

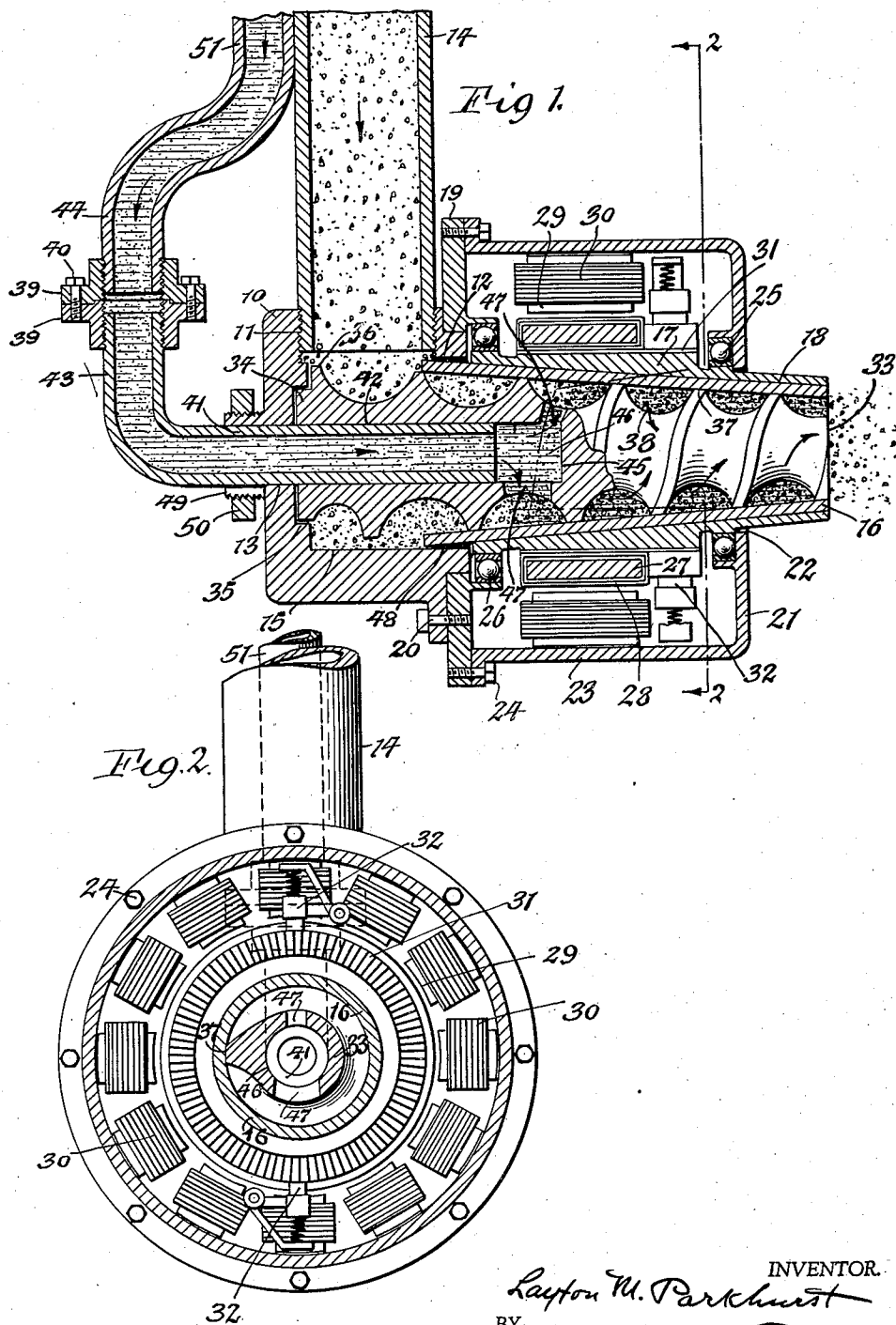
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L. M. PARKHURST

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APPARATUS FOR MIXING AND PLACING CONCRETE

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INVENTOR.
Layton M. Parkhurst
 BY *Papp & Papp*
 ATTORNEYS

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APPARATUS FOR MIXING AND PLACING
CONCRETE

Layton M. Parkhurst, Buffalo, N. Y.

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This invention relates to apparatus for mixing and placing concrete. Heretofore concrete was completely prepared in condition for use and fed in this condition to an apparatus which applied the same to a surface intended to receive the same. Concrete in this previously prepared form is very heavy and not only requires a sturdy apparatus for handling the same but also consumes an undue amount of power for projecting the concrete against the receiving surface.

