Aug. 18, 1953 S. H. GIBERSON 2,649,289

CONCRETE GUN

Filed Jan. 17, 1952 3 Sheets-Sheet 1

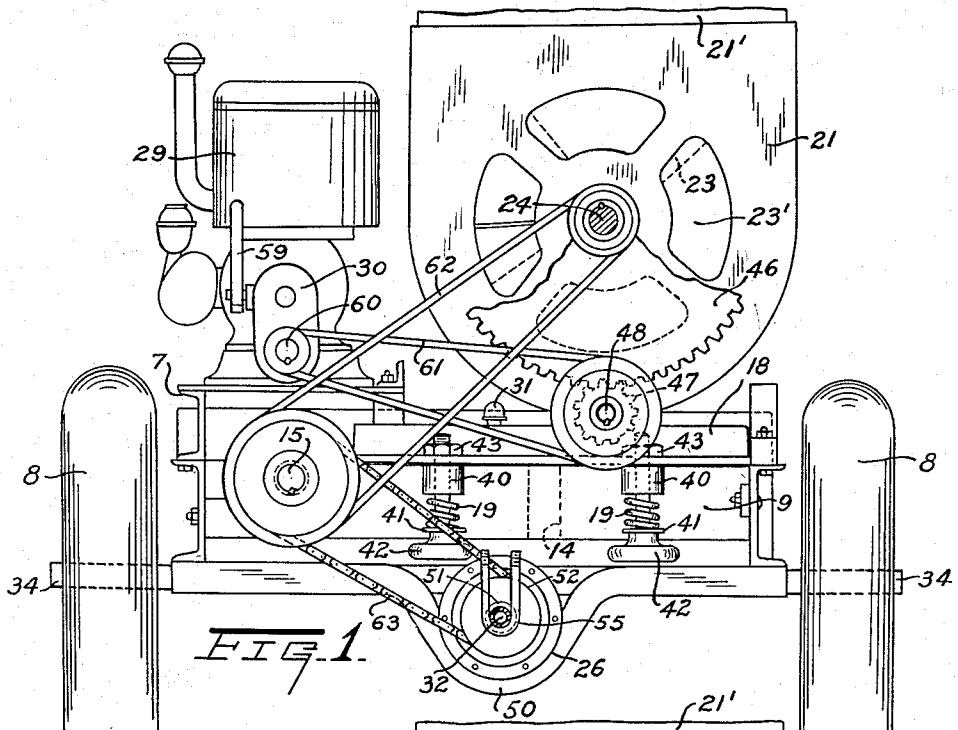


FIG. 1.

