United States Patent

Burtin

[15] **3,672,646**

[45] **June 27, 1972**

[54] PNEUMATIC CEMENT GUN MACHINE

[72] Inventor: **James D. Burtin,** Lebanon, Mo.

[73] Assignee: **Detroit Tool and Engineering Company,** Lebanon, Mo.

[22] Filed: **April 15, 1971**

[21] Appl. No.: **134,190**

[52] **U.S. Cl.** **259/151,** 259/8

[51] **Int. Cl.** **B28c 5/06**

[58] **Field of Search** 259/147, 148, 151, 153, 178, 259/164, 165, 169, 170, 7, 8

[56] **References Cited**

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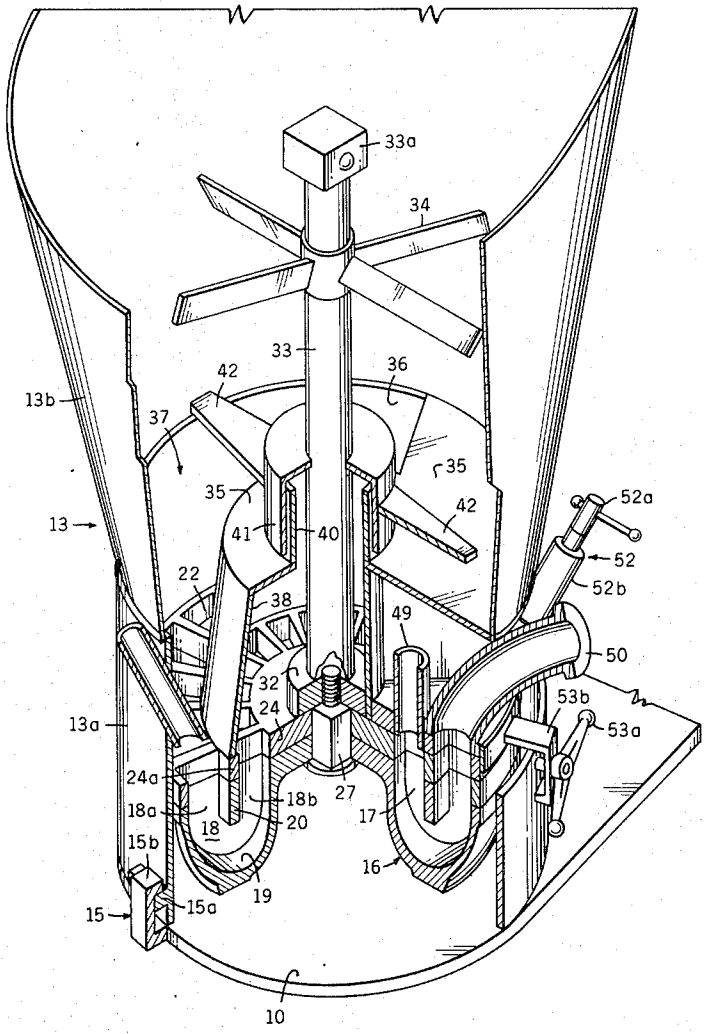
Primary Examiner—Robert W. Jenkins

Attorney—Cohn and Powell

[57] **ABSTRACT**

A cement gun machine has a hopper subtended by a rotary transport bowl which is divided into radial compartments. The bowl receives dry cement mixture from the hopper, and moves it to a station where the mixture is pneumatically discharged into a delivery hose. A hood structure within the hopper traps cement dust and prevents it from escaping into the ambient atmosphere. Means are provided for introducing measured quantities of accelerator material into the cement mixture in the transport bowl.

