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PROCESS AND APPARATUS FOR PREPARING CONCRETE

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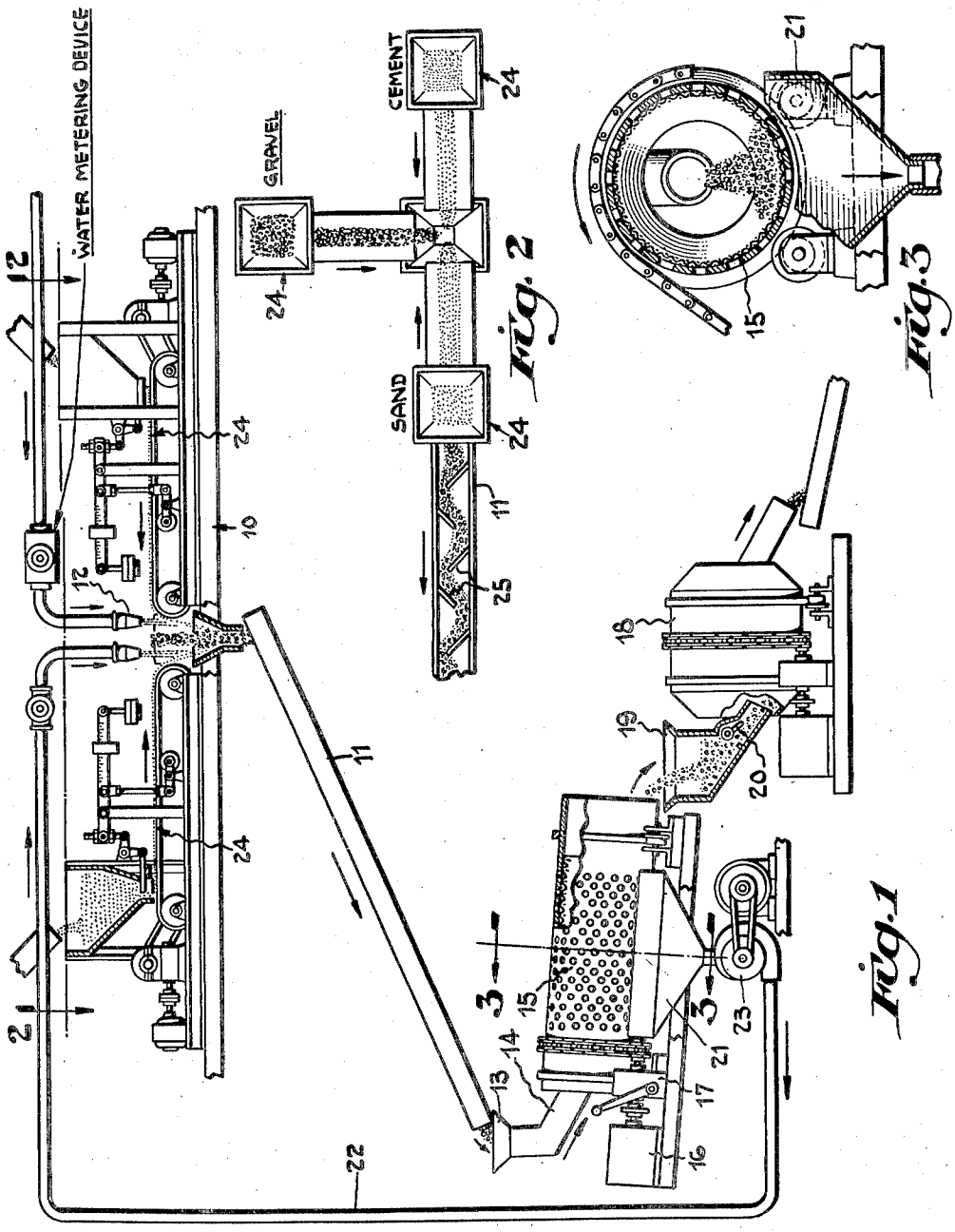

Fig. 1

Fig. 2

Fig. 3

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PROCESS AND APPARATUS FOR PREPARING CONCRETE

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This invention relates to a method and apparatus for making concrete. It is well known that workmen have a tendency to mix too much water with concrete so that it may be handled and poured more easily. It is also well known that concrete which is so wet that it is sloppy when poured, does not make a strong structure. For best results the concrete should be fairly stiff, i. e., like a stiff mud, when it is poured into the forms.

