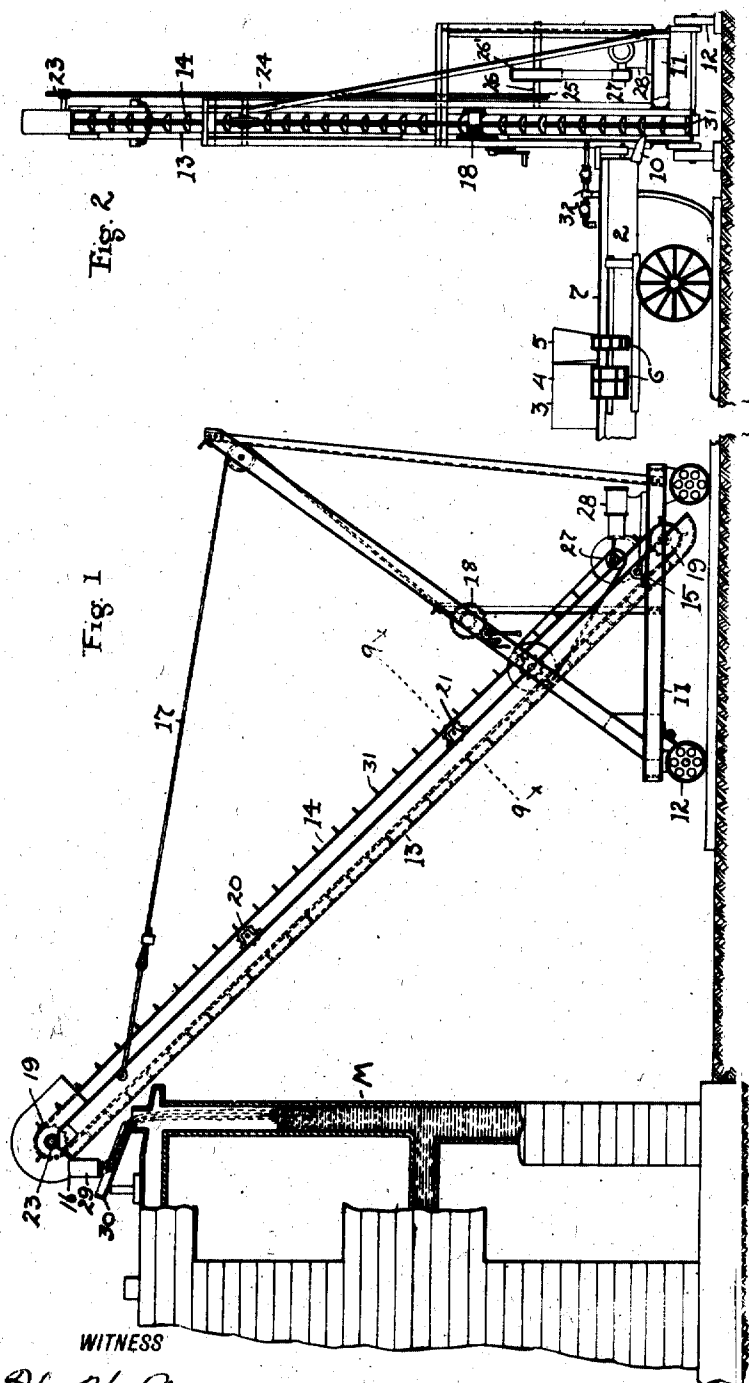


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MIXING AND TRANSPORTING CONCRETE.
APPLICATION FILED JUNE 1, 1915.

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Patented Mar. 27, 1917.

2 SHEETS—SHEET 1.

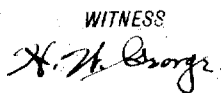


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MIXING AND TRANSPORTING CONCRETE.

1,220,338.

Specification of Letters Patent.

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Application filed June 1, 1915. Serial No. 31,382.

To all whom it may concern:

Be it known that I, DUDLEY S. HUMPHREY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Mixing and Transporting Concrete, of which the following is a specification.

10 My invention relates to an improved process and apparatus for mixing and conveying concrete, and the improvement consists in a mode of treatment of concrete mixtures by suitable instrumentalities, whereby the densest possible mixture to 15 eliminate the voids in the concrete mass may be obtained while forcing the mixture forward and upward to a distant place of use, all substantially as herein shown and described, and more particularly pointed out in the claim.

An ideal concrete is a mixture with a minimum percentage of voids, and to obtain the densest possible mixture, it is 25 desirable that the ingredients be thoroughly mixed, well graded and enough cement be used to obtain a rich mixture. The use of plenty of water will drive out the air entrained between the particles of the aggregates, and produce a mushy mixture 30 adapted to be poured. To prevent weakness the material should be poured immediately after mixing, and the tendency for the cement and sand to separate and form separate layers must also be prevented during 35 transportation and pouring.

