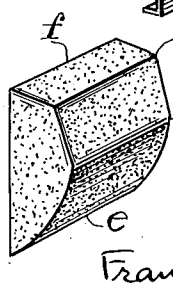


Fig. 7.



INVENTOR:
Francis P. Sloan

BY
Morrison, Kennedy & Campbell
ATTORNEYS.

Patented June 14, 1938 2,120,269

UNITED STATES PATENT OFFICE

2,120,269

HOPPER

Francis P. Sloan, Scarsdale, N. Y.

Application September 11, 1935, Serial No. 40,011

9 Claims. (Cl. 221—144)

This invention is a novel hopper, or apparatus in the nature of a reservoir, with gate and operating mechanism, adapted to supply in intermittent or measured manner certain fluent or flowable materials, whether in a solid or dry condition or of a semi-solid or wet nature. A typical instance of the use of the hopper hereof is for the handling of concrete mixes or mortars, for example hoppers of the portable kind, known as floor hoppers, shiftable with the progress of the work. Other fluent materials that may be handled include broken stone or coal, humus, fertilizers; and peat or other fuels or materials may by this hopper be fed intermittently, as to a furnace.

In general, hoppers of the class referred to are employed to receive the materials from a larger or bulky supply, hold the same for local use, and deliver or distribute the materials to or toward the place of final use or deposit; in the case of concrete mix a typical use being between a mixing machine and the barrows or buggies by which the mix is distributed as required. The particular type of hopper to which the invention is applied is that in which the reservoir walls converge to an inclined outlet or mouth at one side, herein for convenience termed the front, whereby a receptacle brought to the front receives a measured portion of material discharged in a downward-forward direction of incline by the opening and closing of the gate; as distinguished the type wherein the outlet is underneath discharging vertically downward.

A principal object of the present invention is the improvement of the delivery of hoppers of the class specified, so as to prevent jamming or choking of the mouth or outlet, especially in the case of inclined gravity discharge, involving a horizontal frontward component in the delivery of the material to the barrow or otherwise. A further object is to allow an increased size of mouth or outlet, and to provide for this purpose an improved gate, with mechanism by which it is readily widely openable and closable. A particular object is to afford a hopper wherein, when the outlet is opened, the material will reliably start its own discharge, minimizing the desirability of manual or other poking or agitating operations; although for greater assurance a mechanical agitator may be added. Another object is to afford a hopper in which can be handled efficiently and conveniently concrete mixes, mortars or other materials in either relatively dry and stiff or relatively wet and fluid or soapy condition. A further object is to provide for ready and compact collapsibility of the hopper within its supporting frame for transportation.

Other objects and advantages of the invention will be explained in the hereinafter following description of a hopper constituting an illustrative embodiment of the invention, or will be understood by those conversant with the subject. The invention consists in the novel hopper, and the novel features of mechanism, combination, arrangement and construction, herein illustrated or described.

In the accompanying drawings Figure 1 is a left side elevation of a hopper embodying the present invention, with the lower part of its reservoir broken away to show the construction of mouth and gate. Herein the side at which the discharge occurs is termed the front side for convenience of description and claim.

Fig. 2 is a left elevation similar to Fig. 1, but showing the hopper in its collapsed condition, wherein it is of minimum horizontal dimensions and well adapted to be elevated or lowered through a shaft.

Fig. 3 is a perspective view of the lower side of the mouth showing a desirable lip or notch feature to be described.

Fig. 4, looking at an upward rear slant, shows a part of the mouth and gate, the latter slightly opened to expose the lip.

Fig. 5 is a general perspective view of the complete hopper showing its front and right sides.

Fig. 6 is a partial left elevation differing from Fig. 1 in that the gate is indicated as wide open, although for clearness the material is indicated as having remained in position, contrary to the true action.

Fig. 7 in perspective shows a theoretical block or plug of the material as it would stand vertically above the hopper mouth, indicated also in Fig. 6 in unsupported position, and the descent of which starts the discharge of the hopper, upon the opening of the gate.