Concrete as stiff as this may give trouble in chuting. It may demand an excessively vertical chute and segregation may occur in chuting if the fall is too near vertical. If the slope is too gentle, the concrete may not slide, i. e., the chute may become clogged. This is especially true when the concrete must be poured under freezing conditions. If whole concrete is poured it may encrust the chute. If any falls over the side of the chute, cement values are lost.

According to the present invention, I take full advantage of the lubricating and washing action that water has in chuting sand and gravel. I use an excess of water during chuting, but I remove or otherwise adjust the excess before it can do any harm. I remove or adjust the water content without hindering the mixing operation in any way, so that continuous mixing may be practiced if desired. The stiffness of the final mix is under the control of the operator at all times. Further, in the preferred modification of my process, I save chuting the cement, i. e., I chute only sand, gravel and water. This procedure saves the cement that otherwise may fall to the side of the chute. The chute cannot encrust and the water may be re-cycled. The process is therefore highly economical as well as a guarantee of good stiff mixes.

In my preferred process, I chute sand, gravel (hereinafter either individually or collectively termed the "aggregate" and an excess of water (sufficient to promote easy chuting) to the place where the concrete is to be laid or thereabout. At the lower end of the chute or flume, I dewater the sand and gravel, not completely, but to an extent that when well mixed with the customary amount of cement, the result will be a good stiff mix of concrete. The operator can readily control the degree of dewatering by regulating the speed of the dewatering means or by lengthening or shortening the time during which the sand and gravel are de-watered.

Figure 1 is a plan view partly in section of my apparatus;

Figure 2 is a section on line 2—2 of Figure 1; and

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Figure 3 is a section through the dewatering cylinder on line 3—3 of Figure 1.

Referring to the accompanying drawing, 10 is a high point from which the chuting is to be done. 11 is a chute which is not flatter than 1 to 4 (25% grade) nor steeper than 1 to 2 (50% grade). 12 is an orifice that delivers water substantially at the top of the chute onto the chute at a uniform or nearly uniform rate. At the bottom of the chute is a hopper 13 which has an outlet 14 which is at an angle to the hopper. Arranged to receive material from the outlet 14 is a de-watering cylinder 15 which is made of perforated metal and which rotates. It is positioned at a gentle downward slope toward its outlet. It may be driven by an electric motor 16, oil engine or other means. The motor 16 has, preferably, a variable speed drive 17. At the end of the dewaterer from which the sand and gravel are to be discharged, there is a concrete mixer 18. The cement may be added in proper proportion to the de-watered sand and gravel to form a settable concrete at any point between the dewatering device and the concrete mixer, the mixer serving to thoroughly admix the ingredients in the usual manner. Between the mixer 18 and the dewaterer 15 there is a volumetric gaging bin 19 which may alternatively be a scale bin and which is arranged with a valved bottom discharge 20 to the mixer. For continuous operation a poidometer may be substituted for the gaging bin.

To operate this apparatus according to my invention, I deliver to the chute 11 at its topmost point a stream of gravel and a stream of sand, or alternatively an already mixed stream of the two in correct proportions for the particular concrete mix to be made, and in both cases a sufficiently large stream of water to promote easy sliding down the chute. These streams are each preferably, but not necessarily, metered by a poidometer. The chute delivers the mixed material into the hopper 13 from which it makes its exit from outlet 14 into the de-watering cylinder 15. The latter rotates at from 5 to 60 revolutions per minute, although this invention is not limited to any particular number of revolutions. Its perforations have substantially from 50% to 75% of the area of the inner surface of the cylinder, but here likewise there is no definite limitation on the area of perforation. The perforations should be sufficient merely to rid the mix of as much water as will drain freely therefrom and should not be so large as to cause an excessive loss of sand.