My improved process and apparatus is especially designed to accomplish each and every desirable result as stated, particularly in erecting a structure having monolithic walls of concrete.

In the accompanying drawings, Figure 1 is a side view of a combined concrete mixer and transporting device employed by me in practising the process herein described, including a sectional view of a mold or form for a two story house. Fig. 2 is an end view of the combined mixer and transporting apparatus and a side view of a machine for proportioning the ingredients. Fig. 3 is a plan view of Fig. 2, and Fig. 4 is a sectional view somewhat enlarged, of the outer portion of the conveyer. Fig. 5 is a cross section on line 5-5, Fig. 4, and 55 Fig. 6 is a cross section on line 6-6, Fig. 4. Fig. 7 is a plan view, and Fig. 8, a

side view, of the lower or pivot end of the mixing conveyer. Fig. 9 is a cross section on line 9-9, Fig. 1.

The strength of concrete depends upon 60 the mixture employed, character of mixing, care and method practised in placing the mixture, protection afforded the work, and upon the age of the concrete. Sand, and broken stone, or gravel, mixed with cement 65 and water, is the usual mixture employed, but other materials than stone or gravel and substitutes for sand have also been used. The proportions of the materials is dependent upon the use to which the concrete is to be put, and a rich and wet mix 70 gives the best results in building structures having walls of monolithic character. In work of this kind and following my process I use a continuous mixing machine 2 in 75 which the sand, stone and cement is fed separately and concurrently in a dry state from separate hoppers 3, 4 and 5 by suitable chain carriers 6. These materials are deposited in definite and fixed proportions 80 into a receptacle 7 in which a shaft 8 having spirally arranged blades 9 is adapted to rotate and mix and feed the dry materials thoroughly together while continuously conveying them forward to a discharge spout 10 at the outer end of the 85 receptacle. Water is usually added to the materials at or near the discharge end of the receptacle. As it is very important to obtain a thorough and uniform distribution 90 of the cement, which is the vital element of concrete, the materials are mixed dry as a first step. Cement binds the particles of aggregate together, helps fill the voids, and gives density. The function of 95 water in the mixture is to develop the chemical activity of the cement; and the proportion and proper distribution of the water has an important bearing on the results attained. Both the time of setting 100 and the strength of the concrete are affected. The amount of water in the concrete also depends somewhat on the rate of running of the machine, and where large quantities of concrete have to be delivered 105 without intermission as in the construction of a house with monolithic walls, a continuous flow of water is necessary. Therefore, a thorough initial mixing of the dry materials is desirable to permit a constant 110 feed of uniform mix before adding the water and continuing the mixing operation.

The wet mixture, I have discovered, should be divided into small portions maintained under constant agitation and mixing while being conveyed to its ultimate place of use if the voids in the sand are to be filled and each grain is to be completely coated with cement and each stone covered with a film of mortar and so that the concrete will possess the maximum density and strength.

Where the concrete is discharged in a continuous stream at a considerable distance from its initial point of mix and delivery, it is also desirable and of advantage to produce a regurgitating action and mixing of the small divided portions of the wet mix, that is, to repeatedly transfer and mix parts or all of each small divided portion to and with the next portion more or less retrogressively as the wet mixture is being conveyed to its place of use.

The most convenient place for handling the materials and manipulating a machine is on the natural level or ground, and my present invention permits such placement of the machine while also permitting continuous mixing in the manner described and continuous delivery of the mixture for a considerable distance and to higher levels as in building the walls of a house and in pouring floors and roofs for the house, see Fig. 1. In this way, the concrete is not allowed to set nor the aggregates to settle for an instant during transportation.