The object of this invention is to provide a portable apparatus whereby the various materials entering into the composition of the concrete are mixed in situ and immediately delivered to the parts adapted to receive the same, thereby permitting of making the apparatus comparatively light and easily operable, as well as consuming less power and also delivering the concrete in fresh form to the receiving surface so that its maximum strength is retained.

Another object is to provide such a portable apparatus whereby the concrete is applied as comparatively dry mix and provides a stronger concrete with a smaller amount of cement.

In the accompanying drawing:

Fig. 1 is a vertical longitudinal section of satisfactory form of apparatus which embodies this invention.

Fig. 2 is a vertical transverse section of the same taken on line 2-2, Fig. 1.

The main frame of the apparatus preferably includes a hollow body 10 which is provided on its top wall with an inlet opening 11, in its front wall with outlet opening 12, and on its rear wall with a conduit opening 13. Above the body is arranged a vertical supply pipe or conduit 14 through which a dry aggregate, such as gravel or other aggregate, is carried into the receiving chamber 15 formed within the body. The aggregate supply pipe is secured by a screw joint or otherwise in the inlet 11 of this chamber while its upper end is adapted to receive the dry aggregate from any suitable source. In the operation of the apparatus the dry aggregate flows by gravity from the source of supply through this pipe and into the receiving chamber preparatory to being mixed with a water and cement emulsion to form a semi-wet ready to use concrete mixture which can be projected onto the surfaces intended to receive the same.

In front of the receiving chamber is arranged a horizontal conical mixing and delivery tube 16 which is of forwardly tapering form and has its rear end projecting through the outlet 12 of the receiving chamber and into the interior of the

latter so that the dry aggregate can flow from this chamber forwardly into the mixing tube. This tube is preferably constructed of steel or other suitable metal or material which is capable of hard use and adapted to be replaced when worn by the concrete ingredients flowing forwardly therethrough in contact with the bore of the tube. In the operation of this apparatus the mixing tube is rotated about its longitudinal axis and for this purpose the same is preferably mounted and driven by an electric motor as follows:

The numeral 17 represents the longitudinal shaft of an electric motor provided with a forwardly tapering axial socket 18 into which the conical periphery of the mixing tube 16 is removably fitted. This shaft and mixing tube engage each other sufficiently tight so that they are normally coupled frictionally and are caused to turn together. This shaft is rotatably supported on a housing which forms part of the main frame of the apparatus and also forms an enclosure for the electric motor whereby this shaft is rotated. In its preferred form this housing, as shown in the drawing, comprises a vertical rear wall 19 which may be secured to the front side of the body 10 around the front outlet thereof by screws 20 or other suitable means, a vertical front wall 21 provided with an opening 22 which receives the front part of the motor shaft, and a longitudinal side wall 23 which has its front end integrally connected with the front wall 21 and its rear end detachably connected by screws 24, or otherwise, with the rear wall of the housing. The shaft may be journaled on this housing in various ways, for example by ball bearings 25, 26 interposed between the inner sides of the front and rear walls 21, 22 and the adjacent parts of this shaft. The electric motor for driving the shaft and the parts connected therewith is arranged within the housing and may be of any suitable construction, but, as shown in the drawing, the same preferably comprises a rotor having an annular armature 27 mounted on the periphery of the shaft and provided with a coil 28, a stator or electric field having an annular row of cores or poles 29 mounted on the inner side of the housing around the armature and provided with coils 30, and a commutator having an annular row of contact strips, bar or segments 31 mounted on the shaft, and brushes 32 mounted on the housing and adapted to successively engage the commutator bars for conducting the electric current to the coils of the stator.

A propelling or feeding device is arranged

within the mixing tube and the receiving chamber whereby the ingredients entering into the composition of the concrete are thoroughly mixed and projected from the front end of the mixing tube toward the place which is to receive the concrete. In its preferred form this propelling device has the form of a forwardly tapering conical screw which turns with the mixing tube and has its body 33 provided at the rear end with a neck 34 which is arranged within a recess 35 in the rear wall of the receiving chamber 15 and its front end terminating at the front end of the mixing tube. By thus extending the rear end of the mixing screw into the rear wall of the receiving chamber a thrust bearing is provided for the mixing screw which maintains the same against rearward motion while moving the concrete materials forwardly and it also reduces the possibility of dry concrete materials getting between the rear end of the mixing screw and the rear wall of the receiving chamber and wearing the same unduly rapid.

The rear part 36 of the helical thread on the periphery of this screw is arranged within the receiving chamber and exposed to the inlet in the top thereof and the intermediate and front part 37 of this thread is arranged within the mixing tube and engages its conical summit with the conical bore of the mixing tube, thereby forming a helical passage 38 between the screw and the mixing tube from the rear end to the front end of the latter, as shown in Fig. 1. The mixing screw is fitted sufficiently tight in the mixing tube so that the frictional engagement between these members causes the same to turn together, but if desired additional fastening means may be provided for this purpose.

