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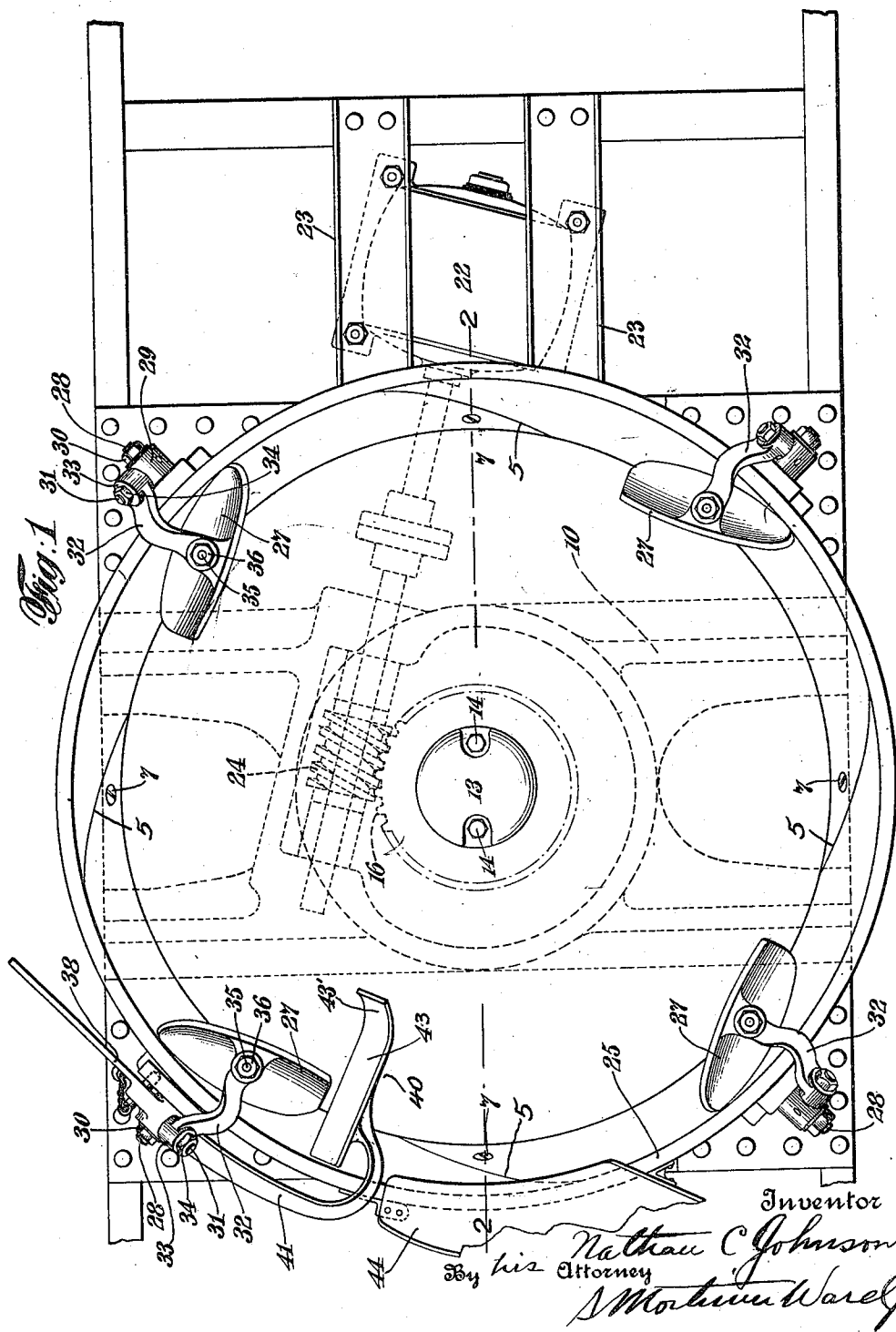
METHOD OF AND APPARATUS FOR MIXING CEMENT WITH OTHER INGREDIENTS.

APPLICATION FILED MAY 29, 1918.

Patented Oct. 7, 1919.

5 SHEETS—SHEET 1.

1,318,282.



