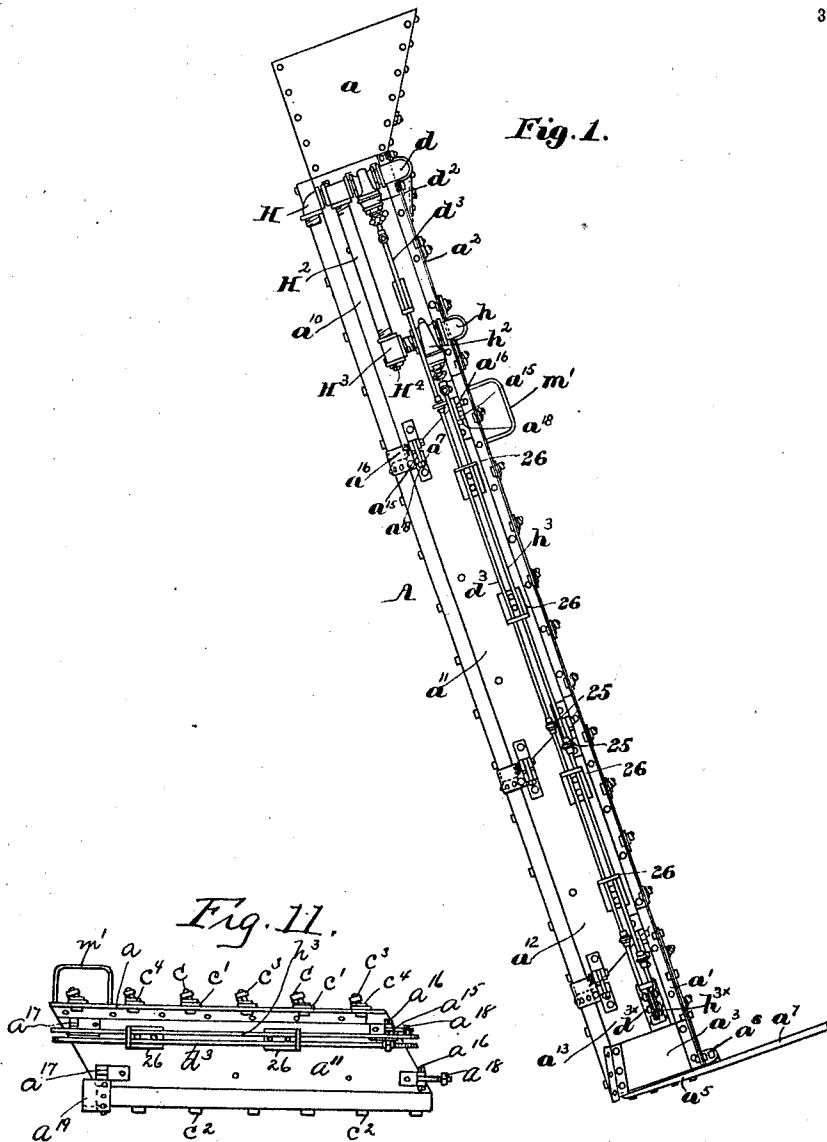


1,004,411.

3 SHEETS--SHEET 1.

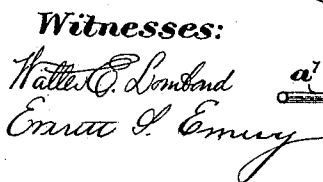


Witnesses:
Walter E. Lombard.
Ernest J. Ewing

Inventor:
Frank B. Gilbreth,
by Maurice L. Emery-
Atty.

1,004,411.