Means are provided for supplying a water and cement emulsion to the dry aggregate while the latter are being propelled forwardly through the mixing tube. In their preferred form this water-cement emulsion supplying means comprise a conduit having a lower L-shaped section and an upper S-shaped section which are detachably connected by flanges 39 applied to the opposing ends of these sections, and coupling screws 40 connecting these sections. The lower L-shaped conduit section has a lower inner horizontal part 41 which extends through the opening 13 in the rear wall of the receiving chamber and into a cylinder bore 42 formed axially in the rear part of the mixing screw and a vertical outer part 43 projecting upwardly from the horizontal part. The upper S-shaped section has its lower end 44 connected by the coupling 39, 40 with the vertical part 43 of the lower conduit and the upper part 51 of the S-shaped section is arranged close to the aggregate supply pipe 14 to secure compactness and is adapted to receive water-cement emulsion from any suitable source.

The horizontal inner or front part 41 of the water-cement emulsion supply pipe has its periphery in engagement with the cylindrical wall of the bore 42 in the mixing screw so that this periphery of the pipe 41 forms a journal or bearing around which the rear end of the mixing screw rotates when the apparatus is in use. The inner end of the same terminates short of the inner end 45 of this bore, thereby forming an emulsion distributing chamber 46 in the central part of the mixing screw. Communication is established between this distributing chamber and the helical passage 38 by means of one or more ports 47 formed in the mixing screw and leading from the distributing chamber to the

adjacent parts of the helical passage, as shown in Figs. 1 and 2.

In order to prevent any material creeping through the joint between the mixing tube and the main frame, this joint may be filled with a packing or gasket 48 of any suitable character.

A tight fit of the receiving chamber around the pipe 41 may also be produced for the purpose of avoiding leakage by providing the rear wall of the receiving chamber with a split collar 49 around this pipe section 41 and contracting this collar by a clamping nut 50 engaging with a screw thread on the conical periphery of this collar, as shown in Fig. 1.

In the operation of the apparatus dry sand, gravel or like aggregates are continuously supplied to the conduit 14 and the water-cement emulsion is also supplied continuously to the pipe 51, 43 while the motor is running at, say, 1800 R. P. M., and turning the mixing tube 16 and the mixing screw 33 rapidly about the longitudinal axis of the same. The dry aggregate is delivered from the conduit 14 into the receiving chamber 15 where it is taken hold of by the rear part of the screw thread of the mixing screw and forced into the mixing tube 16 in which the forward movement of this aggregate is continued by those parts of the screw thread which are arranged in this tube and finally ejected from the front end of this mixing tube. After the dry aggregate has entered the rear end of the mixing tube, a water-cement emulsion is added thereto, which emulsion passes from the lower end 41 of the water-cement emulsion supply conduit into the distributing chamber 46 of the mixing screw and radially outward through the ports 47 in the latter into the adjacent parts of the helical passage between the mixing screw and mixing tube which contains the dry aggregate. After the water-cement emulsion has been added to the dry aggregate the latter and the water-cement emulsion are moved forwardly by the wedge action of the thread of the mixing screw and during such movement the water-cement emulsion and dry aggregate are thoroughly and intimately mixed and produce a semi-wet but comparatively dry concrete in which the several constituents are uniformly distributed throughout the entire mass and form a product which upon drying possesses the maximum strength.

Owing to the high speed at which the mixing screw and tube are rotated the finished semi-wet concrete is discharged from the front outlet end of the mixing tube under high pressure and projected toward the surface or place which is intended to receive the same. The semi-wet concrete issues from the outlet of the mixing tube in the form of a powerful concentrated stream so that the concrete will be deposited on this surface with such force that it will cling thereto tenaciously and enter any crevices in the surface. This causes the concrete to adhere to this surface and become intimately bonded thereto and thus prevent the concrete from peeling or separating from this surface. The delivery of the semi-wet concrete immediately after the mixing of the same has been effected causes the same to retain its maximum strength and thus produce a strong and durable coating on the structure to which it is applied.

By making the mixing tube of forwardly tapering form and the mixing screw of gradually decreasing diameter from its rear end toward its front end, the forward movement of the concrete is gradually accelerated and the concrete is also

solidified and thus thrown at a high speed and in the form of a compact air-free mass against the surface which is intended to receive the same, thereby materially strengthening the structure to which the concrete is applied.

