

April 6, 1937.

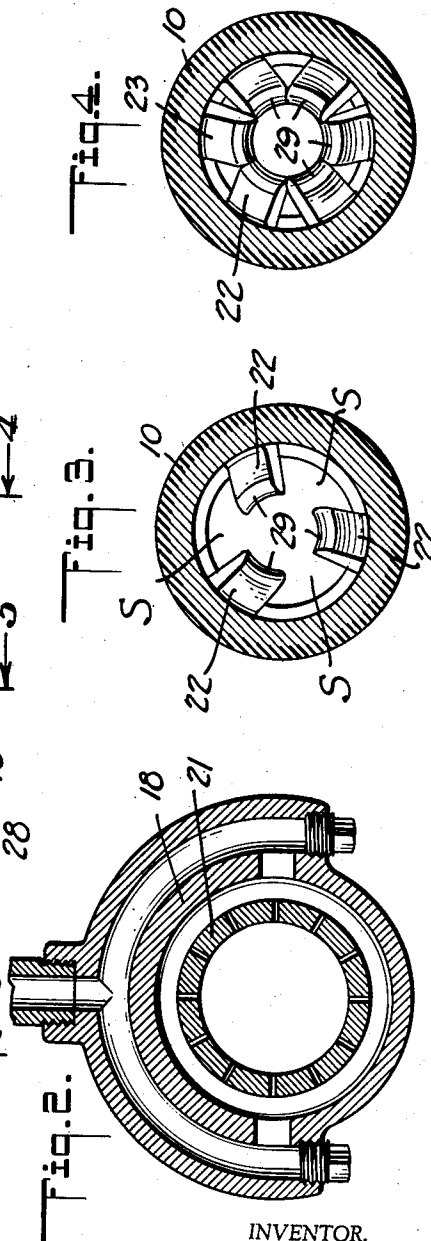
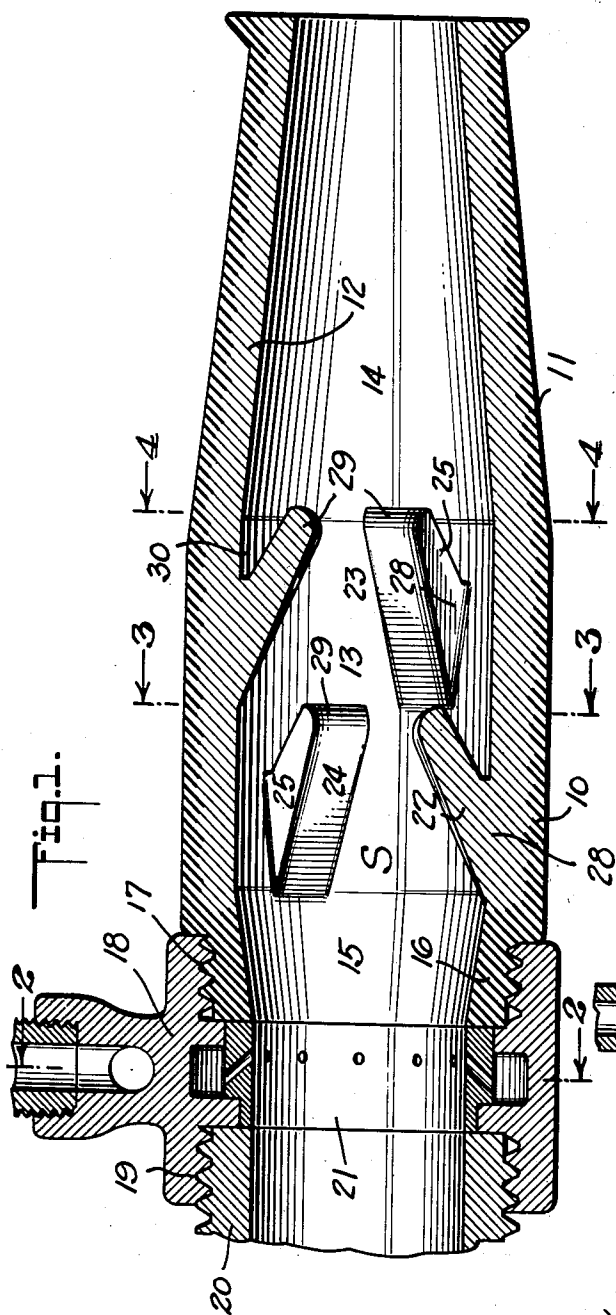
H. SAMPÉL