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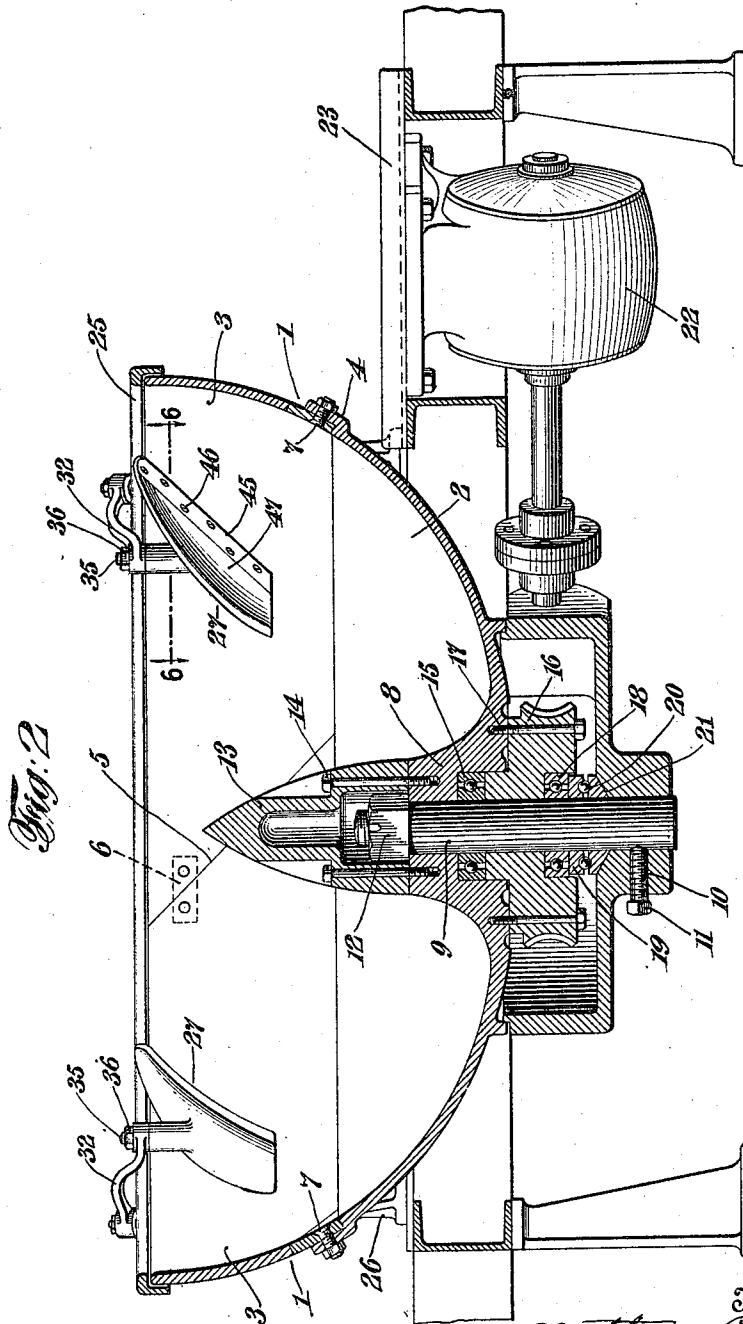


Fig. 2

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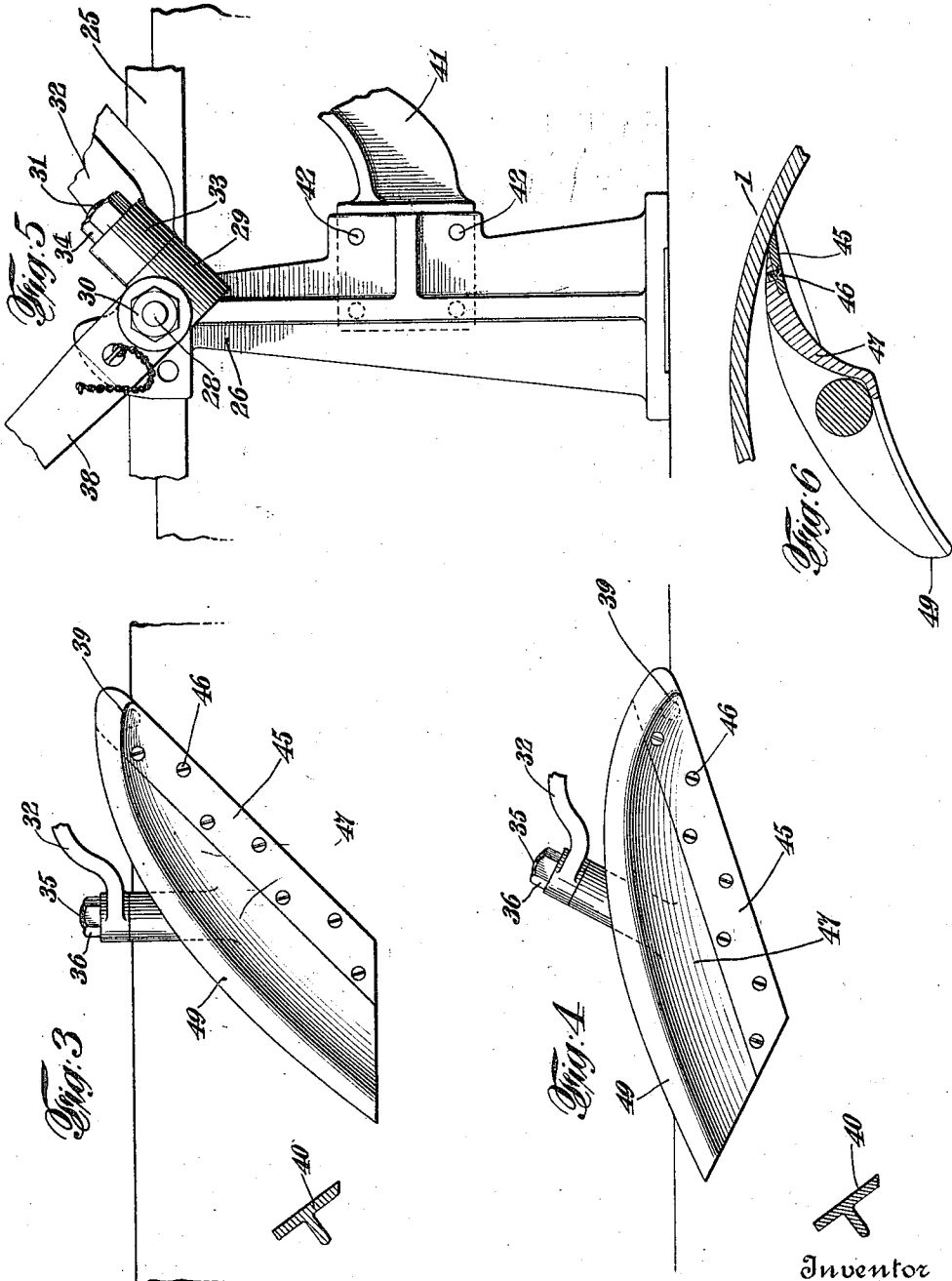
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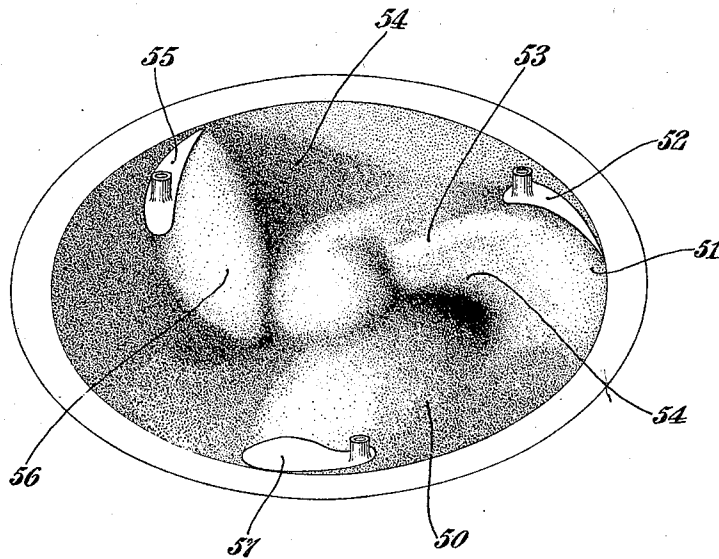
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5 SHEETS—SHEET 4.