14 Claims, 7 Drawing Figures



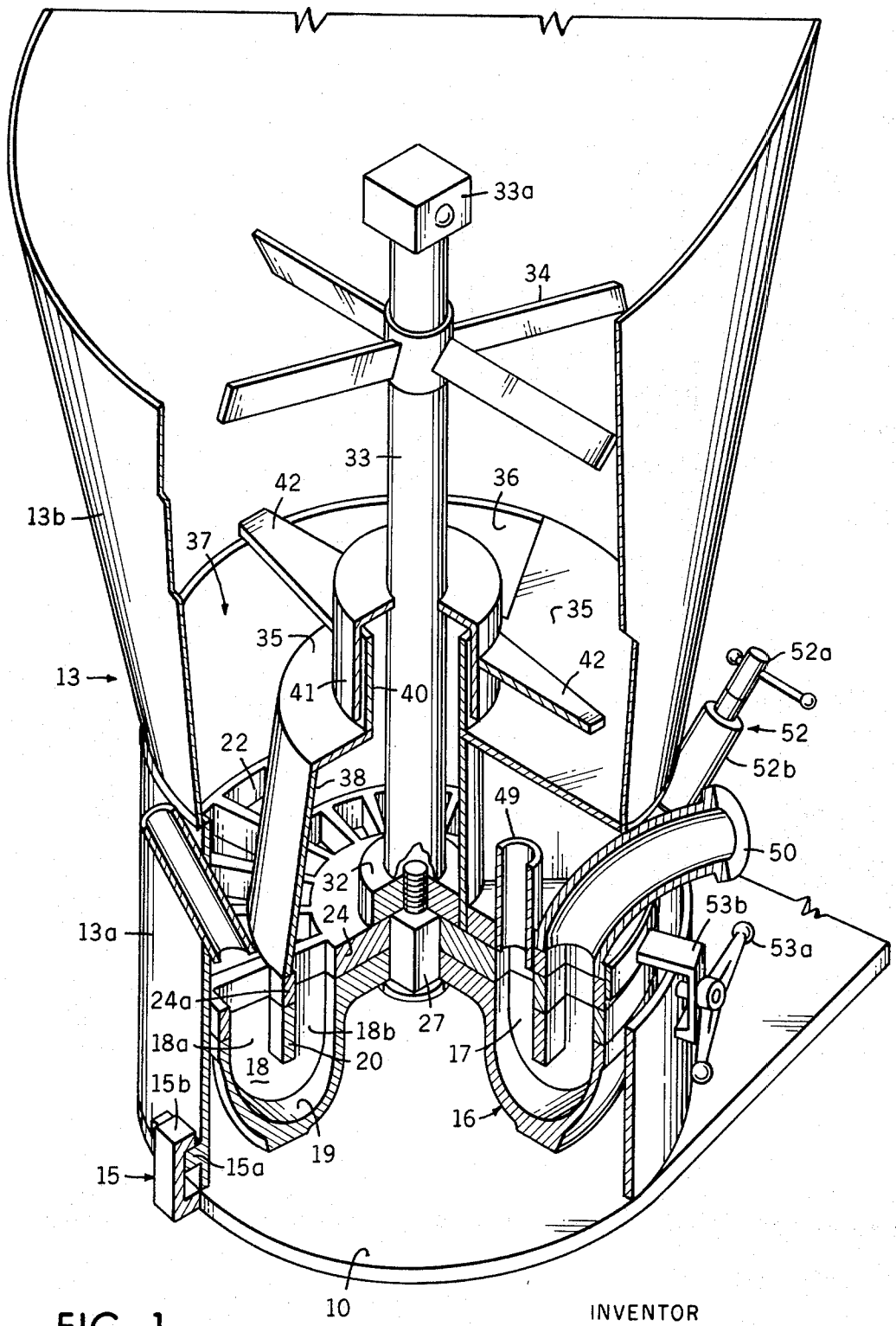


FIG. 1

INVENTOR
JAMES D. BURTIN
BY Cohn and Powell
ATTORNEYS

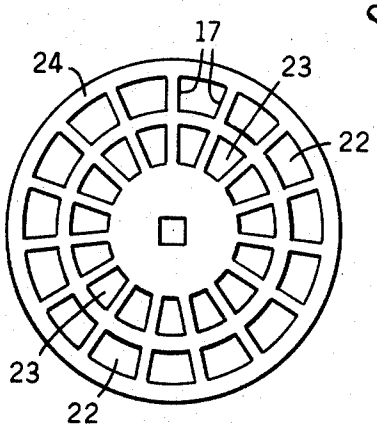


FIG. 3

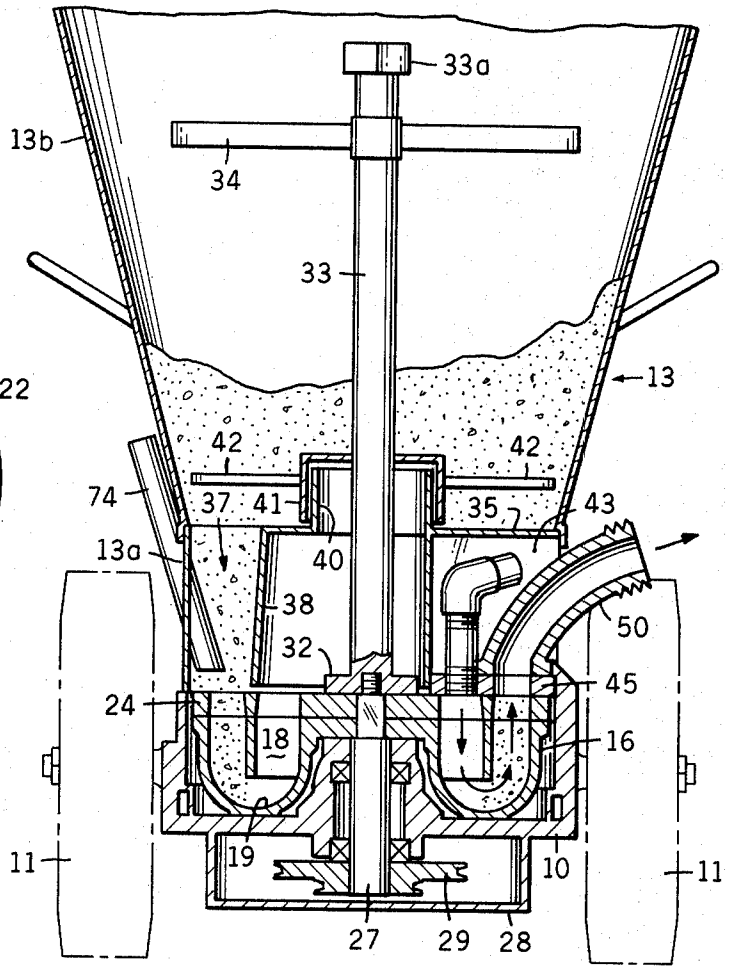


FIG. 2

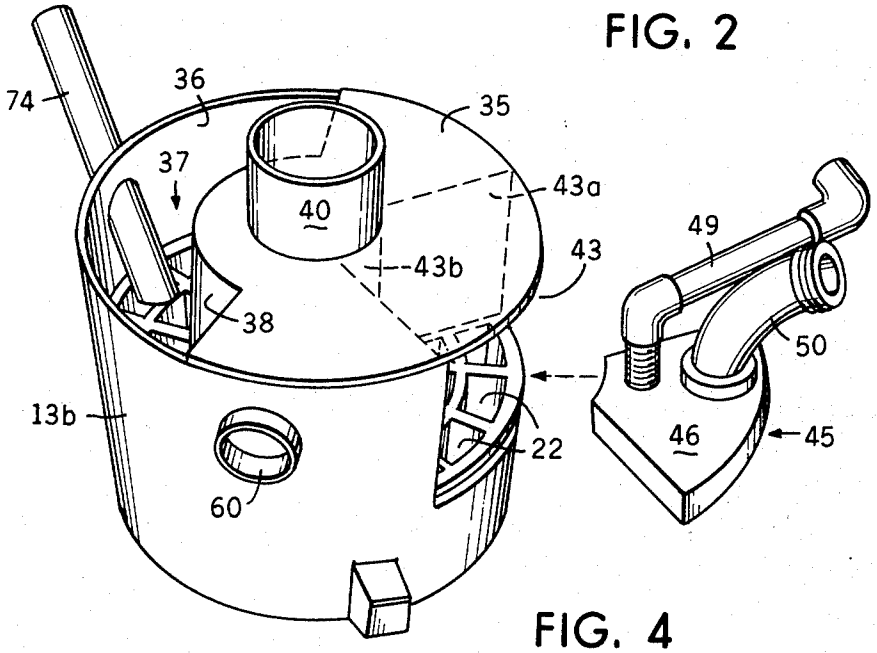


FIG. 4

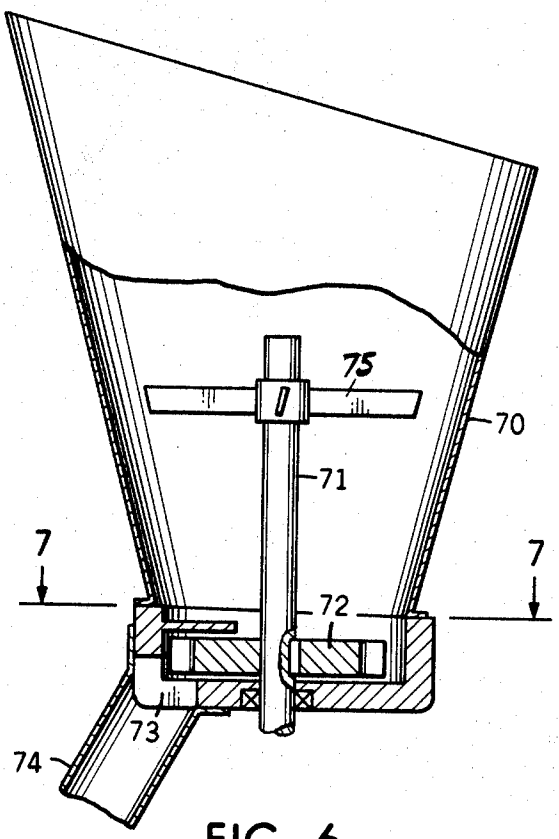


FIG. 6

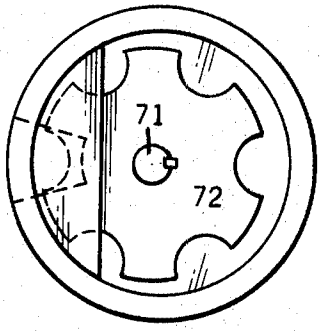


FIG. 7

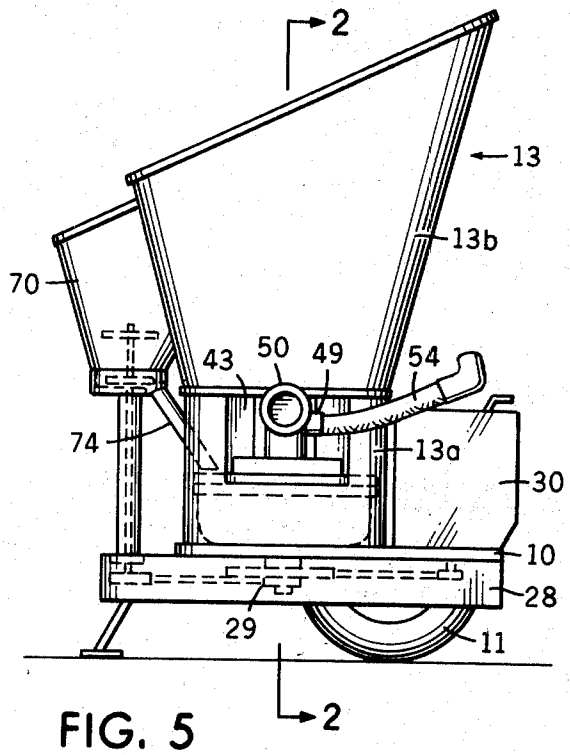


FIG. 5

PNEUMATIC CEMENT GUN MACHINE

BACKGROUND OF THE INVENTION

In cement gun machines of the type herein concerned the ingredients are mixed and conducted in a dry state by air to a discharge nozzle. Water is piped to the nozzle and is there fed into the stream of discharging material, initiating hydration process.

A serious disadvantage heretofore attending the dry mix "shotcrete" process as herein described is the air pollution problem resulting from the leakage and dispersal of concrete dust from pressurized compartments of the machine. This problem is especially undesirable where the machines are operated in an enclosed space, in a mine or tunnel, wherein the shotcrete process is widely employed for lining wall surfaces with cement. The present invention stems from the need for reducing the particulate matter that normally escapes from shotcrete machines of heretofore prevailing construction, whereby to improve atmospheric conditions in the vicinity of the machines.

Another achievement of the present invention is the provision of improved means for introducing an accelerator agent into the cement mix in a way that reduces tendency of the cement to cake while in the machines, or to foul machine surfaces.