The apparatus for practising the steps and obtaining the desired results as described comprises a movable frame 11 on wheels 12, and an extended trough 13 thirty-five feet or more in length containing an endless conveyer 14 is pivotally mounted at 15 on said frame and adapted to be raised and lowered to place the discharge end 16 at any suitable elevation within limits above the ground level. Trough 13 may be sectional or made in any length, and a cable or rope 17 attached to the trough 13 near its discharge end and a winding drum or reel 18 on frame 11 provide a convenient means for raising and lowering the trough and conveyer together, the said conveyer being carried by sprocket wheels 19 and idlers 20 mounted on shafts having bearings 21 on the upper side edges of the trough. Conveyer 14 is driven by a sprocket wheel 22 located at one side of the trough on a shaft 23 mounted at the discharge end 16, and by a sprocket chain 24 which extends from wheel 22 to a power-transmitting sprocket 25 mounted on a shaft 26 having bearings in or upon frame 11. Shaft 26 carries a pulley 26' which is belt-driven from a small pulley 27 operated by a motor or engine 28 of any suitable kind. Shaft 26 is somewhat removed from pivot 15, but sufficient slack is left to accommodate any difference in the arc movements of said chain and the trough respectively, when a change of inclination of the trough and conveyer is brought about. The discharge end 16 is covered to prevent a spattering discharge and also provided with a downwardly-extending spout 29, but this hooded member may be omitted providing the mixture is otherwise properly directed into the forms or molds M. Conduits 30 of any desired length may be used and to avoid too great a fall of the concrete mixture, the conduits may be of sufficient length to extend into the molds any desired distance. The bottom of the trough 13 is substantially semi-circular in transverse section and has straight sides to provide a relatively deep receptacle for the conveyer 14 which comprises a sprocket chain having flat semi-circular blades 31 affixed to the links thereof at relatively close intervals. Blades 31 correspond roughly in shape to the curved bottom of the trough and have straight edges 32 over which the wet mixture is adapted to cascade, and the blades are relatively low in height as compared with the depth of the trough to keep the material within the trough. That stretch of the chain of the conveyer which is located within the bottom of the trough is kept taut by the outward pull of the sprocket wheel 19 at the discharge end 16, and the blades ride on their curved edges over the bottom of the trough. The blades operate like scrapers to carry small portions of the mixture forward, and because these blades are flat of surface and travel loosely within the trough the material carried forward by each blade is not absolutely confined and kept within bounds but is more or less free to pass under the edge of each blade and escape into the adjoining pocket or space at the rear of the blade. This is especially true when the mixture is a rich wet mix, and to produce this mix water is added in a continuous stream in the right proportion at the discharge end of the receptacle 2 or the lower end of the trough 13 by means of a pipe or hose 32. This pipe may have a valved branch to discharge into the trough 13 at any suitable point, and also a valve branch to discharge the water into the discharge end of the mixing machine 2, and either or both may be used. Any suitable means may be employed to provide a constant feed of concrete forming materials into the lower end of trough 13.

In practising the process, the blades 31 pull and drag small pocketfuls of the wet mixture up an inclined plane. Both the blades and the trough are inclined relatively to the perpendicular, and the trough is stationary. The result is that the mixture is necessarily agitated and shuffled along and a part thereof within each pocket is constantly transferred to the next lower pocket and intermixed with the material therein and then this mixture is likewise

transferred in part to the succeeding pocket or pockets, and the same operation repeated innumerable times until each mixture is discharged eventually through the spout 29. It is a process of repeated mixing together of small portions of a wet concrete mixture during a more or less extensive and continuous travel of the material, and in this way the proper quantity of water is uniformly distributed. The mixture is worked best when in a more or less semi-liquid state, and the speed of the conveyer is a factor in producing a thorough mix. When a wet and flowing mixture is being handled the speed of the conveyer is relatively rapid to carry a considerable amount of water along, increase agitation of the mixture, and obtain uniform mixture by preventing the aggregates from settling separately. Agitation and intermixture of small divisions of the mixture cause the cement and the sand to be perfectly distributed before discharging, and obviously, each small division of the mixture is not permitted to set for an instant until finally poured into its place of actual use. The resultant concrete will have the maximum density, strength and water tightness which an ideal concrete should possess, and time, labor and expense is reduced to a minimum in mixing and placing the concrete according to my invention.

When the wet concrete mixture is discharged at spout 29 it possesses greater tenacious viscosity than the first mix and the

aggregates do not settle so easily. The aggregates are also in better shape, that is, cleaner after their forced and agitated upward travel. Moreover, the consistency of the discharged mixture is such that no tamping or spading of the mixture in the forms is required, and the mixture is also so dense and the aggregates so thoroughly covered that the rough aggregates do not show at the surface and all voids are completely filled.

What I claim is:

The process of forming concrete which consists primarily in mixing the sand, gravel, cement and other possible ingredients with saturation to produce a semi-liquid or free flowing mixture adapted ultimately to be poured and to be self-distributing to horizontal levels substantially like a liquid substance; then entraining the mixture in a continuous stream up an incline for a greater or less distance to its discharge and at the same time further mixing and improving the quality of the mixture by causing small portions thereof to flow backward or retrogressively at given intervals in and against the main ascending stream while the stream itself, as a whole, is moving forward to its point of delivery.

In testimony whereof I affix my signature in presence of a witness.

DUDLEY S. HUMPHREY.

Witness:

R. B. MOSIER.