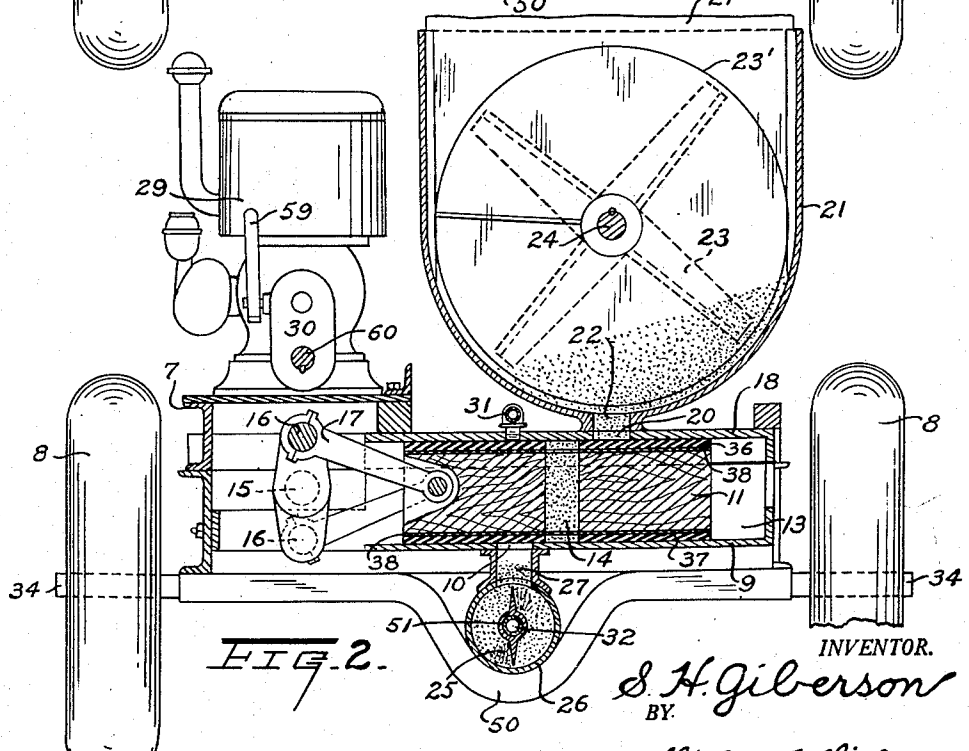


FIG. 2.

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CONCRETE GUN

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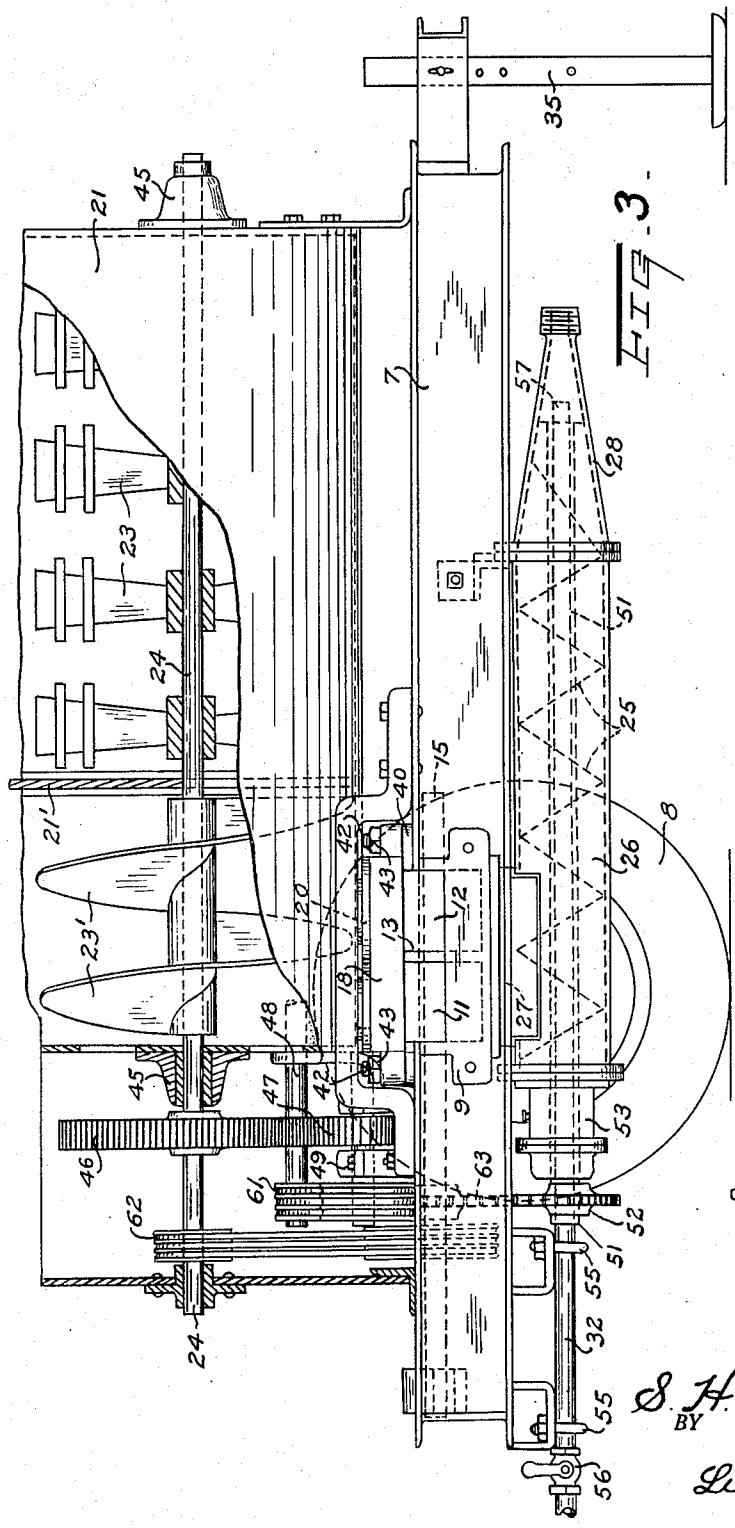