3 SHEETS—SHEET 2.



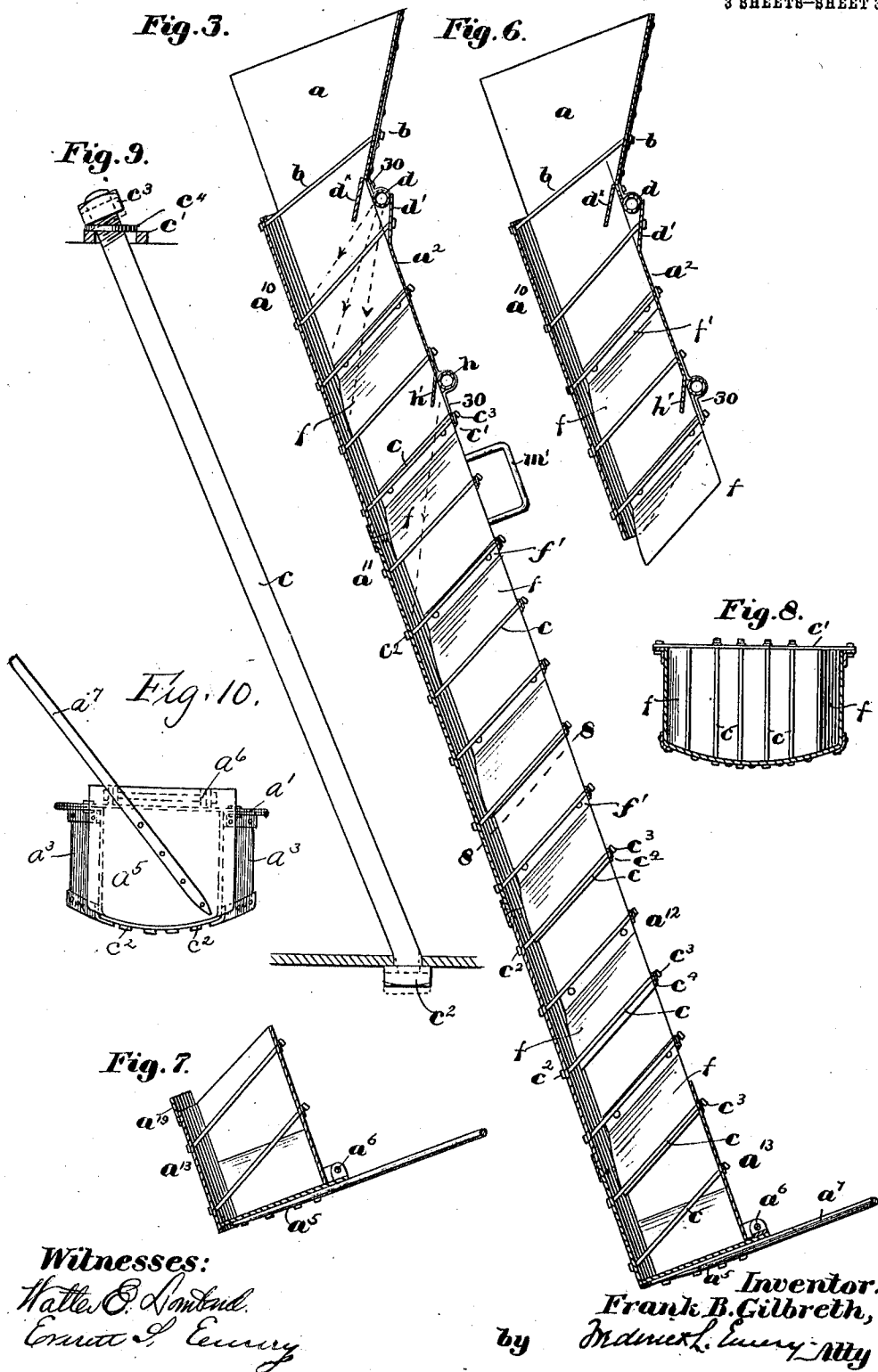
Inventor:
Frank B. Gilbreth,
Meredick L. Emery -
Atty.

F. B. GILBRETH.
SECTIONAL GRAVITY CONCRETE MIXER.
APPLICATION FILED JUNE 10, 1901.

1,004,411.

Patented Sept. 26, 1911.

3 SHEETS—SHEET 3.



Witnesses:
Walter O. Lombard.
Ernest S. Emery.

Inventor:
Frank B. Gilbreth,
by Maxwell L. Emery, Atty

UNITED STATES PATENT OFFICE.