Fig. 7



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METHOD OF AND APPARATUS FOR MIXING CEMENT WITH OTHER INGREDIENTS.

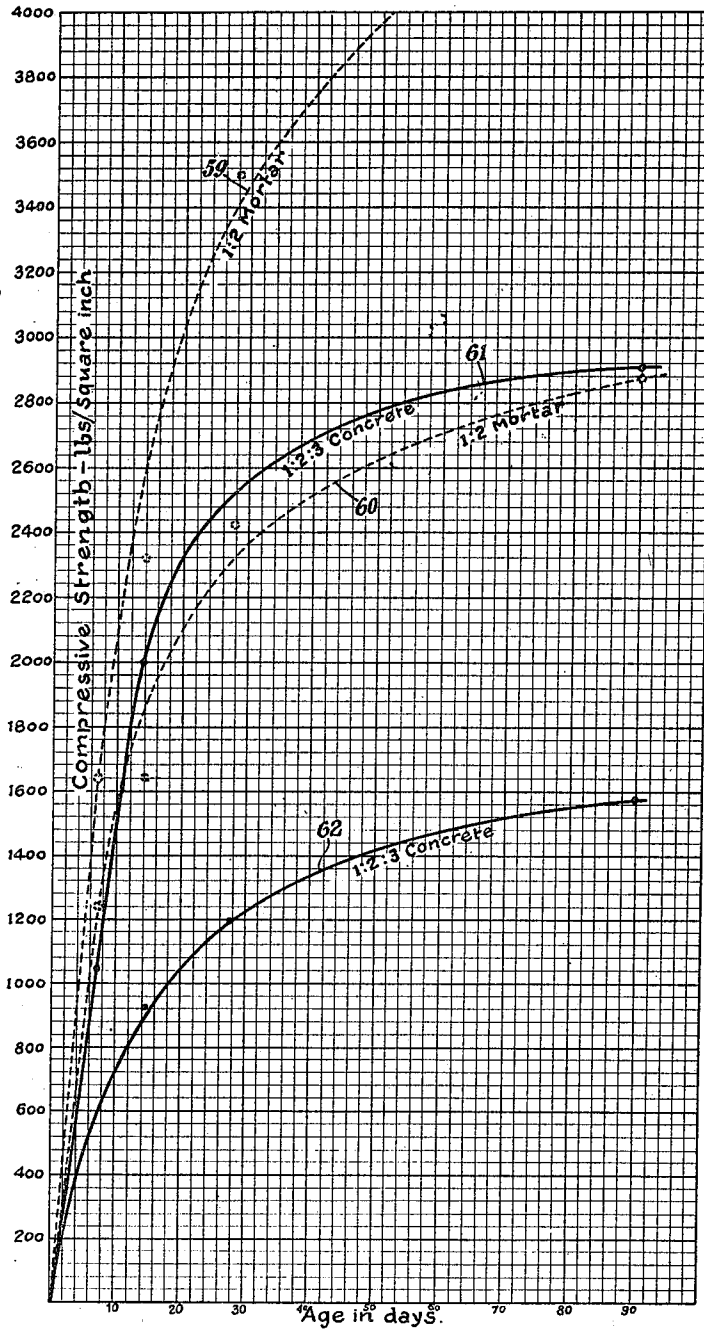
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5 SHEETS—SHEET 5.

Fig. 8



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR MIXING CEMENT WITH OTHER INGREDIENTS.

1,318,282.

Specification of Letters Patent.

Patented Oct. 7, 1919.

Application filed May 29, 1918: Serial No. 237,216.