FIG. 3.

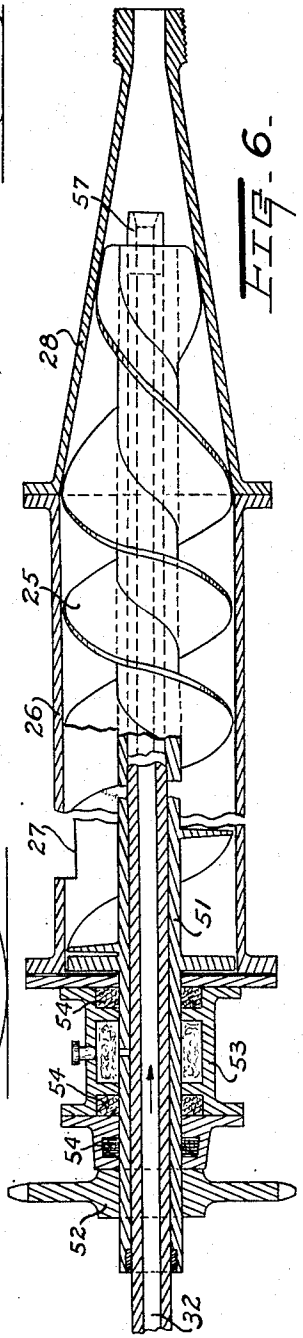


FIG. 6.

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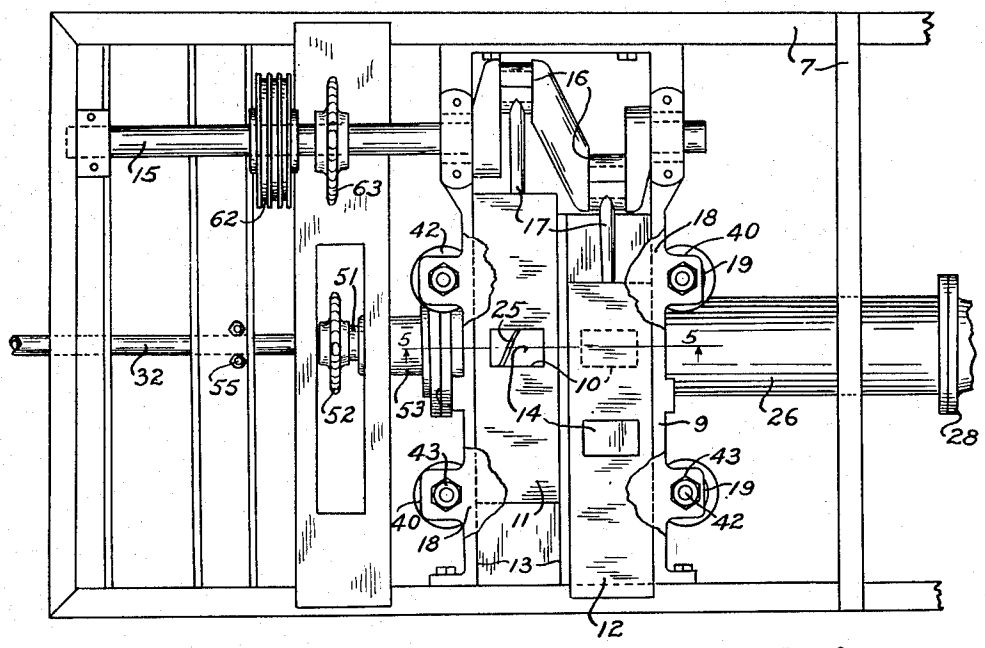