FRANK BUNKER GILBRETH, OF BOSTON, MASSACHUSETTS.

SECTIONAL GRAVITY CONCRETE-MIXER.

1,004,411.

Specification of Letters Patent. Patented Sept. 26, 1911.

Application filed June 10, 1901. Serial No. 63,833.

To all whom it may concern.

Be it known that I, FRANK B. GILBRETH, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Sectional Gravity Concrete-Mixers, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to what are known as gravity mixers for concrete, cement, mortar, artificial stone and other substances, such, for instance, as illustrated in my U. S. Patent No. 620,028, dated February 21st, 1899.

The various features of my invention will be hereinafter described and set forth in the claims at the end of this specification.

In the accompanying drawings, to which reference may be had,—Figure 1 is a side elevation of a mixer, illustrating one embodiment of my invention; Fig. 2, a face or front view of the mixer, Fig. 1, but on a larger scale; Fig. 3, a vertical longitudinal section on the dotted line 3—3, Fig. 2; Fig. 4, a view looking at the inlet end of the mixer, Fig. 2; Fig. 5, a view looking at the discharge end of the mixer, Fig. 2; Fig. 6, a view similar to Fig. 3, with three of the sections of the mixer removed, shortening the same; Fig. 7, a detail section of the lower or delivery end of the mixer, showing the relative arrangement of inclined end surface and stop surface coöperating therewith; Fig. 8, a cross section, on the dotted line, 8—8, Fig. 3; Fig. 9, an enlarged sectional detail illustrating the means for mounting the mixer pins, and Fig. 10 a detail looking at the lower end of the hopper section and showing the obliquely arranged handle, a' ; and Fig. 11 a detailed side view of one of the mixer sections detached.

In the particular embodiment of my invention selected for illustration herein and shown in the drawings, A is a long chute or trough, preferably substantially open at its front side, and provided at its upper end with a suitable receiving hopper, a , and at its lower end with a suitable receptacle or receiver, a' . This chute may be made of any desired material constructed or put together in any desired manner, although I prefer to employ sheet metal for this purpose, bent and riveted together as indicated in the drawings, because of its durability

and its capacity to vibrate freely while in use to prevent clogging.

The upper end of the chute immediately below the receiving hopper, a , is shown provided with a front plate, a^2 , forming a sort of receiving chamber to prevent escape of the materials thrown into the hopper by the workmen. The bottom of the chute adjacent the receiver, a' , is shown as made hopper like, with inclined sides, a^3 , the outlet opening between the said inclined sides being provided with a door or closure, a^5 , hinged at a^6 , and provided with a long handle, a^7 , as best shown in Figs. 1 and 3. The handle, a^7 , is arranged obliquely,—see Fig. 10—in order that its free end may be brought into convenient position for handling by the workman, who, by means of the handle, holds the door, a^5 , closed until the desired quantity of material is collected in the receiver, a' , when he releases the same, permitting the material to open said door and discharge itself. The handle serves an added purpose, in that when the door is swung open suddenly, upon release of the handle, to free the contained material in the receiver, said handle is swung against the front plate of the receiver, jarring and vibrating the structure sufficiently to free any material that may have collected on the inner walls of the receiver, and keeping the lower end of the trough always free from obstruction. This, and, in fact, all arrangements or constructions for keeping the mixer free and clear, are of great importance when considering the practical use of the mixer.

Referring particularly to Fig. 1, my present invention comprehends the making of the mixer in a plurality of sections; for instance, the sections a^{10} , a^{11} , a^{12} and a^{13} ,—the latter being, in effect, as herein shown, the receiver or receiving chamber at the discharge end of the mixer already referred to. By making the mixer or trough in sections in this manner, the effective length of the trough or mixer may be varied at will, by removing or adding one or more of the sections; for example, the top section, a^{10} , shown in Fig. 6, may have applied to it the bottom section, a^{13} , Fig. 7, thus making a short mixer for certain jobs and certain classes of work; or, the sections a^{10} and a^{11} , or, a^{10} and a^{12} , may be used in connection with the bottom section, a^{13} , or without the bottom section, if so desired. Thus it is possible by varying the length of the mixer,

to vary the duration and character or thoroughness of the mixing by varying the effective length of the mixer, rendering the latter readily and completely adaptable to any piece of work, whatever the materials employed and whatever the necessary degree of completeness or character of the mixing. To facilitate the coupling together and removal of these sections, they are similarly constructed at their adjacent ends and provided with fastening devices of a construction that will permit the proper ends of any two sections to be joined together.