SUMMARY OF THE INVENTION

In a concrete gun machine of the character described, including a hopper providing a mixing chamber and rotary bowl having radial compartments for receiving and conveying the material to a pressurizing zone below a fixed sealing plate, means are provided for preventing pressurized air that may be carried with the rotating distributor bowl beyond the discharge port from escaping to the outside atmosphere through the body of material in the hopper.

Accordingly, it is an object of the present invention to prevent the dry constituents in the mixing chamber of the hopper from being discharged from the hopper into the atmosphere during the operation of the machine.

Another object is directed to improvements for facilitating assembly and disassembly of the machine as for cleaning and servicing purposes.

Yet another object resides in improved provisions for depositing metered quantities of an additive to the cement mixture for purposes of accelerating the setting time mixture.

These and other objects and advantages of the invention from the following detail description and the accompanying description of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a prospective view of the machine of the invention with portions thereof removed for purposes of illustration;

FIG. 2 is a sectional view taken at a vertical plane indicated by line 2—2 of FIG. 5;

FIG. 3 is a top plan view of the transport bowl;

FIG. 4 is a perspective view of the lower hopper section with certain discharge fittings separated therefrom for purposes of illustration;

FIG. 5 is a side elevational view of the machine;

FIG. 6 is a side elevational view, partly in section, of the auxiliary hopper for accelerator material, and

FIG. 7 is a sectional view taken at line 7—7 of FIG. 6.

DETAILED DESCRIPTION

The cement gun of the present invention has a base plate **10** (FIGS. 1 and 2) and is desirably provided with ground wheels **11** suitably mounted on the said plate. Resting on base plate **10** is a hopper **13**, comprising a cylindrical lower section **13*a*** surmounted by the generally conical upper section **13*b*** that received the dry ingredients of the mix through its open top. Hopper **13** and interior partition means, to be hereinafter described, are detachable from the base plate but normally

rigidly connected thereto by suitable means, such as the wedge clamp provision indicated at **15**. The means shown include a wedge block **15*a*** on the hopper wall, which block is moved, when the hopper is turned relative to the base plate, into and out of wedging engagement with the arm of a C-clamp **15*b*** on that plate.

Mounted for rotation within the lower section **13*a*** of the hopper is a transport bowl **16** that carries small batches of the dry mix from a chute at one side to a discharge station at the opposite side of the hopper. Bowl **16** is formed to provide an annular chamber which is divided by radial partitions **17** into a ring of radial pockets **18**. The pockets **18** have rounded bottoms **19**. An annular partition **20** transversely intersects the pockets **18** and extend downwardly therein to a plane spaced above the rounded pocket bottoms **19**. Accordingly, the bowl pockets **18** are, in effect, U-shaped passages with outer legs designated **18*a*** and inner legs **18*b***, which terminate in upwardly facing openings **22** and **23**, (FIG. 3), respectively.

Removably disposed on the top surface of the bowl **16** is a circular wear-plate **24** having the form of a grid, the plate **24** being provided with rings of outer and inner openings that conform in size and shape to the immediately underlying openings **22** and **23** of the bowl hopper **16**.

The distributor bowl **16** and its wear-plate **24** are mounted on and keyed to the upper end of a vertical drive shaft **27** that projects upwardly through the base plate **10**. Below plate **10** within a housing **28** are transmission means **29** that operatively interconnect shaft **27** with a drive motor **30**, (FIG. **5**). Motor **30**, mounted on the rear deck of the base, provides power for driving the shaft **27** and other operating parts to be subsequently described. Shaft **27** has a threaded stud at its upper end to receive the base portion **32** of a vertical agitator post **33**. The said post is provided with a pair or more of paddles or agitator arms **34**, these being located in the central region of the upper hopper section **13*b***. The agitator post **33** has an integral cap block **33*a*** formed to provide flat, wrench-receiving surfaces that facilitate the securement and removal of the post from the drive shaft. The base **32** of the post functions to clamp the transport bowl and its wear-plate in place onto the drive shaft **27**.