In Figs. 1 and 6 the near buggy wheel rim and a spoke are broken away to avoid conflict with the showing of the outlet parts that stand between the wheels.

The hopper as a whole is to be understood as including not only the reservoir or container **10**, open at the top end, with its lateral walls converging downwardly, but also the gate closing its mouth, the gate operating mechanism, and the preferably transportable supporting frame, as will be described more in detail. The base may be considered as partly overlying a vertical shaft, through which the collapsed hopper has been brought to the place of operation, and Fig. 1 indicates a bucket **11** which has brought a supply of mortar or other material up through the shaft and dumped it into the hopper, which is shown as having been filled up to the charging line *a*. The hopper has its body portion and an outlet portion, and the outlet exit or mouth **12** is at the lower front side, and a receptacle or buggy **13** with wheels **14** is shown as having been brought to a front position to receive a portion of the

charge, as may be measured or limited by the operation of the gate.

The hopper is shown as of generally rectangular form, although this is not essential. The four sides will be described in detail, as the particular contour shown is of advantage. The hopper front comprises a top wall **16** which may be inclined, thus truncating the corner and reducing the fore and aft dimension when knocked down as in Fig. 2. Below section **16** is a vertical wall section **17** extending down to a transverse line *b*, which may be approximately at the point where the charge line *a* terminates. Below section **17** and line *b* is the wall section **18** slanting inwardly or rearwardly to the line *c*, adjacent to which is accommodated the top edge of the gate when fully opened as seen in Fig. 6. Below the line *c* is the wall section **19** inclined outwardly and extending to the line *d* constituting the upper edge of the hopper mouth. The front therefore has a reentrant contour accommodating the open gate but limited to the minimum in its rearward extension.

Each of the right and left sides comprises a top wall section **21** which may extend vertically down to the line *b*, and therebelow the sides comprise inwardly converging sections **22** extending to a line somewhat above the top edge of the mouth, and below this are vertical wall sections **23** completing the lateral sides of the reservoir. The back side of the hopper comprises a vertical top wall section **25**, coextensive in height with the side sections **21**, and therebelow a long slanting section **26** extending forwardly to the line *e* constituting the lower or rear edge of the mouth.

All of the described wall sections are united, preferably by welding, into a unitary integral reservoir. All four sides are shown reenforced at the top by channel members **28**, and the rear channel member carries a wear block or nosing **29** on which the spout of the bucket **11** may rest when charging the hopper.

The outlet portion of the hopper is bounded by the downwardly-frontwardly slanted wall **26** at the rear, the parallel vertical wall sections **23** at the lateral sides, and the upwardly-rearwardly slanted wall **19** at the front affording clearance for the upswung gate. These combine to define an outlet passage or chute which has a decided frontward incline to its exit or mouth, delivering thus into the locally shiftable receptacle **13** pausing at the front of the hopper.

The hopper mouth **12** is not restricted like the usual delivery spout, but is relatively large in both dimensions and directed to delivery at a downward forward slant into the receptacle **13**. An important feature is that indicated by the construction lines on Fig. 6. The vertical plane *e, f, g* above the lower edge *e* of the mouth is spaced well rearward not only of the upper edge *d* of the mouth, but of the line *c* between the wall sections **18** and **19**, which is the furthest rearward extension of the reentrant contour or angle of the front wall. The consequence is that there is a substantial volume of material, herein conveniently spoken of as a plug or column, bounded between the side walls and by the construction lines *c, d, e* and *f*, as diagrammatically shown separately in perspective in Fig. 7, which rests solely on the gate and becomes totally unsupported upon the opening of the gate as in Fig. 6 and is therefore well adapted to drop vertically as indicated by the arrow *x* and thus start the discharge of the material, which continues both vertically and in an inclined direction as indicated by the arrow *y*. As a matter of fact with this construction, the entire vertical column including the plug *c, d, e* and *f* and the material *c, f, g* and *h* above it is vertically unsupported except by the gate. If the hopper be empty one may look downwardly vertically through the space demarked by these lines and see unobstructedly to the floor. The self starting of the discharge thus described constitutes such an important improvement as to dispense with the usual requirement of an extra workman posted above and ready to poke at the material to start each discharging action. The horizontal dimensions of the plug or unsupported column must both be substantial, as a narrow volume would not possess the weight necessary for reliability.