Referring to Fig. 1, the lower end of each section is provided, at each side, with a swing bolt, a^{15} , pivotally hung, at a^{16} , and adapted to be dropped into the slot in an ear, a^{17} , opposed to it on the adjacent end of the next section, a nut, a^{18} , on the end of the bolt, furnishing means by which to clamp the latter tightly against the ear, a^{17} , and thus draw the adjacent ends of the two sections firmly together. The upper end of each section (see Fig. 7) is shown provided with a stop surface or lap plate, a^{19} , that insures a lap joint at the bottom of the mixer, which bottom as here shown is made concave or trough-shaped from top to bottom.

Referring to Fig. 1, it will be noticed that the abutting ends of adjacent sections are cut or formed in a plane inclined to the length of the mixer. This inclined construction in and of itself furnishes greater support of one section by its next section, when the several sections are coupled together, especially when the mixer is permitted to lie in an approximately horizontal position; and, in addition to this, by having the abutting ends of adjacent sections inclined as shown, the action of the bolts or clamps employed to draw the sections one against another, causes one inclined end to slide upon the inclined or abutting end, until the stop surfaces or lap, a^{19} , contacts with the bottom of the next section; the effect is thus to insure close contact of the lap, a^{19} , with the bottom of the next section, and also to insure a closer contact between the ends of adjacent sections and a more complete support of the one by the other than would be possible were the sections made to abut in planes that were perpendicular to the length of the mixer. The swing bolts, a^{15} , are permanently attached to the lower ends of the several sections, and the nuts thereon require only to be loosened,—never removed,—to permit disengagement of the bolts from the ears against which they were clamped; thus, each section is self-contained or complete in itself, and there are no parts to be lost or misplaced, for it is unnecessary to remove any part from any section, either in removing or inserting it.

Referring now to Figs. 2 and 3, the open

or front side of the chute or trough, A, is provided with a series of cross cleats, c' , that form supports for the mixing members here shown as in the form of pins, c , they being inserted through slots in the said cleats and extend obliquely toward the bottom of the trough, as shown in Fig. 3, passing through the said bottom, and fitted outside the said bottom with heads, c^2 . The mixing members, c , while preferably arranged substantially parallel with the sides of the mixer, are arranged on an incline or at an acute angle with the bottom of the mixer when viewed in longitudinal section, as in Fig. 3, thus causing the material gravitating through the mixer, as it comes in contact with said mixing devices, to rebound or be thrown back against the bottom of the mixer and the material sliding downward thereupon; it being understood that the working position of the mixer is more or less inclined, for instance, as illustrated in Figs. 1 and 3. These mixing members, c , are arranged in parallel transverse series, each series being herein shown as composed of two pins, and the various transverse series, one above the other, are so arranged that the pins of one series are staggered relative to the pins of the adjacent series above and below, thus providing for effective mixture of the materials gravitating through the mixer.

I have provided the mixer with side deflectors, f , shown best in Fig. 2, that cooperate in passing the gravitating materials from one to the opposite side of the chute and also against the back of chute, thus adding to the thoroughness of mixing of the various components of the mixture of materials. In the present embodiment of my invention, these deflector plates (see Fig. 8) are made of springy material arranged in the same inclined positions or planes as the mixing devices, and are rigidly secured along their upper side edges, as at f' , Fig. 3, to the side walls of the mixer. The lower ends of these deflectors are curved to fit the curved or trough-like bottom of the mixer chute; and are thereby held firmly in position,—that is, the curvature of the bottom prevents the plates from swinging or bending flatwise against the side walls, although leaving said plates free to rebound or vibrate under the action of the materials striking them, to aid in keeping themselves free. My invention further comprehends leaving the upper ends (next the open front of the chute) of said deflectors unattached, thus leaving said deflectors secured along one, their upper side edges only, with their lower side and top and bottom edges free to vibrate sufficiently to keep themselves always free and clear.