To all whom it may concern:

Be it known that I, NATHAN C. JOHNSON, a citizen of the United States, and a resident of Englewood, county of Bergen, and State of New Jersey, have invented certain new and useful Improvements in Methods of and Apparatus for Mixing Cement with other Ingredients, of which the following is a specification.

My invention relates to methods of and apparatus for mixing cement with other ingredients, and it is especially useful in mixing concrete.

Heretofore, concrete has been mixed in various ways and by different kinds of apparatus. The machine now most generally used for mixing concrete consists of a slowly rotating horizontal or inclined drum open at each end or at one end, and carrying inner blades or blades and buckets which cut the mass, elevate it to a certain distance, from whence by gravity it is spilled back to the bottom of the drum, in repeated cycles until the mixture is adjudged made. The unmixed ingredients are fed in at one end and the mass is discharged either at the other end through a suitable chute moved into position to receive the mass as spilled from the buckets, or through tilting of the drum. Machines of this type are slow in operation and output and are clumsy, the actual capacities of such mixing means averaging approximately 500% greater than the actual volume of maximum batch accommodated.

Various other machines have been used, such for example as one having a series of spiraled mixing paddles which rotate slowly in an open trough, mingling the mass while conveying it through the machine. Due to the mixing actions of such machines, it is impossible with them to obtain a proper quality of concrete in the comparatively short period of time ($\frac{1}{2}$ to 1 minute) allowed in practice for mixing a batch; and when concrete is thus not properly mixed, its structure is not uniform, homogeneous and dense in texture, but is, on the contrary, heterogeneous, non-uniform, porous and weak. Inasmuch as the output of a concrete mixing machine directly affects the cost and speed of building concrete structures, and as its quality determines their values and endurance, it is important to provide mixers having not only a large output, but also those that by their mixing action shall produce material having the character desired.

The mixing of concrete by utilizing the action of centrifugal force to a greater or less degree has also been described from time to time in patents, but my invention contemplates a different kind of action and constitutes an improvement over these proposed devices. According to my invention, the mass of ingredients is subjected to strong centrifugal force and is moved at high velocity and is compacted, in such manner as to effect interparticle attrition and a rapid mixture of the ingredients without undue aeration, and this method of mixing the mass is carried out by very compact, simple and inexpensive apparatus.

It is well understood that the inert ingredients of concrete, such as sand and gravel, or stone, are "cemented" or "glued" together by the physico-chemical actions of the cement in setting. And it is also appreciated that in gluing any substances together, to produce thorough union, the surfaces must be clean. In the mixing of concrete, too little attention has been paid to this fundamental necessity, largely because of the difficulty of carrying out economically any process for the adequate cleansing of materials. It is the practice to sometimes wash sand, and gravel or stone with water before incorporating them with cement, but this not only entails additional time, labor and expense, but it also does not remove foreign coatings inhibitive of such gluing, except those that might be readily dissolved or washed away by a simple fluxing with water.

It is also a fact that air bells adhering to the solid particles when these are wetted with mixing water are productive of voids in the set concrete; and that minute lumping of very fine cement particles is common in commercial cements due to slight hydration by steam treatment at mills, or by contact with moist air; and that these cut down the efficiency of use of cement in all concretes as usually made.

Grouping and surface hydration of cement particles before use particularly reduces the strength of concrete by preventing thorough and uniform hydration of the cement and its utilization in sufficient quantity to bring about complete coating of the inert particles by the hydrated cement, as is essential for proper results.

Unclean surfaces of inert particles; the presence of weak particles, such as mica; the lumping or surface hydrating of cement;

and the occlusion of air—all tend to produce concrete that is structurally weak and un-uniform, through "voids", feebly united surfaces and particles which make it a reticulated mass in place of a homogeneous solid. Commercial practice has therefore become reconciled to these detrimental features and has set its standard for concrete at a low level both in strength and in endurance.

This standard, however, is unsatisfactory. Greater strength, density, uniformity and reliability of concrete structures are being insistently demanded, as for example, in ship constructions, etc. There is need, therefore, for means to overcome these various deficiencies incident to usual methods; and this should be effected without reduction in output.

The principal objects of my invention then, are to produce a novel and efficient method of mixing cement with other ingredients (particularly in the making of concrete), and novel and efficient apparatus for carrying out the same, whereby these detrimental factors are overcome.

My invention consists in the process hereinafter set forth according to the preferred manner of practising the same, and in the novel features and combinations of parts hereinafter shown and described in their preferred forms; and the invention is more particularly set forth in the appended claims.

Further objects and advantages of the invention will more fully appear from the following description and the accompanying drawings illustrating the preferred form of mixing machine.

In carrying out my invention, I effect interparticle attrition sufficient to scour all particles, and compacting of the mass sufficient to release entrained air under the action of centrifugal force and high-velocity mass flow. This interparticle attrition is sufficiently violent to elevate the temperature of the mass; to scour the inert particles and remove from their surfaces dirt and foreign coatings; to scour the cement particles and remove any preuse surface hydrations, to break off weakly attached parts, and to break down and comminute fragile particles; to break up and separate small lumps or groupings of cement particles; and to thoroughly mix the cement and water so as to form a cementitious fluid of superior hydration with which the inert particles are intimately contacted, while the compacting squeezes out of the mass air bells released by scouring of particles, so that in a mixing operation of brief duration a batch of thoroughly mixed concrete having uniform consistency and improved strength is produced.