FIG. 4.

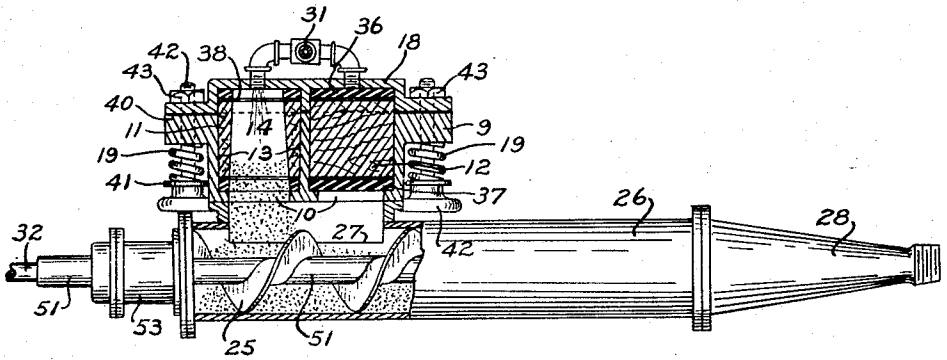


FIG. 5.

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2,649,289

CONCRETE GUN

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5 Claims. (Cl. 259—151)

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My present invention relates in general to improvements in the art of delivering granular material at high velocity through a conduit, and relates more specifically to improvements in the construction and operation of guns for automatically mixing and for continuously delivering rapid streams of dry concrete aggregate and cement or the like through nozzles to remote zones of utilization.

The primary object of this invention is to provide a simple, compact and effectively sealed concrete gun unit adapted to deliver a thorough mixture of dry granular materials through a conduit with the aid of high pressure fluid such as air.

In the application of concrete to roads, buildings or the like, it is common practice to mix and to transport the dry aggregate and cement with the aid of mechanism and air under pressure to a nozzle wherein the granular ingredients are supplied with regulated quantities of water and from which the final concrete is continuously shot into the desired places. Numerous types of gun units for effecting such mixing and transportation of the granular materials have heretofore been proposed and utilized with varying degrees of success, but practically all of these prior guns are either too complicated and costly to manufacture and maintain, or they do not provide sufficiently effective seals for preventing escape of high pressure feeding air, or they are not capable of resisting rapid wear due to abrasive action of the aggregate material and cement, or they require considerable attention and a special ingredient mixer during normal use.

It is therefore an important object of my invention to provide an improved concrete aggregate and cement mixing and feeding unit which obviates all of the above mentioned defects, and which is entirely automatic and highly efficient in operation.

Another important object of the present invention is to provide a simple and durable concrete gun unit comprising relatively few readily adjustable and accessible parts all of which may be quickly inspected or replaced, and wherein the ingredient mixer is embodied directly within the unit itself.

A further important object of this invention is to provide a feeding device for transporting dry granular material at high velocity through ducts or passages with the aid of high pressure air, wherein undesirable escape of the transporting fluid is most effectively eliminated.

Still another object of the invention is to provide an improved mechanism for pneumatically

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feeding abrasive material in the form of a continuous stream from a source of supply to points of utilization, in which an effective air lock is maintained by means of readily renewable and inexpensive sealing elements.