Inasmuch as the aggregate entering into the composition of the concrete produces an abrasive action on the surfaces, particularly those which contact the concrete while the same is under pressure, the periphery of the mixing screw and the bore of the mixing tube becomes worn in time and therefore replacement is required. Whenever, therefore, these members become worn to such an extent that renewal thereof is desirable or necessary this can be easily done by removing the screws 20 and disconnecting the housing from the body of the receiving chamber. This permits the mixing screw to be slipped off of the outlet section 41 of the water-cement emulsion supply pipe and the mixing tube to be removed from the outlet of the receiving chamber after which the worn mixing tube and mixing screw may be readily removed from the hollow motor shaft and replaced by new ones.

An important feature resides in the use of a water-cement emulsion and in mixing this emulsion with the aggregate just prior to delivery by the apparatus. I have found that in order to get the full adhesive value of Portland cement it is necessary to mix the cement in the water so as to provide as nearly perfect an emulsion of the cement and water as is possible. This admixture of the cement and water requires a certain time or a certain amount of violent mixing, shaking or agitating to effect emulsification, as in a mechanical mixer or emulsifier. This complete emulsification cannot be obtained in the short time of travel of the materials in the gun along the length of the screw or other projecting means. Therefore, in accordance with the present invention, this emulsification is accomplished by pre-mixing the cement in water to provide a water-cement emulsion before admixture with the dry aggregate in the gun. This is an important feature of the invention especially as by providing such a water-cement emulsion it is possible to obtain a much stronger concrete with a smaller amount of the more expensive component, that is, the cement. The admixture of a water-cement emulsion and the mixture of this emulsion with the dry aggregate as a part of the gunning operation eliminates quite a number of troubles encountered in the gun placing of concrete. With the gun application of concrete semi-wet or comparatively dry mixes of aggregate must be used and must be used within a certain time limit, approximately 45 minutes, or suffer loss of strength. With the present invention the material is applied immediately after the aggregate has been mixed with the water-cement emulsion. Further, the present invention eliminates the bulky and costly equipment which has heretofore been necessary to apply a semi-wet or dry mix, this comprising mixers, buggies, conduits, pipes, hose, etc., thereby effecting a very substantial economy in the cost of applying the concrete.

The mixture of the dry aggregate with the water-cement emulsion just prior to the application of the semi-wet or comparatively dry mix to

the wall or other surface to be coated, has been found to be entirely satisfactory inasmuch as a thorough mixing of the dry aggregate with the water-cement emulsion is not so important.

It has been found that the dry aggregate will continue to draw and absorb the emulsion even after it has been placed and that a high strength concrete is obtained in carrying out the present invention with smaller amounts of cement than has heretofore been necessary in the gun application of concrete.

This apparatus comprises comparatively few parts considering the work which is performed by the same; this apparatus contains no delicate parts which are liable to get out of order; the same is very light and thus capable of being conveniently transported from place to place for applying concrete directly on the surface wherever the job may be located, and the same enables concrete to be firmly applied to the surface to be coated with the expenditure of a minimum amount of power.

I claim as my invention:

1. A concrete mixing and placing apparatus comprising a receiving chamber having an inlet for the admission of aggregate materials and an outlet for the same, a mixing tube having its rear end communicating with said outlet, a rotatable screw arranged within said tube, and means for delivering water-cement emulsion to the space between said tube and screw, including a bore in said screw the rear end of which extends to the rear end of the screw and the front end of which communicates with the space between the screw and said tube, and a water-cement emulsion supply conduit having an outlet part which extends through the wall of said receiving chamber and projects into said bore.

2. A concrete mixing and placing apparatus comprising a receiving chamber having an inlet for the admission of dry aggregate materials and an outlet for the same, a mixing tube having its rear end communicating with said outlet, a rotatable screw arranged within said tube, and means for delivering water-cement emulsion to the space between said tube and screw, and said screw being provided at its rear end with a neck which projects into a recess in the adjacent wall of said receiving chamber.

3. A concrete mixing and placing apparatus comprising an electric motor operating at a speed in the order of 1800 R. P. M. and having an armature and a stator surrounding said armature and provided with field coils, said armature being provided with a coaxial bore, an open ended tube fixed in said bore and extending through said armature, a screw in said tube and fixed thereto and adapted to propel the concrete therethrough, means for separately supplying a stream of water-cement emulsion and a stream of aggregate to said tube in proportions to provide the desired final amounts of water, cement and aggregate for the concrete, the rapid rotation of said screw effecting intimate admixture, while traversing said screw, of said final amounts of water, cement and aggregate into concrete ready for placing and ejecting said concrete ready for placing at a high rate of speed from said tube.

LAYTON M. PARKHURST.