According to the preferred manner of practising my process, as for example in

the mixing of Portland cement with water, sand and stone or gravel for forming concrete, I place the ingredients in a suitable rotary container, preferably an upright bowl with curved outwardly flaring side walls, and while the ingredients are being placed therein, or after they have been placed therein, the container is rotated rapidly so as to subject the batch while confined therein, to such centrifugal force as to produce high velocity mass flow. I have found that a peripheral velocity of the bowl of approximately 1500 feet per minute is sufficient to give the desired velocity and flow to the mass when apparatus of the character shown herein is utilized. Under the momentum of the mass it is caused to circulate at high velocity in a steady continuous stream along one or more predetermined paths (determined by the shape of the container and the location and shape of the mass-deflecting devices) rapidly changing in direction, in such manner as to produce compacting of the mass during said circulation together with violent interparticle attrition so as rapidly to scour all particles of the mass and thoroughly mix and incorporate the same with the cement and the water in a substantially uniform mass without undue aeration.

The preferred manner of carrying out the process will be more readily understood from the following description taken in connection with the accompanying drawings illustrating the preferred form of machine for carrying out the process, and also forming a part of my invention, and in which—

Figure 1 is a plan view of a concrete mixer embodying the preferred form of my invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a part of the apparatus showing the contour of the inner face of the mixing blade;

Fig. 4 is a similar view with the lower end of the blade lifted;

Fig. 5 is an enlarged detail showing the supporting stanchion for the mixing and deflecting blades;

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 2 looking in the direction of the arrow;

Fig. 7 is a perspective view of the interior of a concrete mixer in operation, showing the action of the mass therein; and

Fig. 8 illustrates some comparative plotted curves.

Referring to the drawings (Figs. 1 and 2) 1 is a vertical mixing bowl the depth of which is equal to about one-half of its diameter. The bowl has curved outwardly flaring walls with a slight flattening at the bottom, and is preferably made up in sections. It is shown in its present form as consisting of

a bottom section 2 and a plurality of upper sections 3, preferably of hard metal, such as cast steel. The sectional construction reduces cost of manufacture and enables worn portions to be replaced without scraping the entire bowl. The lower section 2 is provided with an offset flange 4 so as to provide a shoulder for receiving the upper sections 3. There may be any suitable number of these sections 3, and they preferably have their abutting edges chamfered so as to fit one another obliquely, as shown by line 5. This is of special advantage in view of the scraping action of the mixing blades against the sides of the bowl. The adjacent upper sections are held together in any suitable manner such as by butt straps 6, and are secured to the lower section 2 in any suitable manner, as by bolts 7, the heads of which are countersunk in the inner face of the bowl.

From the bottom of the bowl extends a central projection 8 for receiving the stationary shaft 9 secured to the supporting base 10 by a set screw 11. The upper end of the shaft 9 is threaded and the bowl is held from any upward movement by means of a nut 12 on this threaded portion. The upper end of the shaft and nut are inclosed by a protecting cap or housing 13 which tapers upwardly and is cylindrical in section. This cap is held in place on the projection 8 by means of bolts 14. A ball bearing 15 is mounted on the shaft 9 within the projection 8, and a worm gear 16 is secured to the bottom of the bowl by bolts 17 with its hub extending into the recess and against the bearing 15. The lower face of the gear is recessed to receive ball bearing 18 and an upper plate 19 of a thrust bearing 20. The lower plate of this thrust bearing fits in a recess 21 in the supporting frame 10.

The bowl is driven in any suitable manner, as for example by an electric motor 22 suspended from supporting beams 23 and driving a worm 24 meshing with the worm wheel 16.

A suitable stationary guard ring 25 is provided for the rim of the bowl, and is supported in any suitable manner, as for example by being bolted to upright stanchions 26 (see Fig. 5). There are a series of these stanchions surrounding the bowl, four in this case, each of which supports a suitable mixing blade 27 secured to the stanchion as follows: Each stanchion is provided with a lateral projection or boss 28 for receiving a member 29 which is fitted thereon and secured rigidly thereto and held in place by a nut 30. The member 29 is provided with a spindle or pin 31 extending upwardly therefrom in a plane substantially tangent to the rim of the bowl at that point, and at an angle of approximately 45 deg. to a vertical plane through the lateral projection 28

(which would be a radial plane through the base of pin 31). On the pin is pivotally mounted an arm 32 having a hole 33 fitting over the pin and secured thereon by a nut 34. To the other end of the arm 32 is suitably secured the mixing blade 27. This is preferably effected by having the end of the bracket bored out, and into this hole extends a pin 35 from the back of the blade, the pin being secured to the arm by a nut 36. The object of having the spindle or pin 31 extend at an angle to the vertical plane, is to permit the mixing blade to be held by gravity in proper position against the bowl, as hereinafter described.

Each of the mixing blades 27 is arranged and secured as described, except that one of the supporting members 29 is pivotally mounted on its supporting pin 28 so that it can be rocked about the same, and it is provided with a handle 38 for rocking it about the pivot to lift and lower the blade. The arrangement and construction of the blade, arms and pivots are such that as the handle 38 is lowered, the rear portion of the blade is lifted or tilted as shown in Fig. 4, the blade in this movement pivoting substantially about its forward point 39, which remains substantially fixed in position.