The construction giving this advantage may be described as so shaping and spacing the front and rear side walls in horizontal direction as to leave the described vertical column of enclosed material unsupported except upon the gate, whereby on retracting the gate, in any manner, the column drops vertically, thus starting the discharge action. The gate preferably swings across the discharge direction and when retracted is accommodated in front of the inclined wall section **19**, which is well frontward of the rear edge *e* of the outlet.

The gate **32** is shown as a curved plate concentric with its own shifting movement and slidably contacting snugly all of the four edges of the mouth **12**. The gate comprises not only its curved plate but opposite side plates **33**, all welded together. The side plates **33** are so extended in vertical planes as to afford strengthening and stiffening front flanges **34** and rear flanges **35**, giving great strength and durability to the gate, and they protect the gate from blows by the buggies. A rear extension **36** at each side is pivoted upon a fulcrum or stud **37**, mounted on the side wall section **23**. The long radius of swing permits the easy wide opening shown in Fig. 6 without conflict with the hopper wall sections.

The gate operating mecahnism comprises a novel arrangement of links and levers as will now be described. These parts are preferably in symmetrical duplicate, affording a durable construction and preventing racking movements of the gate. A link pivot or axle **39** is shown at the front side of the gate, and moreover near its lower edge, mounted on the gate flanges **34**. From this axle near its ends extend two long links **40** which at their upper ends are pivoted to parallel rockarms **41** by means of a transverse pivot pin **42**. The arms **41** in turn are attached upon a rock axle **43** mounted horizontally in bearings **44** on the upper front wall section **17**. The actuation is preferably from the axle **43** and this is shown extended beyond the side walls at one or both sides, so as to receive an operating lever **45** which may be swung or rocked freely through a large arc without conflict with the reservoir.

By the described operating mechanism a multiplication of power is obtained, as the handle end moves through a much greater distance than the lift of the gate. Moreover, due to the forward position of the rockarms **41** the gate opening commences with relative slowness, thus easing the effort, then accelerating but ending with relative slow and smooth movement. The position of the operating lever does not interfere with the presenting of the buggy to the hopper, and the lever may be swung through 85° more or less. One man can readily control the movements of the

gate. The lever may have a lateral extension **46** to afford easy reach and access, in effect a double handle.

The gate mechanism is substantially self closing, by the mere release of the lever **45** from the open position shown in Fig. 6, since the weight and gravity of the lever, the rockarms **41**, the links **40** and the gate cooperate in the effective closing of the gate. When closed a self stopping action occurs, with the parts as shown in Figs. 1 and 5. This is herein brought about by the arrangement of the links **40**, which are curved and pivoted to the lower corners of the gate, the shape of the links being such that when the gate is closed as in Fig. 1 the links bear rearwardly against the upper part of the gate adjacent the line *d*. This not only stops the descending movement, but causes the links to press against the gate and hold it more snugly to the hopper mouth.

When the hopper is used for ordinary mixes the gate will be thrown suddenly wide open for the discharge and will be allowed to close suddenly as the receptacle **13** becomes nearly filled. Sometimes it may be necessary to handle a very wet or soapy mix or material which would tend to spread sidewise and discharge beyond the receiving vehicle and to flow out completely with substantial opening of the mouth. To permit the handling of such material a lip or notch is herein provided by which a very narrow stream and slow rate of discharge can be insured. Thus a lip **48** is shown in Figs. 1, 3, 4 and 6. This consists of a deflected portion of the bottom wall **26** but could equally well be provided as a notch at the lower edge of the gate. By slightly lifting the gate, as shown in Fig. 4, the discharging is confined to the small area exposed at the lip or notch, thus rendering the hopper available for very fluid material.