An additional object of my invention is to provide an improved portable granular material dispensing unit which is operable with minimum attention and cost of replacement parts, and which may be employed for diverse purposes.

These and other more specific objects and advantages of the invention will be apparent from the following detailed description, from which it will be apparent that the gist of my invention is the provision of a gun for producing a continuous stream of dry granular material with the aid of two or more reciprocable piston members each having an open ended pocket therein, the upper ends of which pockets are adapted to be alternately brought into communication with a source of the material while the lower pocket ends are likewise communicable with one end of a screw conveyor for receiving and transporting the successive batches of material delivered thereto from the pockets by compressed air through an outlet at the opposite end thereof with the aid of additional air under pressure.

A clear conception of the several features constituting the present improvement, and of the construction and operation of a typical concrete gun embodying the same, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is an end view of a portable concrete gun embodying the invention, looking toward the rear of the unit and with the rear bearing for the initial agitator shaft omitted in order to more clearly reveal other parts;

Fig. 2 is a transverse vertical section through the portable unit taken transversely through the material supply hopper and screw conveyor and longitudinally through one of the reciprocable piston members;

Fig. 3 is a part sectional side elevation of the same portable gun unit;

Fig. 4 is a fragmentary top view of the gun with the hopper and driving motor omitted and looking down toward the reciprocable material batch feeding members;

Fig. 5 is a part sectional end and side view of the reciprocable piston members and of the screw conveyor respectively of the unit, the section having been along the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary enlarged vertical longitudinal section taken centrally along the screw conveyor.

While the invention has been shown herein as being advantageously applicable to a portable concrete gun embodying only two oppositely reciprocable feeding piston members, it is not the intent to thereby limit the utility of the improved features to a twin piston assemblage, and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the typical portable pneumatic concrete gun shown therein, comprises in general, a sturdy portable main frame 7 mounted on wheels 8; a guide and crank casing 9 firmly but detachably secured to and spanning the medial portion of the frame 7 and having therein a pair of lower openings 10, a pair of oppositely movable parallel simultaneously reciprocable piston members 11, 12 snugly slidable along guideways 13 formed in the casing 9 above the openings 10 and each having an open ended pocket 14 extending vertically therethrough; a crank shaft 15 having a pair of opposite throw cranks 16 revolvable within the casing 9 and connected to the members 11, 12 by connecting rods 17; a casing cover 18 resiliently urged against the piston members 11, 12 by compression springs 19 and having therein a pair of feed inlet openings 20 disposed out of vertical alinement with the casing openings 10; a two compartment batch mixing and supply hopper 21 having a lower outlet opening 22 at one end constantly communicable with the two pocket inlet openings 20 of the cover 18 and also having in one compartment thereof a series of mixing blades 23 and in the other compartment a screw conveyor 23' both mounted upon a shaft 24; an elongated horizontal conveyor screw 25 rotatably supported within a housing 26 having a supply opening 27 at one end alternately communicable with the casing outlet openings 10 and also having a tapered discharge head 28 at its opposite end; an engine or motor 29 mounted upon the main frame 7 and having a variable speed transmission 30 drivingly connected to the shafts 15, 24 and with the conveyor screw 25; and conduit means 31, 32 for supplying compressed air to the pockets 11, 12 and to the conveyor end head 28 respectively.

The main frame 7 may be constructed of standard angle irons and channel bars, and the wheels 8 which are preferably located somewhere near the rear end of the portable unit may be mounted on axles 34 firmly secured to the bottom of the frame 7. The front end of the frame 7 is provided with a vertically adjustable prop 35 and may also be formed for attachment of a tractor draw bar or hitch, see Figs. 1, 3 and 4. Each of the reciprocable piston members 11, 12 which are normally slidably confined within the guide and crank casing 9, has rectangular transverse cross-section and preferably has its main body portion formed of hardwood or other light but durable material, while its top and bottom are faced with rubber slabs 36, 37 respectively having sheet metal backing plates 38. The through pockets 14 of the members 11, 12 are preferably slightly downwardly tapered in order to facilitate free downward delivery of the successive batches of material therefrom, and the casing openings 10 should be of approximately the same area as the larger outlet ends of the pockets 14, as shown in Figs. 2 and 5.