A discharge blade 40 is located behind the tilting mixing blades 27, the location being such that normally the discharge blade is shielded by the mixing blade from the flowing mass, but when the blade is tilted up, the mass will strike the discharge blade and be discharged over the rim, as hereinafter described. As shown in Fig. 5, this discharge blade is supported at the end of a curved arm 41 the lower end of which is bolted at 42 to the same stanchion supporting the tilting blade. This discharge blade has a relatively long narrow flat mass-engaging surface 43 located radially within the bowl, with its upper edge tilted backward in the direction of rotation of the bowl approximately 45 deg. from the vertical. The longitudinal axis of the deflecting surface lies in one of the horizontal radii of the bowl in a plane slightly above the lower edge of the mixing blade while the inner end 43' of the blade is curved upwardly. I have found that a blade shaped and located as shown and described, is very effective in engaging the rapidly flowing mass and directing it over the side of the bowl into a suitable chute a part of the mouth of which is shown at 44 as secured to the guard ring 25.

The shape and position of the mixing blades 27 are best shown in Figs. 2, 3, 4 and 6. The blade is preferably cast and made fairly heavy, and the outer portion adjacent the side of the bowl is provided with a chilled or hardened section 45 secured to the body of the plate in any suitable manner, as by countersunk screws 46.

The object of this is to provide a durable mass-engaging edge. In the present machine this edge fits or contacts with the side of the bowl substantially throughout its length, and by reason of the abrasive action of the materials in the rapidly flowing mass, and the scraping of the entering edge against the sides of the bowl, it will be rapidly worn down unless it is hardened. It is also important to have it hardened so that a fairly sharp entering edge may be maintained to cleanly and smoothly divert the mass from the sides of the bowl.

The inner or mass-engaging face 47 of the blade is preferably concaved along its length as well as across its width, and the blade is so located and positioned against the side of the bowl that the blade forms an acute angle with the side of the bowl to the rear of the entering edge, the inner face of the blade being inclined forwardly and inwardly against the direction of flow of the mass, so that the blade somewhat overhangs its entering edge which is inclined upwardly and against the direction of flow of the mass, the top of the entering edge terminating approximately at the rim of the bowl. The concaving of the inner face of the blade starts somewhat gradually at the upper extremity of the entering edge and increases its curvature toward the center, from which position the curvature is gradually lessened toward the trailing or discharge end of the blade. The object is to provide a deflecting blade which will engage the high-speed mass as it flows upwardly along the sides of the bowl and turn it therefrom and divert and direct it toward the center of the bowl in as smooth, solid and steady a stream as possible so as to reduce to a minimum any splashing or aeration of the mass.

The mixing blade is provided with an up-turned flange or cowl 49 extending along its upper edge to facilitate the smooth flow of the material and avoid splashing. It will also be seen by this arrangement and construction of the blades that the action of the mass against the blades tends to hold them firmly against the side wall of the bowl.

Mixing blades as herein shown and described have proven very efficient because the blade first engages the most rapid flowing portion of the mass, namely, that adjacent the rim of the bowl, and takes this top portion of the mass and diverts and turns it over first, thereafter progressively engaging the mass toward the lower portion of the side of the bowl, and the top or more rapidly flowing portion of the mass is, by reason of the shape of the inner surface of the blade, directed along the longer path of flow, toward the center of the bowl, than the portions of the mass lower down. Thus not only is the top and more rapidly

flowing portion engaged and turned over first, but the mass is so guided that while its direction is rapidly and abruptly changed by these mixing blades, it is accomplished in such manner as to cause the mass to be compacted against the face of the blade and made to flow in a steady smooth stream to avoid aeration.

The contour of the bowl is such as to permit the material to flow outwardly and upwardly toward the rim of the bowl under the action of centrifugal force, at the same time securing the desired compacting of the material by pressure against the sides of the bowl. The upwardly curving bowl permits the mass to flow outwardly in a smooth stream, but its inclination is such as to give sufficient resistance to the outward flow of the material to cause it to be compacted by pressure against the side walls as it flows, so as to increase the interparticle attrition and squeeze out or liberate entrained air; while the action of the mixing blades on the mass is such as to continue this compacting of the mass and interparticle attrition therein.

The particular paths taken by the mass will be determined by the shape and location of the deflecting blades and the shape of the bowl.

In Fig. 7 is shown a perspective view of the interior of a concrete mixer illustrating the manner in which the mass is caused to flow for mixing concrete according to my invention. The particular machine, more or less diagrammatically shown in this view, contains three mixing blades instead of four.

Referring to Fig. 7, the operation is as follows: The ingredients of the concrete are emptied into the bowl, which is then rotated at relatively high speed—such as to produce a peripheral velocity preferably of approximately 1500 feet per minute. As the bowl is speeded up, the mass is impelled under the action of centrifugal force outwardly and upwardly along the inclined curved sides of the bowl in a spiral path. The flow of the mass in the bowl may be traced as follows: Commencing, for example, at point 50, the rapidly flowing mass sweeps upwardly and outwardly in a spiral path toward the rim of the bowl as it is moved around with the rapidly rotating bowl, and at 51 the upper portion of the entering edge of the deflecting blade 52 engages the extreme upper portion of the onwardly sweeping mass and diverts it from the side of the bowl along the inner face of the deflecting blade in such manner as to turn the mass back on itself and toward the central portion of the bowl. All of that portion of the mass which has been impelled upwardly on the side of the bowl in front of the blade 52 and to the height of the blade, is thus deflected away from the side and to the central portion of the bowl, as shown at 130

53. This deflected portion of the mass is impelled inwardly in a smooth steady stream, and the contour of the blade, as heretofore described, is such that the velocity of the deflected portion of the mass is reduced as little as possible by the deflecting action.