Cement mix in the hopper is introduced into the bowl pockets only through the outer ring of openings **22**, and is precluded from entering the inner openings **23** by a hood structure, as best appears in FIG. **1**. The hood structure has a top plate **35** which is spaced above the distributor bowl and is fixed, as by welding, to the hopper wall, in the plane of the junction between the upper and lower hopper sections **13*a*** and **13*b***. Plate **35** constitutes a floor for the upper portion of the hopper and has an arcuate marginal recess or opening **36** through which the mix in the hopper drops into the chute **37**, and therefrom to and through the bowl openings **22**. Chute **37** is formed between the hopper side wall and a skirt **38** that depends from the top plate **35**. Its lower edge lies in close proximity to, or in light contact with, the ring portion **24*a*** of the wear-plate. The chute **37** has end walls that extend radially from the end edges of the skirt **38** to the outer wall of the hopper. Circumferentially, the chute **37** extends through an arc of approximately 160°.

The top plate **35** of the hood has a circuit central opening to accommodate the agitator post, and a short up-standing tube section **40** fixed to the plate coacts with a cup-shaped cap **41** on the agitator post, to prevent cement mix from entering the space within the hood structure. The cap **41** rotates with post **33** and has radial agitator arms **42** that augment movement of the mix into the chute **37**.

The rotating transport bowl **16** moves the cement mix in the bowl pockets to a discharge compartment **43**, (FIG. **4**) located within the hood structure diametrically opposite the chute **37**. Compartment **43** is generally wedge-shaped in plan and spans an angle of about 45°, encompassing several pairs of the bowl openings **22**, **23**. The compartment **43** is fronted by a rectangular opening in the lower hopper section, and is formed by and between radial side walls **43*a*** and an inner or back wall

43*b*. These compartment walls are welded to, and extend downwardly from the hood top plate and their lower margins closely approach the upper surface of the bowl wear-plate.

Disposed within compartment **43** is a discharge head **45**, comprising a wedge-shaped orifice plate **46** having two openings therein that register respectively with the bowl openings **22** and **23**. Pipe fittings **49** and **50** are mounted on the orifice plate with their inner ends in communication respectively with the plate openings. The discharge head **45** is detachable from the hopper and is normally held in place by clamps, one thereof, indicated at **52**, comprising a clamp screw **52***a*, and a threaded collar **52***b* which is welded to the hopper wall. Clamp **52***a* is angularly arranged to have its lower end bear downwardly upon the orifice plate **46** with sufficient pressure to provide an effective seal between orifice plate and wear-plate **24** without placing an undue frictional load on the rotating bowl. Another clamp includes a screw part **53***a* and a clamp member **53***b* arranged to prevent the orifice plate from working out of the discharge compartment.

The pipe fitting **49** is connected to an air pressure hole **54**, and pipe fitting **50** is connected to the hose for conducting the cement mix, blasted from the bowl pockets and into pipe **50**, to a discharge nozzle, not shown. Water from a separate hose is injected into the stream of discharging cement mix at the nozzle.

An undesirable condition heretofore attending the operation of concrete gun machines of the type described herein is that pressurized air is carried by the rotating bowl beyond the discharge station and released into the body of cement mix in the hopper. The leakage air, escaping through the open top of the hopper, carries with it the fines of the cement mix and creates a severe dust condition in the vicinity of the machine. The dust laden atmosphere presents a serious health hazard to the operating personnel. The condition is aggravated where the machines are used in closed areas, as in mine shafts and tunnels, an application where guncreting, except for the above noted fault, has proven an effective and efficient method for producing a cement lining shell on the wall surfaces.

In the machine of the present invention, leakage air is trapped by the hood structure, and prevented from entering the cement mix in the hopper. Air and cement dust that finds its way into hood space is evacuated therefrom to a suitable dust collector. Numeral **60** designates a pipe fitting which is in communication with the suction line leading to interior of the hood and connected to a dust collector (not shown).

Another novel and improving feature of the present invention is the provision of means for introducing measured quantities of an accelerator agent to the concrete mix. Accelerator agents for concrete and cement are well known and used in the trade. Such agents cause the cement to set up very rapidly following the addition of water to the mix, and use thereof is especially desirable where the cement is being applied to a wall or ceiling surface.