The upper casing cap 18 is normally held in resilient sealing engagement with the reciprocable members 11, 12 by the four heavy springs 19 the upper ends of which coact with lugs 40 formed integral with the lower casing 9 while their lower ends react against washers 41 carried by manually adjustable screws 42 the upper ends of which have screw thread coaction with nuts 43 coacting with the cap 18, as illustrated in Figs. 1 and 5. The cap 18 should be spaced slightly from the top of the casing 9, and the heavy springs 19 thus insure tight sealing between the rubber slabs 36, 37 and the adjacent top and bottom flat surfaces of the cap 18 and casing 9 at all times, and these springs may be readily adjusted to compensate for wear. The upper inlet opening 20 in the cover 18 and the lower outlet opening in the casing 9 should be spaced apart a distance approximately twice the width of each pocket 14 in order to provide an effective air lock for the compressed air supply pipe or means 31.

The granular material source or hopper 21 is also mounted directly upon the upper portion of the main frame 7 and is divided into mixing and feeding compartment by a vertically movable gate 21'; and the mixing compartment should hold an abundant supply of dry concrete aggregate of any suitable kind, and of dry cement. The mixing blades 23 are revolvable to thoroughly mix the fresh batches of material and when the gate 21' is lifted the revolving screw conveyor 23' will feed the mixed dry granular aggregate and cement admitted to the second compartment toward the lower hopper outlet opening 22. The shaft 24 is journalled in bearings 45 and is rotatable by a gear 46 meshing with a pinion 47 carried by a countershaft 48 mounted in bearings 49 carried by the frame 7, see Figs. 1 and 3. The elongated conveyer screw housing 26 is also firmly suspended from the lower portion of the main frame 7 by means of saddles 50, and the conveyer screw 25 is mounted upon a hollow shaft 51 journalled in an elongated bearing 53 at the receiving end of the screw and this shaft is adapted to be rotated by a sprocket 52 secured to its outer end. The forward end of the screw supporting shaft 51 is embraced by packings 54 as shown in Fig. 6 in order to eliminate leakage of compressed air past the bearing 53, and the interior of this shaft 51 snugly embraces the stationary compressed air supply pipe or means 32 which is suspended from the frame 7 by U-bolts 55 and has one end provided with a control valve 56 while its opposite end has an air ejector nozzle 57 disposed centrally within the tapered discharge head 28.

The propelling motor 29 which is supported upon the main frame 7 adjacent to the hopper 21, may be either an internal combustion engine as shown, or any other suitable type of motor; and the variable speed transmission mechanism 30 which is controllable by a lever 59 and drives a power shaft 60, may also be of any suitable and well known type. The power shaft 60 may be drivingly connected to the counter shaft 48 by means of a multiple V-belt drive 61 or the like, and this shaft 48 may be likewise drivingly connected with the crank shaft 15 by a similar V-belt drive 62 or the like. The crank shaft 15 is also drivingly connected to the driving sprocket 52 by means of a chain and sprocket 63, so that operation of the motor 30 will simultaneously rotate the agitating and conveying flights 23 and the conveyor screw 25 and will also revolve the

cranks 16 to reciprocate the piston members 11, 12.