The portable frame or cradle in which the hopper container is mounted is shown as comprising a base **50**, composed of angle irons, adapted to rest upon a floor or partly upon beams extending over a shaft. At the front corners are shown uprights or columns **51** composed also of angle irons, these at an intermediate point being bent back at an incline to meet the vertical rear uprights or columns **52**, shown as channels. These frame elements are welded into a unitary whole and are stiffened by welded diagonal and horizontal braces **53** at various points. At the top of the frame structure at each side is shown a frame head in the form of a substantially vertical plate **54**. The reservoir **10** at its respective side walls **21** is shown pivoted near the upper portions of the frame plates **54** by studs or short fulcrum axles **56**, projecting from the reservoir walls.

When in use the back plate **26** of the reservoir bears against and is positioned by a removable bar or beam **58** which is shown in Figs. 1 and 5 as held in place by cleats **59** on the uprights **51**. In Fig. 2 the bar **56** has been removed thus letting the reservoir swing down to its knockdown position. To assist the swinging of the reservoir into and from its operative position the following arrangement is shown. On each side wall **22** is shown a front cleat **61** and a complementary rear cleat **62**. These pairs of cleats are so arranged as to receive lifting bars **63**, the positions of which are indicated in dotted lines. These bars are temporarily set in place for the putting up or collapsing of the hopper and are then removed.

When the hopper is collapsed as in Fig. 2 the reservoir may be positioned, as by coming into contact at the back with a stop, as a cross bar or angle iron **64**, extending from one back column **52** to the other.

The pivot plate **54** of the frame is herein used also as a hanger, and for this purpose each plate **54** is shown as having a suspension cable attached at a proper point, so that when these cables are both applied to a lifting hook **66** operated by a cable from a power source, the hopper will hang vertical as in Fig. 2 with its center of gravity beneath the cable attachment.

The operation has been indicated, affording the advantages recited. The starting of discharge is helped by the large area of the outlet and mouth, and the proportionately reduced side friction. The tall and thick column or plug of material initially rests directly vertically on the gate. With non-liquid materials the flow does not start readily, and even with this invention the start of materials of sluggish consistency may be delayed until the gate is nearly open. When started the flow proceeds quickly and so fills the buggy evenly, requiring no trimming. The vertical drop and quick discharge minimize segregation of the mixed materials. The construction of the hopper permits the buggy to be received readily beneath the discharge. The wheels and buggy side walls pass outside the flanges **33** of the gate and such flanges thus gage and ensure the proper positioning of the receptacle beneath the hopper front exit. The handle is far to one side and does not interfere. It thus may be of good length and swing through a greater arc, both these factors increasing the power to overcome gravity and frictional pressure of the material. A sudden lift of the gate and a timed release give the required quick discharge and cause the gate to chop down and cut off the flow.

What is claimed is:

1. A transportable hopper of the class usable for supplying concrete mix to local receptacles and of the type having an elevated reservoir on a frame and an outlet chute of downward-frontward incline affording a frontward discharge to the receptacles, and such chute having a curved gate swingable upwardly about a rear axis to open the outlet, and the lower-rear and upper-front walls of the outlet chute each having an upward-rearward incline; and said hopper characterized in that the entire hopper front wall including said outlet chute upper-front wall has a contour with a reentrant angle forming a space to receive the upper edge of the upswung gate, but with the apex of said reentrant angle no further rearward than conveniently to accommodate the upper edge of such fully opened gate, such apex being thereby positioned substantially further forward than the front edge of the outlet lower-rear wall, whereby there is left a vertical column of enclosed material of substantial fore-and-aft thickness and of the full depth of the hopper wholly unsupported when the gate is retracted, thereby effectively starting the downward-frontward discharge of the material to the receptacle.

2. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, the outlet chute having its lateral walls substantially parallel and vertical and its rear wall inclined downwardly-frontwardly and its front wall extended upwardly-rearwardly

sufficiently to afford clearance for the upswung gate, and the reservoir lateral walls being flared upwardly above the parallel vertical lateral walls of the chute, and a curved gate mounted at the chute exit and retractible swingingly upwardly, said gate pivoted on rear pivots at the chute lateral walls and having side plates extending from such pivots to the gate proper, such side plates being substantially sector shaped but cut away at their upper edges to clear the flared reservoir lateral walls when the gate is swung fully open.

3. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, a curved gate mounted at the chute exit and retractible swingingly upwardly about the rear side pivots to open the gate, the outlet chute having its rear wall inclined downwardly-frontwardly and its front wall extended upwardly-rearwardly sufficiently to afford clearance for the upswung gate, and mechanism for operating the gate comprising a pair of spaced-apart parallel links pivoted to the front of the gate and extending upwardly, a pair of parallel rockarms pivoted to the top ends of the links, a transverse rockshaft fulcrumed on the reservoir and carrying said rockarms, said rockshaft being spaced above the chute outlet by at least twice the extent of swing of the gate, and the links being of such length that the rockarms are below the horizontal when the gate is closed but above the horizontal when the gate is open, and an operating lever extended frontward from said rockshaft when the gate is open.

4. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, a curved gate mounted at the chute exit and retractible swingingly upwardly about the rear side pivots, the outlet chute having its rear wall inclined downwardly-frontwardly and its front wall extended upwardly-rearwardly sufficiently to afford clearance for the up-swung gate, and mechanism for operating the gate comprising a pair of spaced-apart parallel links pivoted to the front of the gate and extending upwardly, a pair of parallel rockarms pivoted to the top ends of the links, a transverse rockshaft fulcrumed on the reservoir and carrying said rockarms, the operating links being pivoted to the lower part of the front of the gate affording maximum length of link, and an operating lever extended frontward from said rockshaft.

5. A hopper as in claim 4 and wherein the operating links are shaped to bear against the gate when lowered, tending to close it tightly, the gate thereby constituting a stop for its own closing movement.

6. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, a curved gate mounted at the chute exit and retractible swingingly upwardly, and mechanism for operating the gate comprising a horizontal transverse rockshaft fulcrumed on the front of the reservoir, an operating lever extended frontwardly from said rockshaft, a rockarm extended frontwardly from the rockshaft, and a long link extending from the rockarm down to a pivot at the front side of the gate, said pivot being near the lower edge of the gate and said link being shaped to bear rearwardly against the front face of the gate when closed, thereby affording a stop for the descent of the gate under the weight of the gate, link, rockarm and lever.

7. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, a curved gate mounted at the chute exit and retractible swingingly upwardly about a rear pivot, and mechanism for operating the gate comprising a horizontal transverse rockshaft fulcrumed on the front of the reservoir, an operating lever extended frontwardly from said rockshaft, a rockarm extended frontwardly from the rockshaft with a radius shorter than that of the gate, and a link extending from the rockarm down to a pivot at the front side of the gate, the link being substantially longer than either the rockarm or the gate radius of swing, and the rockarm pivot being so located that the rockarm swings from above to below horizontal when the gate swings closed, and avoids alinement with the link, and the lever swings from a frontward to a depending position in the same action and the link maintains an approximately upright position throughout its movements.

8. A transportable hopper for receiving concrete mixes or ingredients and lever-operable for delivering the same to local receptacles, the same having a reservoir converging downwardly and with a front outlet chute having a downward-frontward incline adapted for discharge into a local receptacle positioned beneath the front side of the reservoir, a curved gate mounted at the chute exit and retractible swingingly upwardly about a rear pivot, and mechanism for operating the gate comprising a horizontal transverse rockshaft fulcrumed on the front of the reservoir, an operating lever extended frontwardly from said rockshaft, a rockarm extended frontwardly from the rockshaft, and a link extending from the rockarm down to a pivot at the front side of the gate; the rockarm being shorter than the gate radius, and the link being at least twice as long as the gate opening movement.

9. A hopper as in claim 8 and wherein the link is pivoted to the lower part of the gate so that the radius from gate axis to link pivot is always below the horizontal, while the link is of such length that the rockarm swings from below to above horizontal.

FRANCIS P. SLOAN.