The deflected mass is concaved in cross-section, as indicated by the shaded portion at 54. It strikes the central portion of the bowl at such an angle that its momentum is added to the impelling centrifugal force in moving this portion of the mass outwardly and upwardly along the opposite side of the bowl.

That portion of the mass which is being impelled upwardly and outwardly on the side of the bowl at 54, is in like manner caught by blade 55 and deflected to the central portion of the bowl as shown at 56; and likewise with the blade 57. Most of that portion of the mass deflected by blade 52, for example, does not again reach the upper portion of the bowl in time to be caught and deflected by the next succeeding blade 55, but reaches it in time to be caught and deflected by the second succeeding blade, namely, 57. In other words, the flow of portions of the mass is such as to engage every other blade. There are thus in this instance three distinct paths or cycles over or through which the mass flows in very swift smoothly flowing streams, during which the mass is turned, commingled, and compacted as and for the purposes heretofore described. The interparticle attrition has been found to be so extensive as to actually increase the temperature of the mass approximately 10° F. in two minutes of mixing time.

The raising of the temperature of the mass is a highly desirable feature, since it increases the reaction of the cement with the water, thus effecting a more rapid and complete transformation of the powdered cement into liquid form and increasing its concentration and usefulness.

By utilizing the described process and the preferred form of mixing apparatus as shown and described herein, large batches of concrete may be rapidly and thoroughly mixed. A charge of ingredients sufficient to fill the bowl to about two-thirds of its capacity can be thoroughly and uniformly commingled in about 20 seconds.

In Fig. 8 two sets of plotted curves are shown illustrating the comparative strengths of set mortars and concretes as mixed by hand and as mixed by my process. The ordinate of these curves is in compressive strength per square inch, while the abscissa is in age in days. The curve 62 is one illustrating the compressive strength of a 1:2:3 concrete carefully mixed in the laboratory by hand for twenty minutes, while curve 61 is a concrete made of the same proportions and ingredients mixed according to my invention for two minutes, and curve 60 illus-

trates the compressive strength of a 1:2 mortar carefully mixed in the laboratory by hand for twenty minutes, and curve 59 illustrates a mortar of the same proportions and ingredients mixed for two minutes according to my invention. A twenty-minute hand mix is an acceptable standard; and concrete properly mixed by hand for this length of time is superior to concrete mixed with machines for the time interval now used in commercial operations.

By comparing curves 61 and 62 it will be seen that concrete ninety days old made by a careful hand mixing shows a compressive strength of less than 1600 pounds per square inch, while concrete of the same proportions and ingredients made according to my invention and of the same age, shows a compressive strength of approximately 2900 pounds per square inch. By comparing curves 60 and 59 it will be seen that a mortar made by hand mixing and fifty days old, shows a compressive strength of a little over 2600 pounds per square inch, while a mortar of the same ingredients and proportions made according to my invention shows a compressive strength of almost 4000 pounds per square inch, and at this point the curve is shown with practically no tendency to flatten out. It will be observed from these curves that not only is the concrete or mortar, after being allowed to stand for a few months, vastly improved in strength when mixed according to my invention, but that it shows a decided increased strength while newly set or fairly green. This, of course, has its advantages in permitting more rapid building operations in many instances.

While I have described my invention according to the preferred manner of carrying out the same, and have illustrated and described preferred forms of machines embodying the same, it will be obvious to those skilled in the art, after understanding my invention, that various alterations, modifications and substitutions may be made without departing from the spirit and scope of the invention, and I aim in the appended claims to cover all such modifications.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. The method of mixing cement and water in batches with or without other ingredients, which comprises subjecting the batch while confined within the side walls of a container, to such centrifugal force as to produce high velocity mass-flow of the batch, causing the particles of the mass to be compacted during their centrifugal flow, and diverting the rapidly moving mass while still compacting it, and causing it to flow into position where it is again moved and compacted under the influence of the centrifugal force, and continuing the cycle until

the batch is mixed, thereby effecting the mixing with compacting and interparticle attrition.

2. The method of mixing cement and water in batches with or without other ingredients, which comprises subjecting the batch while confined in a container, to such centrifugal force as to produce high velocity mass flow of the batch, and under centrifugal force and momentum causing the mass to circulate rapidly in a continuous stream along one or more predetermined paths rapidly changing in direction, and in such manner as to cause the particles of any particular portion of the mass to be compacted together during and at the end of its centrifugal flow, thereby effecting the mixing by distribution and with compacting and violent interparticle attrition under the influence of centrifugal force.

3. The method of mixing cement and water in batches with or without other ingredients, which comprises subjecting the batch while confined in a container, to centrifugal force and high velocity movement, causing the particles to be compacted under the action of centrifugal force, and at the end of said action on any particular portion of the mass diverting it while continuing the compacting of the particles of said portion, and causing it to flow at high velocity into position where it is again brought under the action of centrifugal force, and continuing the cycle causing the mass to circulate in one or more steady streams until it is mixed.

4. The method of mixing cement and water in batches with or without other ingredients, which comprises subjecting the batch while confined in a container to such centrifugal force as to produce high velocity mass flow of the batch therein, and under the momentum of the mass causing it to circulate in such manner as to produce interparticle attrition sufficient to substantially raise the temperature of the mass in a brief time interval and without substantial aeration thereof.