When the improved gun unit has been properly constructed, assembled, and the conduit 31 and pipe 32 have been connected to a source of high pressure compressed air, the motor 29 may be operated to cause the various parts to revolve and reciprocate, whereupon the hopper 21 should be constantly provided with abundant successive batches of dry aggregate material and cement. The revolving mixing blades 23 then operate to thoroughly mix the dry granular ingredients and when the gate 21' is lifted the screw conveyor 23' advances the mixture toward the hopper outlet 22 whereupon the pockets 14 of the reciprocating piston members 11, 12 are successively brought into open communication with this hopper outlet through the adjacent upper casing openings 20 and are filled by gravity with batches of the granular mixture as depicted in Fig. 2. Each of the filled pockets is thereafter transferred by its revolving crank 16 to the corresponding outlet opening 18 and is simultaneously exposed to the compressed air supply conduit 31; and the compressed air thus admitted after each pocket 14 has been sealed from communication with the supply hopper 21, promptly ejects the batch of material from the pocket into the screw conveyor housing 26 through the opening 27, as shown in Fig. 5.

The successive batches of mixture received by the oppositely reciprocating piston members 11, 12 are thus alternately delivered in rapid succession into the front end of the screw conveyor, and the helical screw 25 of this conveyor further mixes and advances the granular material through the tubular housing 26 and into the larger end of tapered discharge head 28 in the form of a continuous stream. In the tapered head 28, the dry material is subjected to violent ejector action by high pressure air delivered from the pipe 32 through the nozzle 57, and the compressed air thereafter transports the well mixed granular material through a hose connected to the head to the final gun nozzle in which liquid is applied in a well known manner and from which the final concrete can be delivered to the work. In this manner a constant and forcible stream of homogeneous concrete is automatically produced and ejected from the unit under the influence of compressed air which escapes as the stream is exposed to the ambient atmosphere.

During normal operation of the gun, escape of compressed air into the hopper 21 is effectively prevented, not only due to the staggering or spacing of the casing opening 18, 20, but also by virtue of the action of the stiff springs 19 which force the casing cover 18 into intimate contact with the upper rubber slabs 36 of the piston members 11, 12 and also force the lower rubber slabs 37 of these members into like engagement with the bottom of the crank casing 9. These rubber sealing slabs 36, 37 are firmly secured as by vulcanizing to the metal backing plates 38 and the latter are detachably but firmly secured to the sturdy piston bodies. While the rubber slabs will resist wear for a long time, they may be readily renewed from time to time, and the screws 42 may be manipulated to compensate for wear until renewal of the slabs becomes necessary. The control lever 59 of the variable speed transmission 30, and the compressed air control valve 56 may also be manipulated in order to insure proper operation of the unit, and the wheels 8 facilitate movement of the entire outfit from place to place.

From the foregoing detailed description of the invention it will be apparent that I have in fact provided a concrete gun unit which besides being simple, compact and durable in construction, is substantially automatic and highly efficient in operation. The improved unit embodies only a relatively few sturdy parts capable of thoroughly mixing and of pneumatically delivering a constant stream of the dry granular material at high velocity to the final concrete ejecting nozzle, and all of these parts are well sealed against undesirable escape of compressed air and are conveniently accessible for inspection and renewal of worn parts. The unit is readily transportable and adapted to be manufactured in various sizes and maintained in operating condition at moderate cost, thereby making it usable upon small as well as more extensive concrete jobs.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation of the dual piston concrete gun unit herein specifically shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In a unit for converting bulk granular material ingredients into a continuous homogeneous compact stream of mixed material, a hopper having therein a batch ingredient mixer and a cooperating mixed material conveyor separable from the mixer by a flow control gate, said mixer and conveyor being exposed to the ambient atmosphere and the latter having an outlet remote from said gate, a screw conveyor disposed closely adjacent to said hopper and having a sealed casing provided with an inlet disposed out of alinement with said hopper outlet, a pair of oppositely reciprocable plungers each having a pocket alternately communicable with said outlet and with said inlet and of less width in the direction of travel of said plungers than the distance between the adjacent edges of the outlet and inlet, means for confining said plungers to provide an air-lock between said hopper and said casing, means for injecting compressed air through said pockets while in communication with said inlet, and means for delivering compressed air through the delivery end of said screw conveyor to forcibly discharge a constant stream of the mixed material from said casing.