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CEMENT GUN NOZZLE

Filed Jan. 16, 1935

2 Sheets-Sheet 1



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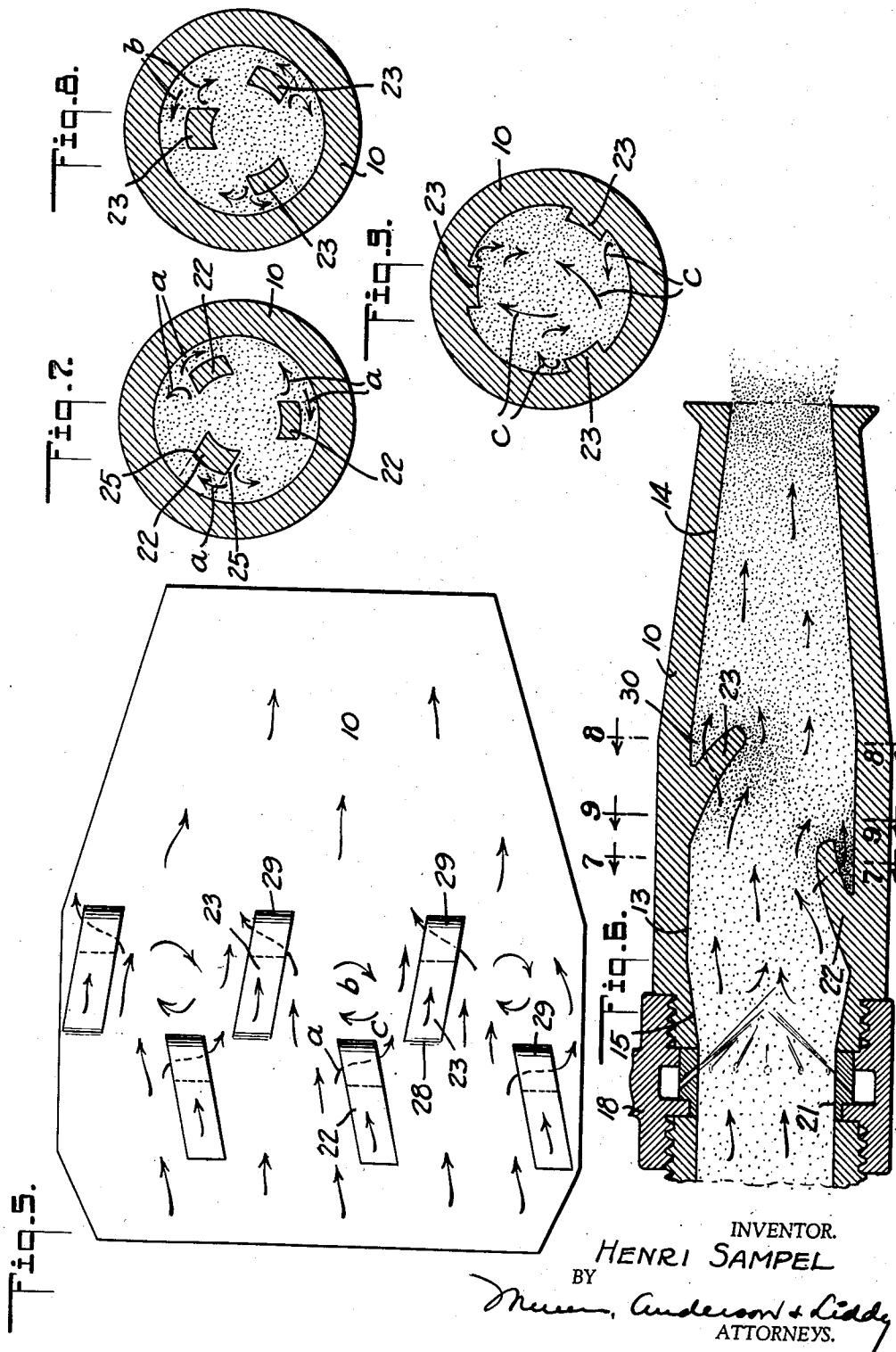
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CEMENT GUN NOZZLE