The de-watered mix is dumped from the lower

end of the cylinder into the volumetric gaging bin 19 under the influence of the incline of the cylinder and its rotation. The slope of the cylinder may be from 5 to 20 percent, and here again the amount of slope is not critical. Steeper slopes may be used if spiral baffles(not shown) are employed within the cylinder to prevent too fast a delivery of material.

Optional equipment is an open tank 21 under the cylinder for the purpose of catching water eliminated therefrom. This water may be returned to the top of the chute by means of a pipe 22 and a centrifugal pump 23. Such equipment is useful both to cut down the consumption of water and to keep the working places around the bottom of the chute reasonably dry. If poidometers 24 have been used at the top of the chute, and a poidometer is used to feed cement to the concrete mixer 18, the volumetric gaging bin or scale bin 19 may be dispensed with.

In an alternative process, I may chute the complete concrete mix with an excess of water, de-water the mixture in cylinder 15 to the desired and correct degree of stiffness, and then use the stiffened mixture directly in construction. In this modification, the water recovered from the cylinder 15 is preferably returned to the top of the chute, since it carries cement values which should not be wasted.

In a third modification, I provide the chute 11 with a multiplicity of angled baffles 25 arranged as shown, so that the material descending the chute is tossed from side to side, i. e., from one baffle to another so that there is a continuous rebound. Mixing is promoted by this construction. I feed separate streams of cement, sand, gravel and water, the latter being in sufficient excess to promote chuting. The baffle construction of the chute mixes the concrete on the way down. At the bottom of the chute, i. e., a place near where the concrete is to be laid, I de-water the mix by any suitable means, say the de-watering cylinder 15 or a centrifugal extractor (not shown), vacuum filter, Dorr-type thickener or similar machines. The water, which bears cement values is preferably recycled to the top of the chute.

It is to be understood that one or more poidometers may be substituted by other forms of continuous weighing or weighing-and-proportioning equipment. For example, a proportional feeder can be used to feed a proportioned mixture of sand and gravel or the proportional feeder can supply a proportioned mixture of sand and cement while a weighed stream of gravel enters the top of the chute from another source. Such operation, i. e., that in which cement is fed at the top of the chute is limited to use when angle baffles 25 are employed on the chute.

I claim as my invention:

1. The process which comprises admixing the non-cement constituents of concrete with a sufficient excess of water over what they require in a normal concrete mix to render them freely flowing, conveying the said mixture by gravity to the immediate neighborhood of the place where the concrete is to be prepared and used, adding cement sufficient to make a normal concrete mixture in respect to all other constituents except that water is in excess, then mixing said cement with the other constituents under efficient de-watering conditions until a normally well-mixed and normally wet mix is obtained.

2. The process of making concrete which comprises conveying by gravity a stream of sand and gravel under the influence of a substantial steam of water directed thereon, continuously adding to said stream of sand, gravel and water, a stream of cement sufficient to establish the proper proportion thereof in the concrete to be made, said cement, gravel, sand and water, being conveyed under conditions favoring mixing, eliminating the excess of water at the end of the conveying operation, and discharging the finished mixture as concrete.

3. The process which comprises delivering sand and gravel together in the proportion in which they are to be used in concrete, said delivery being made down a long inclined chute with the assistance of an excess of water over that required to make good concrete mix, said water being added at the top of the chute in sufficient quantity to facilitate delivery, said delivery being made under conditions prevalent on the chute that promote mixing, then draining off the excess of water until the sand and gravel is no more than saturated, and then mixing a proper proportion of cement to make concrete.

4. The process of preparing concrete which comprises delivering all of the constituents of concrete down an inclined chute in which mixing conditions prevail, said delivery being performed in the presence of a sufficient excess of water to facilitate the flow of the materials down the incline and then bringing the materials to rest under conditions favoring the draining off of water for a sufficient length of time to reduce the water content of the concrete to the range of proportions which should occur in a proper mix.

5. A process according to claim 4 in which the water which bears cement values is recovered and returned to the top of the incline for re-use in mixing the additional amounts of sand, gravel and cement.

6. In combination, a chute for delivering the constituents of concrete, extending from a high point to a lower point near where concrete is to be laid, a de-watering device arranged to largely de-water material delivered thereto by the chute and a concrete mixer arranged to receive material which has passed through the de-watering means.