2. In a unit for converting bulk granular material ingredients into a continuous homogeneous compact stream of mixed material, a hopper having therein a batch ingredient mixer and a cooperating mixed material conveyor separable from the mixer by a flow control gate, said mixer and conveyor being exposed to the ambient atmosphere and the latter having an outlet remote from said gate, a screw conveyor disposed closely adjacent to said hopper and having a sealed casing provided with an inlet disposed out of alinement with said hopper outlet, a pair of oppositely reciprocable plungers each having a pocket alternately communicable with said outlet and with said inlet and of less width in the direction of travel of said plungers than the distance between the adjacent edges of the outlet and inlet, means for confining said plungers to provide an air-lock between said hopper and said casing, means for injecting compressed air through said pockets

while in communication with said inlet, means for delivering compressed air through the delivery end of said screw conveyor to forcibly discharge a constant stream of the mixed material from said casing, and a motor for simultaneously actuating said mixer and said conveyors and for reciprocating said plungers.

3. In a unit for converting bulk granular material ingredients into a continuous homogeneous compact stream of mixed material, an elongated hopper having therein a rotary batch ingredient mixer and a cooperating coaxial rotary mixed material conveyor separable from the mixer by a flow control gate, said mixer and conveyor being exposed to the ambient atmosphere and the latter having a lower outlet remote from said gate, a screw conveyor disposed directly beneath said hopper and having an elongated sealed tubular casing provided with an upper inlet disposed out of vertical alinement with said hopper outlet, a pair of oppositely horizontally reciprocable plungers each having a vertical open ended pocket alternately communicable with said outlet and with said inlet and of less horizontal width than the distance between the adjacent edges of the outlet and inlet, a housing for confining said plungers to provide an air-lock between said hopper and said casing, means for injecting compressed air through said pockets while in communication with said inlet, and means for delivering compressed air through the delivery end of said screw conveyor to forcibly discharge a constant stream of the mixed material from said casing.

4. In a unit for converting bulk granular material ingredients into a continuous homogeneous compact stream of mixed material, an elongated hopper having therein a rotary batch ingredient mixer and a cooperating coaxial rotary mixed material conveyor separable from the mixer by a flow control gate, said mixer and conveyor being exposed to the ambient atmosphere and the latter having a lower outlet remote from said gate, a screw conveyor disposed directly beneath said hopper and having an elongated sealed tubular casing provided with an upper inlet disposed out of vertical alinement with said hopper outlet, a pair of oppositely horizontally reciprocable plungers each having a vertical open ended pocket alternately communicable with said outlet and with said inlet and of less horizontal width

than the distance between the adjacent edges of the outlet and inlet, a housing for confining said plungers to provide an air-lock between said hopper and said casing, means for injecting compressed air through said pockets while in communication with said inlet, means for delivering compressed air through the delivery end of said screw conveyor to forcibly discharge a constant stream of the mixed material from said casing, and a motor for simultaneously rotating said mixer and said conveyors and for reciprocating said plungers.

5. In a unit for converting bulk granular material ingredients into a continuous homogeneous compact stream of mixed material, a hopper having therein a batch ingredient mixer and a mixed material conveyor, said mixer and conveyor being exposed to the ambient atmosphere and having an outlet at one end, a screw conveyor disposed closely adjacent to said hopper and having a sealed casing provided with an inlet disposed out of alinement with said hopper outlet, a pair of oppositely reciprocable plungers each having a pocket alternately communicable with said outlet and with said inlet and of less width in the direction of travel of said plungers than the distance between the adjacent edges of the outlet and inlet, means for confining said plungers to provide an air-lock between said hopper and said casing, means for injecting compressed air through said pockets while in communication with said inlet, and means for delivering compressed air through the delivery end of said screw conveyor to forcibly discharge a constant stream of the mixed material from said casing.

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