Bearing in mind the desirability of vibration in all the parts that aid in the mixing

of the materials, to keep them clear, the mixing pins, *c*, Figs. 3 and 9, are there shown as fitting tightly the holes in the back or bottom of the mixer while fitting loosely the slots in the cleats, *c'*, on the front of the mixer; the ends of the pins adjacent the bottom are shown, and preferably, bent somewhat, so as to pass perpendicularly through the holes in the bottom, thus ensuring a tighter and more permanent fit. At the front side of the mixer, above the slotted cleats, *c'*, the mixing pins are shown provided with nuts, *c³*, threaded upon the ends of the mixers, and between the nuts and the cleats are arranged washers, *c⁴*. The slotted openings in the cleats, *c'*, for the pins, *c*, permit the upper ends of the pins to vibrate sufficiently under the impact of the materials against them not only to free themselves of the materials, but also to jar the entire structure for the same purpose. By reason of the bolt fitting the washer, this vibratory movement first takes place between the washer and the cleat. The bottom of the trough is harder and wears less easily than the pin, and, after a time, the constant vibration of the upper end of the pin causes the lower end thereof that passes through the bottom of the mixer to wear away, and by the time this wears away,—and the wear, of course, is slower when the mixer is new than after it has been in use for a time,—the washer under the nut at the head of the pin also wears through and drops out, leaving the pin thereafter supported upon the edge of the nut resting on its cleat. The dropping out of the washer permits the pin to drop through the trough far enough,—as indicated in dotted lines, Fig. 9,—to bring a full section of the pin again into the hole in the harder material of the bottom of the trough, thus taking up the wear at the latter point and preserving the vibration at the upper end of the pin; thereafter, the wearing away of the nut on the upper end of the pin, by its contact with the surface of the cleat, is sufficient to permit the pin continually to drop lower and lower, hence farther and farther, through the bottom, to take up the looseness between the bottom of the pin and the hole in the bottom of the mixer. Thus, by a simple and inexpensive construction, the pins are made to take up their own wear and preserve at all times a substantially tight fit near their lower ends with their upper ends free to vibrate sufficiently to clear themselves and the structure of any materials that might tend to adhere thereto. The vibrating pins permit the chute to be operated in a more nearly horizontal position, without clogging, than is possible where all the parts are fixed.

Referring to Figs. 2 and 3, the top section, *a¹⁰*, of the mixer is provided imme-

diately below the hopper, *a*, with a horizontal sprinkler or spray pipe, *d*. This spray pipe or device, *d*, is shown arranged in an opening between an outwardly bent lip, *d'*, of the plate, *a²*, and the body of the said plate, so that in effect the said spraying device or pipe is located in an offset portion of the trough and is thereby protected more or less from contact with the materials thrown into and down through the chute. A deflector, *d^x*, also further protects the spray pipe, *d*, from materials thrown into the hopper, and further acts to deflect the material striking it, back upon the bottom of the trough for the most effective mixing of the material. This spraying device or pipe, *d*, is provided preferably with a plurality of openings or series of openings arranged to project sprays of water in different directions, as indicated in dotted lines, Fig. 3, thereby to wet the stony material just back of several sets of mixing pins where the stony material can be most efficiently wetted as they gravitate through the mixer, the wetting being much more uniform than is possible where the sprays are projected in a single plane only. The sprays for the best results should be directed so as to strike the bottom, each just above a series of mixing members, and where the materials would be most apt to clog, thus aiding in keeping the mixing members free and clear. In the same section, *a¹⁰*, that carries the first spraying device, is a second, supplemental spraying device, *h*, similar, it may be, in construction to the device, *d*, except that with the second spraying device, *h*, it is not as essential to have the sprays projected in several directions, a single direction only sufficing for all practical purposes. This second spraying device, *h*, is not located in an offset, as is the device, *d*, but is arranged upon the outside of the trough and projects its spray through an opening into the trough, the opening being protected by an interiorly projecting shield or guard, *h'*, Fig. 3, that also deflects the materials striking it, back upon the bottom of the trough. These spraying devices may be supplied from a suitable source and in a suitable manner.