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UNITED STATES PATENT OFFICE

2,075,867

CEMENT GUN NOZZLE

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Application January 16, 1935, Serial No. 2,130

11 Claims. (Cl. 91-44)

My invention relates to pneumatic cement guns.

An object of the invention is to provide positively acting means for thoroughly combining or impregnating an aggregate of cement or plaster with water under conditions that will cause better hydration thereof and prevent formation of dry pockets and sand laminations or striae therein when applied to a shot surface, thereby enabling the mass to more firmly adhere to or become bonded to said surface.

A more specific object is directed to the form and construction of a nozzle in which a pulsating movement is more or less constantly set up in the mixing means, by the action of which, the high velocity stream of aggregate will be squeezed and massaged in a manner to insure a thorough combining of the water with all dry particles thereof.

Another object is to provide a nozzle in which complete hydration can be insured without objectionable or undue retardation of the aggregate stream through the nozzle, thus enabling large quantities of material to be satisfactorily handled in a minimum period of time.

A still further object is to provide a non-metallic nozzle which will effectively resist to practical degrees abrasion of the walls of the delivery bore and/or the mixing elements within said bore during rapid movement of hard particles of aggregate through said bore and against the exposed surfaces of said mixing elements.

Another object is to provide a nozzle having mixing means for imposing varying degrees of lateral force against the mass under treatment and for placing and maintaining the mass in a high state of turbulence in which constantly changing vortex motions are set up during the entire time the mass remains in the effective mixing chamber of the nozzle.

Another object is to provide a nozzle whose mixing means utilizes the inherent flexibility and elasticity of the inner structure of the nozzle in a very advantageous manner, the device being also simple in construction and adapted to be quickly and very conveniently connected in the pressure source from which the aggregate is received.

A still further object is to provide means for changing a straight course motion of the stream of aggregate into rotatory motion in which the direction of rotation of the mass will be automatically reversed during passage of the stream through a mixing chamber of very small area.

To enable others skilled in the art to fully comprehend the underlying features of the in-

vention that they may embody same in various modifications in structure and relation contemplated, drawings depicting a preferred form have been annexed as a part of this disclosure and in such drawings similar reference characters denote corresponding parts throughout all the views, of which

Figure 1 is a vertical longitudinal section through the nozzle;

Figure 2 is a transverse section taken on the line 2-2 of Figure 1;

Figure 3 is a transverse section taken on the line 3-3 of Figure 1 looking toward one set of mixing elements;

Figure 4 is a transverse section taken on the line 4-4 of Figure 1 looking toward both sets of mixing elements;

Figure 5 is a schematic plan view illustrating the nozzle laid open to disclose the relatively opposite diagonal arrangements of the respective sets of mixing elements;

Figure 6 is a schematic section through the nozzle showing the course taken by the aggregate in its passage from the intake end to the discharge end thereof;

Figures 7 to 9, inclusive, are respectively transverse sections taken on the lines 7-7, 8-8 and 9-9 of Figure 6.