In the present example there is provided an auxiliary hopper **70** (FIGS. **5** and **6**) for holding a supply of the accelerator material. Hopper **70** is or may be mounted on the side of the main hopper **13**. Operating within the hopper **70** is a vertical shaft **71** on which is mounted, within the base of the hopper, a shutter disc **72** for controlling and regulating the flow of the accelerator material to a discharge port **73** in the floor of the hopper. The shaft **71** is geared or belted to the drive shaft **27** for the main hopper, so that plate **71** operates to release measured batches of accelerator material in timed relation to the movement of the transport bowl **16**.

A conduit **74** conducts the accelerator agent to the transport bowl, its discharge end being located immediately above the bowl openings **22**. Agitator blades **75** are secured to and rotated by the shaft **71**. It will appear that measured quantities of the accelerator agent are added to the cement mix in the transport bowl shortly before the material is expelled therefrom. The minimal time that the accelerator is in contact with the mix while in the machine reduces the tendency of the mix to cake and foul surfaces of machine parts.

I claim as my invention:

1. A cement gun machine comprising:
a. a hopper for cement mixture,
b. a rotary transport bowl underlying the hopper,
c. drive means for said transport bowl,
d. a discharge tube,
e. pneumatic means for expelling cement from said bowl into said discharge tube, and
f. a hood within said hopper providing a substantially closed chamber above the transport bowl, said bowl preventing air from said pneumatic means from escaping upwardly through the body of said cement mixture in said hopper.

2. A cement gun machine as set forth in claim **1** including an exhaust pipe communicating with said chamber.

3. A cement gun as set forth in claim **1**, wherein: the transport bowl includes partitioning means defining radial, U-shaped pockets subtending inner and outer rings of openings, said hood having wall portions defining a chute for conducting cement mixture to the transport bowl through its said outer ring of openings.

4. The cement gun of claim **1** wherein said hood has a top wall having a central opening, an upstanding collar on said top wall extending around said opening, an agitator post extending vertically from said transport bowl and through said collar, a closure cap surrounding said collar, mounted on said agitator post, and agitator blades carried by said post and overlying the top wall of the hood.

5. The cement gun machine of claim **1** wherein said hood includes wall portions forming a chute at one side of the hopper, leading to the transport bowl, and wall portions at the opposite side of the hopper defining a cement discharging compartment.

6. A cement gun machine as set forth in claim **1** including an auxiliary hopper for accelerator material, said auxiliary hopper being adapted and arranged to release accelerator material therefrom to the cement mixture in the machine.

7. A cement gun machine as set forth in claim **6** wherein said auxiliary hopper is provided with agitator means operatively connected to the drive means for the transport bowl.

8. A cement gun machine as set forth in claim **1**, including an auxiliary hopper for cement accelerator material, and a conduit for conducting material from said auxiliary hopper into the transport bowl.

9. A cement gun machine as set forth in claim **8**, including means operatively connected to the transport bowl for controlling the flow of accelerator material delivered thereto.

10. A cement gun machine comprising:
a. a hopper for dry cement mixture,
b. a rotary transport bowl below the hopper,
c. drive means for said transport bowl,
d. means forming a chute for conducting mixture from the hopper to said transport bowl,
e. pneumatic means for discharging mixture from the bowl,
f. an auxiliary hopper for cement accelerator material,
g. and conduit means for conducting accelerator material from said auxiliary hopper to the transport bowl.

11. The cement gun machine set forth in claim **10** including means for controlling the flow of accelerator material from said container to the transport bowl.

12. The cement gun as set forth in claim **11** wherein the flow control means for accelerator material is operatively connected to the drive means for said transport bowl.

13. The cement gun machine as set forth in claim **10** wherein said conduit means conducts accelerator material into the transport bowl at a point adjacent to the point of discharge of the cement mixture from the transport bowl.

14. A cement gun machine comprising:
a. a main hopper for cement mixture,
b. a rotary transport bowl,
c. drive means for rotating said transport bowl,
d. passage means for conducting mixture from said hopper into the transport bowl,
e. pneumatic means for expelling the cement mixture from said transport bowl,
f. an auxiliary hopper for holding accelerator material to be added to the cement mixture in the machine,

g. and valve means operatively connected to said drive means for coordinating the rate of flow of cement accelerator material with the rotation of said transport bowl.

* * * * *