Referring to Fig. 1, I have here shown the device *d*, as connected with a single suitable inlet, *H*, the connection between the inlet and the device, *d*, being under the control of a suitable valve,—as, for instance, *d²*,—preferably a valve having a sliding gate for a closure as distinguished from a rotatable or lift valve. Between the valve, *d²*, and the inlet is a branch, *H²*, that leads downward to a T, *H³*, the lower end of which forms an auxiliary supply connection and is closed by a plug, *H⁴*; this branch is connected with the spraying device, *h*, the connection being controlled by a valve, *h²*,

similar, it may be, in construction and operation to the valve, d^2 . This, by means of the valves d^2 and h^2 , the admission of water to the two spraying devices may be controlled at will; and should the supply through the inlet H prove inadequate for both spraying devices, a second supply may be connected on at the T, H^3 , by removing the plug, H^4 . For convenience in operating the valves, their stems are shown connected in suitable manner with valve rods, d^3 and h^3 respectively, that lead downward to a point readily accessible to the workman in charge of the swing closure or gate, a^5 , at the bottom of the mixer, said rods at their lower ends being preferably connected to levers, d^{3*} , h^{3*} , fulcrumed upon a suitable support upon the bottom mixer-section by which said valves may be more easily and nicely controlled than would be possible were the ends of said rods left free. The valve operating rods, d^3 , h^3 , are made in sections, as indicated in Fig. 1, corresponding in length to the lengths of the sections of the mixer, adjacent ends of the rod sections being provided with suitable couplings, 25, by which said ends may be readily coupled and uncoupled as the mixer sections are put together or taken apart. Each mixer section is provided as shown with a plurality of carriers or brackets, 26, that serve to support and prevent displacement of the valve rod sections from their respective trough sections.

Referring now to Fig. 2, I have shown the brackets, 30, that support the spraying devices, d and h as slotted lengthwise the mixer for the reception of their clamping or attaching bolts, 31, so that in case the water supply or pressure is such as to produce an unequal spray or discharge at one of the ends of said devices as compared with the other of the ends thereof, the bolts, 31, may be loosened and the angular positions or levels of the spraying devices shifted to any extent necessary to equalize the spray from one to the other side of the trough or to vary the action of the spray upon the materials gravitating through the mixer. For example, should the spray at the far or remote end of the spray tube, h , be found less effective or weaker than the spray near the inlet end thereof, if the far end of the said tube be dropped, it will increase the pressure in the tube adjacent such end, and will therefore increase the spray thereat and equalize the latter with the spray at the opposite end of the tube. A series of screening pins, b , are shown arranged between the hopper and the chute, to exclude stones and the like of a size rendering them unfit for mixing in the chute. The several mixer sections are provided along their front edges with apertures, m , to receive the bail or hanger, m' , by which to suspend the mixer

in desired inclined position or height. Said bail, or hanger, m' , may be dropped flush with the mixer for shipping and may be inserted in any of the apertures, m , along the mixer, for adjustment of the said bails and the mixer.

My invention is not limited to the particular embodiment thereof above described, but may be varied as desired within the scope and spirit of the invention here disclosed.

Having disclosed my invention, and without limiting myself to details of construction, what I claim and desire to secure by Letters Patent is:—

1. In a sectional gravity mixer for concrete and the like, the combination with a plurality of mixer sections, detachable one from another, for varying the effective length of the mixer, means for connecting the said sections at will, spraying devices, controlling means for said spraying devices and sectional operating means for said controlling means.