5. The method of mixing cement and water in batches with or without other ingredients, which comprises subjecting the batch while confined in a container to such centrifugal force as to produce high velocity mass flow, and causing it to circulate at high velocity in a steady continuous flow along one or more predetermined paths rapidly changing in direction in such manner as to produce compacting of the mass and during such circulation interparticle attrition sufficient to thoroughly scour adherent coatings from the particles, substantially to raise the temperature of the mass and to incorporate the particles in a mass of highly uniform composition and consistency, in a brief mixing period.

6. In a machine for mixing cement with

other ingredients, the combination of an upright rotatable container with side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and one or more stationary mass-deflecting devices positioned adjacent the side of the container with a mass-entering edge extending upwardly toward the rim of the container from a point below the same and with a concave mass deflecting face overhanging said edge so as to engage the rapidly moving mass at the sides of the container and cause it to be turned therefrom and projected into another position in the container where it may again be acted upon by centrifugal force.

7. In a machine for mixing cement with other ingredients, the combination of an upright rotatable container with sloping side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and one or more stationary mass-deflecting devices positioned adjacent the side of the container and having a mass-entering edge portion inclined upwardly and against the direction of rotation of the container and lying closely adjacent the sides of the container so as to engage the moving mass at the sides of the container, engaging the upper portion of the mass first, and having a concaved mass-engaging face, whereby the rapidly moving mass is diverted from the side of the container, turned over and projected into another position in the container where it may be again acted upon by centrifugal force.

8. In a machine for mixing cement with other ingredients, the combination of an upright rotatable bowl with upwardly and outwardly sloping side walls, adapted to receive the mass of ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and one or more stationary mass-deflecting devices positioned adjacent the side of the bowl and having a mass-entering edge portion inclined upwardly and against the direction of rotation of the bowl and forming a vertical acute angle with the side of the bowl from the upper or leading portion of said entering edge, the mass-engaging face being broad and concaved curving over and inclining inwardly toward the central portion of the bowl so as to cause the material to be turned over in a smoothly flowing stream from the side of the bowl and directed inwardly of the bowl and delivered adjacent the central portion thereof in a continuous and rapid stream.

9. In a machine for mixing cement with

other ingredients, the combination of an upright rotatable container with sloping side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and one or more stationary mass-deflecting devices positioned adjacent the side of the container and freely supported so as to be moved by gravity against the sides of the container and be self-seating against the same and having a mass-engaging face positioned to engage the rapidly flowing mass under pressure and divert the mass from the side of the container into another position in the container where the mass may again be acted upon by centrifugal force.

10. In a machine for mixing cement with other ingredients, the combination of an upright rotatable container with sloping side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and one or more stationary mass-deflecting devices positioned adjacent the side of the container and having a mass-engaging face for engaging the rapidly flowing mass and diverting the same from the side of the container into another position therein where the mass may again be acted upon by centrifugal force, said deflecting device being pivotally supported about an inclined axis so as to gravitate downwardly against the side of the container in position where it is pressed against the side by engagement of its face with the rapidly flowing mass.

11. In a machine for mixing cement with other ingredients, the combination of an upright rotatable container with sloping side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, and a long and relatively narrow discharge blade having one end adjacent the side of the container and having its longitudinal axis extending in a radial direction toward the center of the container and with its mass-deflecting face inclined backwardly from its entering edge in the direction of flow of the mass to form an acute angle with the vertical.

12. In a machine for mixing cement with other ingredients, the combination of an upright rotatable container with sloping side walls, adapted to receive the ingredients to be mixed and rotatable at such speed as

to subject the ingredients to the action of centrifugal force and cause them to be moved at high velocity, one or more stationary mass-deflecting devices positioned adjacent the side of the container for engaging the mass adjacent the side of the container to divert it into another position in the container where it may again be subjected to centrifugal force, means for lifting said deflecting device from its mass-engaging position, and a discharge blade located behind said mass-deflecting device in position to engage the flowing mass and discharge it over the side of the container when said mass-deflecting device is lifted, but being normally shielded from the flowing mass by said mass-deflecting devices during the mixing operation.

13. In a machine for mixing cement with other ingredients, the combination of an upright rotatable bowl having sloping sides, adapted to receive the ingredients to be mixed and rotatable at such speed as to cause the mass of ingredients to be impelled by centrifugal force outwardly, upwardly and along the walls of the bowl with high velocity mass flow, and a long and relatively narrow discharge blade having one end adjacent the side of the bowl and having its longitudinal axis extending substantially radially toward the center of the bowl with its mass deflecting face inclined backwardly from its entering edge in the direction of flow of the mass to form an acute angle with the vertical, and having its inner end curved upwardly and opposite the direction of mass flow.

14. In a machine for mixing cement with other ingredients, the combination of an upright rotatable bowl adapted to receive the ingredients to be mixed, and one or more stationary mass-deflecting devices positioned adjacent the sides of the bowl and having an entering edge adapted to engage the side of the bowl and turn the mass therefrom during the mixing operation, the upper portion of said bowl where engaged by the entering edge of said deflecting device being made of replaceable sections detachably secured to the bottom portion of the bowl and fitted one to the other along lines inclined to the engaging entering edge of said deflecting device, so as to provide smoother engagement between the said entering edge and the joints of said removable sections during the rotation of the bowl.

In testimony whereof, I have signed my name to this specification.

NATHAN C. JOHNSON.