In carrying the invention into practice, use is made of a nozzle 10 which is preferably moulded from a good quality rubber of respectively different compounds to give to the finished product a more or less hard and rigid shell-like exterior and a very soft and highly elastic or resilient inner structure 12, the latter having formed therein a continuous stream bore, divided into a substantially cylindrical section 13, hereinafter referred to as a mixing zone or chamber; a forwardly disposed section of a forwardly reduced diameter and of greater length than the section 13, and a rearwardly disposed short section 15, the latter being of an increasing diameter in the direction of said section 13. At the free end of the section 15 is formed an externally threaded reduced portion 16 entirely of hard rubber and adapted to be received in the threaded socket 17 in a hydrating head 18. This head is also provided with a similar threaded socket 19 to receive one end of a pipe or conduit 20 through which the aggregate to be hydrated and shot from the nozzle can be fed under pressure to the nozzle from a supply source and subjected to the direct effect of jets of water discharging radially and forwardly into the bore of the nozzle from the ring 21 of said head 18, preparatory to

passage of the aggregate into the mixing chamber or zone 13. The head 18 can be of any suitable well known construction and no claim is made thereto, apart from the relationship which it occupies to the first stage of mixing elements in the zone 13, which elements will be fully described presently.

Contained in the zone 13 is a rearwardly disposed annular series of elongated mixing elements or kneading or massaging fingers 22 and a forwardly disposed series of identical elements or fingers 23. The fingers 22 are equi-distantly spaced apart from each other annularly of the nozzle bore and are disposed in parallelism to each other, and, as illustrated, these elements extend forwardly and obliquely into the bore and are diagonally disposed relatively to the walls of said bore.

The fingers 23 are identical in every respect to the fingers 22, except that they are set at a diagonal angle which is opposite to the angle at which the fingers 22 are set. The fingers 23 of the forwardly disposed set are staggered with respect to those of the rearwardly disposed set 22.

Each set of fingers 22 and 23 more or less, because of their obliquity to the axis of the nozzle bore, describes a resilient frustum-like structure whose small end or throat is forwardly disposed and positioned co-axially of the bore and adapted to freely contract and expand laterally. It will be noted that each of the fingers 22 and 23 is provided with a long, transversely curved surface 24 which directly confronts the axial center of the bore, and two parallel broad, flat side surfaces 25-25. It will be further observed that each finger has a portion 28 of substantial longitudinal and transverse area which joins directly with the walls of said bore and that each finger is further provided with a laterally movable undercut extremity 29 which can freely yield and rapidly pulsate when stressed by loads imposed thereagainst during movement of the aggregate through said bore. The undercut extremities of the fingers co-act with the walls of the bore to define therewith intervening V-shaped spaces 30 through which the aggregate can move during rotatory motion of said aggregate as induced incident to the forms and arrangements of said fingers.

Having described the essential characterizing structural features of the nozzle, the operation thereof will be described as follows:

Dry aggregate is continuously fed to the nozzle at a pressure of, say, from twenty-five to thirty-five pounds. Assuming that water is being sprayed in controlled amounts across the bore of the nozzle, it follows that the aggregate will be effectively moistened and that while in a wet condition it will pass directly into the mixing zone 13 where it will first be acted upon by the fingers 22 and then the fingers 23. The annular or circumferential spacing apart from each other of the fingers of each of the sets employed provides large V-shaped spaces S between the adjacent fingers of each set and the large ends of these spaces face rearwardly or toward the hydrator of the nozzle. The forwardly moving wet aggregate moves partly through the spaces S and partly through the spaces between the surfaces 24 of said fingers 22. In consequence thereof, said wet aggregate will be severely or violently placed in a state of turbulence, causing a vortex to be produced at each undercut extremity of the respective fingers, the rotatory courses of the aggregate being indicated by the arrows c in Figure 7.

This is made possible because of the diagonal positions of said fingers. As a result of this change in the direction of the stream of aggregate from a course which was straight at a position in the bore rearwardly of the fingers 22 to one which is rotatory within the area occupied by the fingers, the wet aggregate will be very effectively squeezed or massaged between the walls of the bore of the nozzle and the adjacent broad faces of said fingers and the water thereby displaced and thoroughly combined with the dry particles of said aggregate. The aggregate which flows through the space defined by the confronting surfaces 24 of the fingers will also be very effectively squeezed or massaged while also in a violently turbulent state. This is made possible because of the high degree of resiliency of the fingers, it following that they will rapidly pulsate incident to changes or fluctuations in the degrees of pressure of the material stream, that is to say, variable pressures which result in consequence of changes occurring at the source or in the line of material supply, plus those changes that are naturally set up in response to the induced turbulent state of the mass as it is acted upon by the fingers.