7. In combination, a chute for delivering concrete or the constituents thereof, extending from a high point to a lower point, receiving and de-watering devices operatively arranged in series at the bottom of the chute to receive material therefrom which is wet with an excess of water and arranged to remove said excess from said material, means for gaging the de-watered material, said means being located adjacent the exit end of the de-watering device and a concrete mixer arranged to receive gaged material from the gaging device.

8. In combination, a chute for delivering concrete or the constituents thereof, said chute extending from a high point to a lower point, a multiplicity of baffles attached to the upper surface of said chute so as to promote mixing of the material descending the chute, receiving and de-watering devices operatively arranged in series at the bottom of the chute to receive material therefrom, which is wet with an excess of water and arranged to remove said excess from said material.

9. In combination, a chute for delivering concrete or the constituents thereof, said chute extending from a high point to a lower point, said chute having a grade inclination not flatter than

25% nor steeper than 50%, the end of said chute being adjacent a place at which concrete is to be laid, receiving and de-watering devices operatively arranged in series in the order named at the bottom of the chute to receive material therefrom which is wet with an excess of water, said devices being arranged to remove said excess from said material, means for gaging the de-watered material, said means being located adjacent the exit end of the de-watering devices and a concrete mixer arranged to receive gaged material from the gaging device.

10. In combination, a chute for delivering concrete or the constituents thereof, said chute extending from a high point to a lower point and having a grade inclination not flatter than 25% nor steeper than 50%, one of more poidometers arranged at the high end of the chute to deliver streams of material thereto, including water for making concrete, receiving and de-watering devices at the lower end of the chute operatively arranged in series in the order named to receive material from said chute which is wet with an excess of water for the purpose of making concrete, said devices being arranged to remove said excess from said material.

11. In combination, a chute for delivering concrete or the constituents thereof, said chute extending from a high point to a lower point, said chute having a grade inclination not flatter than 25% nor steeper than 50%, a plurality of concrete constituent feeding devices adjacent to top of said chute and arranged to deliver concrete-making materials thereto, so that a complete number of concrete-making materials is supplied to the top of the chute, a multiplicity of mixing devices operatively arranged along the length of said chute and a de-watering device arranged at the lower point of said chute to receive material therefrom, said de-watering device being operative to eliminate an excess of water above that necessary to make good concrete from the material received from said chute.

12. The process of preparing concrete including cement and an aggregate which comprises chuting the aggregate mixed with an excess of water to render the mass freely flowable along the chute, removing excess water from the mass adjacent the discharge end of the chute and thence mixing cement therewith in proper proportion to form a settable concrete.

13. The process of preparing concrete including cement and an aggregate which comprises gravitationally chuting from a higher to a lower elevation the aggregate mixed with an excess of water to render the mass freely flowable down the chute, removing excess water from the mass adjacent the lower elevation and thence mixing cement therewith in proper proportion to form a settable concrete.

14. An apparatus for preparing concrete comprising in combination an inclined chute extending from a higher to a lower elevation, a de-watering device arranged adjacent the lower end of the chute and adapted to receive material discharged from the chute and a mixer located adjacent the de-watering device and arranged to receive material discharged from the de-watering device.

15. An apparatus for preparing concrete as set forth in claim 14 including a volumetric gaging device located intermediate the de-watering device and mixer and adapted to transfer material therebetween.

16. An apparatus for preparing concrete as set forth in claim 14 including a pipe extending from the de-watering device to a point adjacent the elevated end of the chute and a pump for returning water recovered from the de-watering device to the chute.

17. An apparatus for preparing concrete as set forth in claim 14 including means for feeding water and aggregate in controlled quantities into the elevated end of the chute.

18. The process of making concrete which comprises chuting the aggregate constituents of concrete from a height to the place at a lower elevation where the concrete is to be used, adding an excess of water to said constituents adjacent to said height to materially increase the ease with which they are chuted and the proportion of said water after addition to said constituents being greater than is required to make a normal settable concrete after the addition of cement to the chuted constituents, draining off the excess of water until the aggregate constituents are no more than saturated, and then mixing cement with the saturated aggregate constituents in proper proportion to form a normal settable concrete.

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