2. In a sectional gravity mixer for concrete and the like, the combination with a plurality of sections, of spraying devices for one or more sections, controlling means for each, and sectional operating devices leading to said controlling means, the operating device sections being carried by their respective mixer sections.

3. In a sectional gravity mixer for concrete and the like, the combination with a plurality of sections divided one from another along planes inclined relative to the length of said mixer, of means to secure said sections one to another.

4. In a sectional gravity mixer for concrete and the like, the combination with a plurality of sections divided one from another along planes inclined relative to the length of said mixer, of means to secure said sections one to another and stop surfaces for the several sections respectively limiting the angular movement of one section on the inclined end of the next.

5. In a sectional gravity mixer for concrete and the like, the combination with a plurality of inclined mixer sections detachable one from another for varying the effective length of the mixer, each of said sections having a trough like bottom, of deflecting members arranged in each section and inclined relative to said bottom, and means for connecting said mixer sections at will in desired number and order.

6. A sectional gravity mixer for concrete and the like, consisting of a plurality of inclined mixer sections adapted to be connected and disconnected for varying the effective length of said mixer, each of said mixer sections comprising a chute or trough provided with one or more mixing devices, means to connect said mixer sections at

will, and a water supply device carried by one only of said sections and adapted to supply water for other mixer sections connected thereto.

5 7. A gravity mixer for concrete and the like, having a chute or trough with a concave bottom, mixing members in said chute or trough, and vibratable side deflectors fitted approximately to said concave bottom but free at their edges opposite said bottom, and means to support said deflectors.

15 8. A gravity mixer for concrete and the like, comprising a chute or trough having a concave bottom, mixing members arranged in said chute or trough, and vibratable deflectors attached at one of their edges to the side walls of said chute or trough and left free at their opposite edges, the lower ends of said deflectors being fitted to the said concave bottom.

25 9. A gravity mixer for concrete and the like comprising a chute or trough with mixing members arranged therein, said chute or trough being constructed and arranged to provide an inclined surface down which the material will gravitate, and one or more vibratable deflecting surfaces opposed to said inclined surface to deflect the material striking said deflectors back upon said inclined surface.

35 10. A gravity mixer for concrete and the like consisting of a chute or trough having a substantially open front with mixing members arranged therein, and vibratable deflectors arranged at the front of said chute or trough, to deflect the materials striking the same back upon the bottom of said chute.

40 11. A gravity mixer for concrete and the like comprising a chute or trough having an inclined mixing surface, a plurality of vibratable mixing members inclined relative to said mixing surface, and side deflectors also inclined relative to said mixing surface and free to vibrate relative thereto.

45 12. A gravity mixer for concrete and the like, consisting of a chute or trough pro-

vided with a plurality of vibratable mixing members formed of pins supported in apertures in the bottom of the chute and having their free ends protruding through enlarged apertures in suitable supports arranged across the front of the chute, and nuts and washers upon said protruding ends, for the purpose specified. 50 55

13. A gravity mixer for concrete and the like, consisting of a chute or trough provided with inclined mixing pins, loosely mounted at one of their ends. 60

14. In a gravity mixer for concrete and the like a chute, mixing members therein, one or more spraying devices arranged near the upper end of said chute, controlling means for each said spraying device, and one or more levers adjacent to the bottom end of said chute and connected with to operate said controlling means. 65

15. In a gravity mixer for concrete and the like, a chute or trough provided with mixing members, a swinging closure at the lower end of said chute or trough and a chute vibrating projecting member thereon adapted to contact with a side of said chute upon opening of said swinging closure. 75

16. A gravity mixer for concrete and the like comprising a chute or trough with mixing members therein and a swinging closure at the lower end thereof provided with an obliquely arranged member as described. 80

17. A gravity mixer for concrete and the like comprising a chute or trough, a plurality of mixing members arranged therein and firmly held at their lower ends but free to vibrate at their upper ends, and suspending heads for said members and supports therefor, the plane of each suspending head being at an angle with the plane of its supporting face. 85

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses. 90

FRANK BUNKER GILBRETH.

Witnesses:

FREDERICK L. EMERY,
A. E. CHESLEY.