As the aggregate leaves the fingers 22, it is acted upon in like manner by the fingers 23, but due to the reverse diagonal position of these fingers with respect to the positions occupied by the fingers 22, the material will be twirled in an opposite direction to that given it in the first stage of its treatment. The rotatory motion at each finger will be in the directions of the arrows b in Figure 8, that is to say, opposite to the motion produced at the extremities of said fingers 22. At the point of joinder of the fingers 23 with the walls of the nozzle bore, the material under treatment will be placed in motion to the extent that a vortex action will be induced co-axially of the bore and at places in the proximity to the flexible points of joinder of said fingers with said walls of the bore.

From the foregoing functional description, it manifestly follows that the aggregate will be separately treated within the area described by the section 13 of the nozzle bore and thoroughly squeezed and massaged to thereby cause all dry particles of the aggregate to be well incorporated with the water. To additionally insure proper hydration of the aggregate the forward or discharge end of the nozzle bore is of a forwardly restricted diameter, whereby the aggregate will be condensed as it is about to be shot from the nozzle.

I shall claim as my invention all those structural and functional features above set forth, including a form of nozzle moulded from rubber to provide an inner structure which is exceedingly resilient and which includes as a part of its integral structure the highly novel forms of resilient fingers 22 and 23, and I shall, of course, reserve the right to make such modifications in the forms, constructions and arrangements of the parts as shall be properly within the true spirit of the invention and scope of the hereto appended claims. It is suggested that at least two sets of massaging and kneading fingers be employed for most satisfactory results. However, there may be instances where a single set of such fingers would be practical and useful. When two sets of fingers are employed, the combined lengths thereof should be at least approximately co-extensive with the length of the bore section 13. The bore section is of uniform diameter throughout, but

I would not wish to be limited in this respect, as it is possible to produce good results with a bore which tapers from one end to another within the area of said section.

Regarding said fingers 22 and 23, it is of course understood that the extent of vortex generation produced by them, may be determined by the number of fingers comprising each of the sets employed. Each set herein illustrated consists of three such fingers. This number has been found entirely satisfactory to produce in the bore of a nozzle of average size and capacity, a sufficient number of low pressure regions in which many vortices will be produced in the turbulent wake when the stream is flowed through the nozzle at a pressure of from 25 to 35 pounds. When two sets of fingers are employed and the fingers of one set are staggered with respect to those of the other set and disposed at an opposite diagonal angle thereto, the vortices are materially multiplied, thus augmenting the pulsations set up in the resilient extremities of the fingers and assuring that all dry particles of the aggregate under treatment will be properly hydrated, that is to say, more effectively squeezed and massaged and the water perfectly combined with all such dry particles.

What I claim as my invention is:

1. A cement gun having a mixing chamber; means for converting linear motion of a wet stream of aggregate into rotatory motion first in one direction at one place in the chamber and then in an opposite direction at another place therein; and means actuable by contact of the aggregate therewith for exerting respectively different degrees of pressure against the aggregate while rotating in said chamber to thereby squeeze and massage the same to thus effect impregnation of the dry particles thereof with moisture.

2. A cement gun nozzle having a bore the walls of which are formed of highly resilient rubber and through which bore a stream of wet aggregate can flow; an annular series of massaging fingers formed integrally with said walls and extending diagonally and obliquely into the bore and having forwardly extending free extremities movable laterally relatively to the walls and hence the axis of said bore; and said fingers being spaced apart from each other to enable the aggregate to enter between the same and to be set in rotary motion around the free extremities thereof, whereby to massage the aggregate and cause the water to thoroughly combine with the dry particles thereof.

3. A cement gun nozzle having a bore the walls of which are formed of highly resilient rubber and through which bore a stream of wet aggregate can flow; an annular series of massaging fingers formed integrally with said walls and extending diagonally and obliquely into the bore and having forwardly extending free extremities movable laterally relatively to the walls and hence the axis of said bore; said fingers being spaced apart from each other to enable the aggregate to enter between the same and to be set in rotatory motion around the free extremities thereof, whereby to massage the aggregate and cause the water to thoroughly combine with the dry particles thereof; and a second similar series of fingers situated in advance of the first series of fingers and disposed at a diagonal angle which is reverse to the diagonal angle of the first fingers, whereby to impart rotatory motion to the stream in a direction opposite to that established by the action of said first fingers.

4. A nozzle having a bore the walls of which are formed of soft rubber and said nozzle having an exterior structure of hard rubber vulcanized to the soft rubber; and means in the bore for yieldingly squeezing and massaging a mass of wet aggregate by reaction set up by flow of the aggregate through the bore and comprising integral angular portions of said soft rubber walls and provided with undercut extremities having surfaces confronting said soft walls and being movable laterally relatively thereto.

5. A nozzle having a bore whose walls are formed of resilient material and said material having an annular series of fingers, disposed at an angle in the bore to provide a substantially frustum-shaped structure through which a wet aggregate can pass and be squeezed and massaged.

6. A nozzle having a bore whose walls are formed of resilient material and said material having an annular series of fingers disposed at an angle in the bore to provide a substantially frustum-shaped structure through which a wet aggregate can pass and be squeezed and massaged, and said fingers being disposed diagonally relatively to the walls of the bore to thereby set the aggregate in rotatory motion in a plane relative to the fingers to enable the aggregate to circulate through the spaces between the walls of the bore and the free extremities of said fingers.

7. A cement gun comprising a nozzle having an axial bore of soft rubber; means for converting linear motion of a wet stream of cement aggregate into rotatory motion while the stream is being forced through the nozzle; and means actuable by contact of the aggregate therewith for massaging the aggregate during conversion of the stream from linear motion into rotatory motion and comprising an annular series of ribs having forwardly disposed extremities movable laterally relative to the axis of the bore.

8. A cement gun nozzle comprising a body provided with an expansible axial bore through which a stream of cement can be forced, the walls of said bore being formed of elastic rubber, said bore including a portion the diameter of which decreases in a forward direction, and an annular series of equi-distantly spaced apart elements forming integral parts of said walls and having forwardly disposed extremities adapted to be placed in pulsatory motion in said bore by contact with said stream.

9. A cement gun nozzle comprising a body formed of rubber and provided with an axial bore, the walls of which are highly resilient, said bore including a section having a forwardly reduced diameter such that propulsion of a stream of cement through the bore will be retarded; and means providing a rifling for said bore rearwardly of the aforesaid section and including an annular series of laterally resilient elements of the same material as said walls and adapted to be placed in motion by contact of the stream therewith and to knead the material of said stream.

10. A cement gun nozzle having a bore, the walls of which are formed of soft rubber; and an annular series of ribs formed integrally with said walls and disposed at a forward angle and having free ends disposed and adapted to be set in pulsatory motion by contact of cement aggregate therewith during movement of a stream of said aggregate through the bore toward the discharge end of the nozzle.

11. As a new article of manufacture, a cement gun nozzle comprising an integral body having

a hard rubber portion at one end adapted to be connected with a hydrator and provided with an axial bore, the walls of which are of highly resilient rubber, said bore having a forwardly tapered portion for constricting the flow of aggregate from the bore; and angularly disposed massaging ribs extending into said bore and forming parts of said elastic walls of said bore

and disposed rearwardly of said tapered portion of the bore and formed to swirl portions of the aggregate in movement of the latter through the bore and for massaging said aggregate before passage of the aggregate to said tapered portion of the bore.

HENRI SAMPEL.