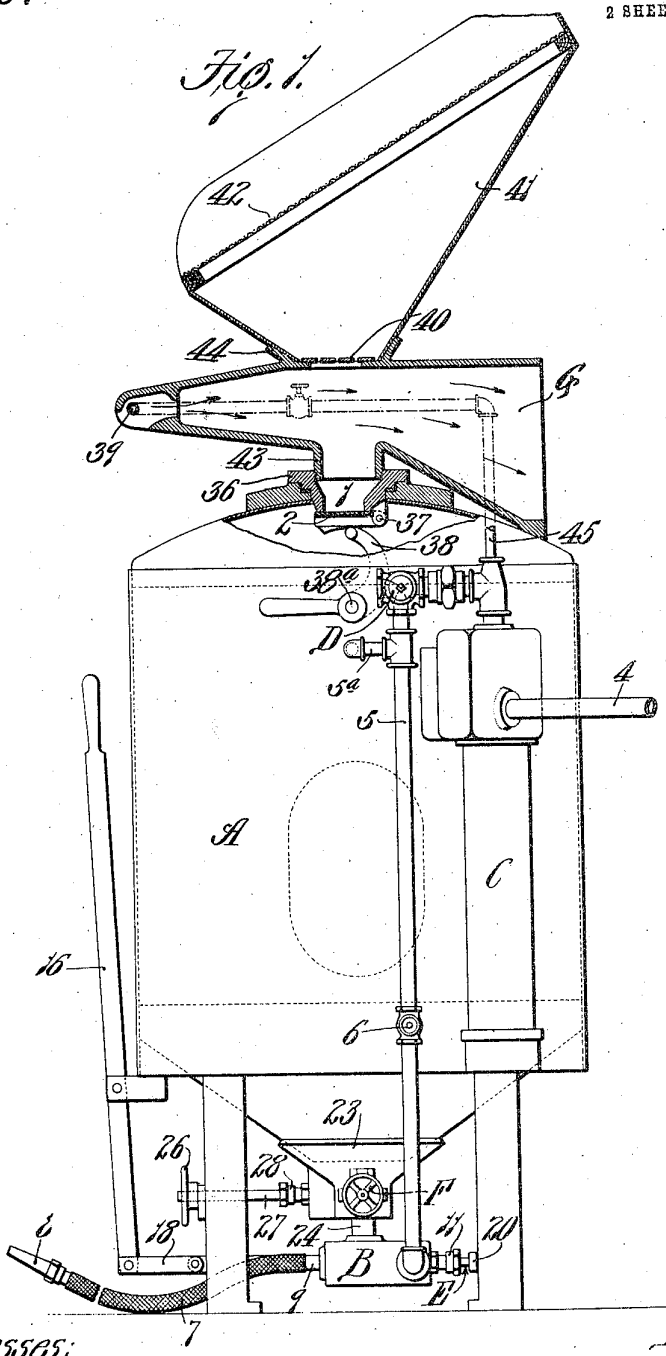
G. F. STEEDMAN.
CLOSED HOPPER SAND BLAST.
APPLICATION FILED JUNE 2, 1910.

979,897

Patented Dec. 27, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

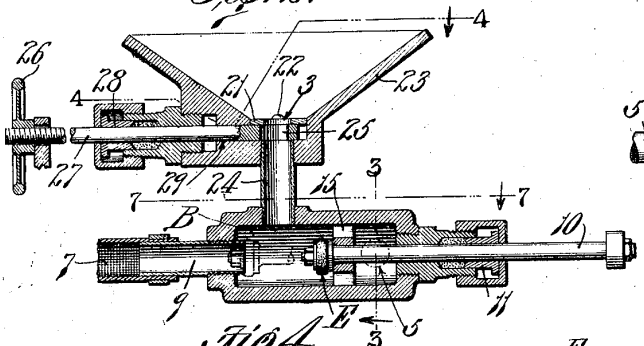


Fig. 3.

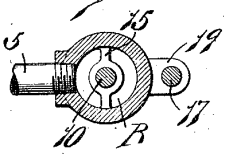


Fig. 4.

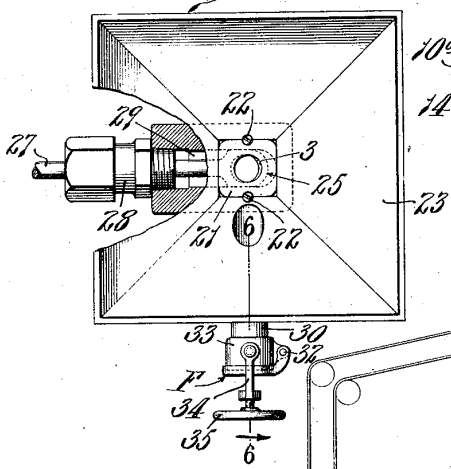


Fig. 5.

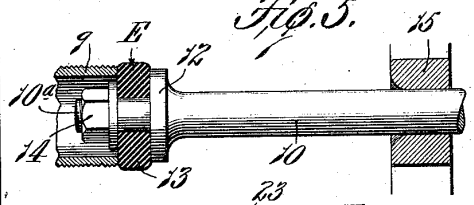


Fig. 6.

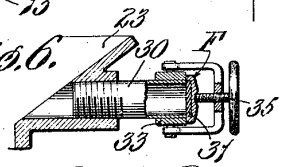


Fig. 7.

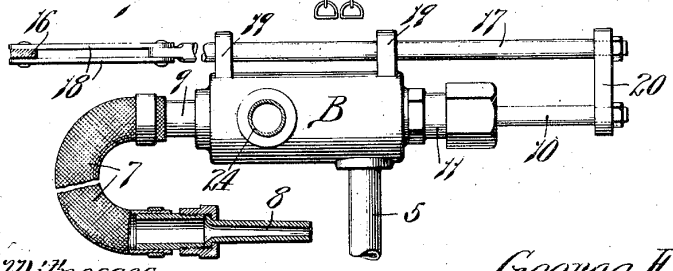
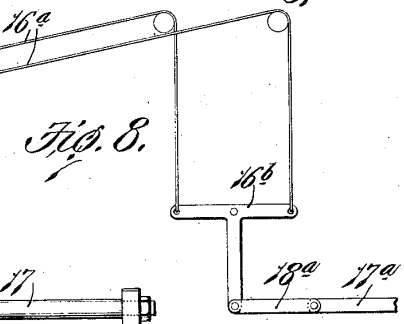


Fig. 8.



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UNITED STATES PATENT OFFICE.

GEORGE F. STEEDMAN, OF ST. LOUIS, MISSOURI, ASSIGNOR TO CURTIS & COMPANY MANUFACTURING COMPANY, OF WELLSTON, MISSOURI, A CORPORATION OF MISSOURI.

CLOSED-HOPPER SAND-BLAST.

979,897. Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed June 2, 1910. Serial No. 564,595.

To all whom it may concern:

Be it known that I, GEORGE F. STEEDMAN, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Closed-Hopper Sand-Blasts, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to sand blast apparatus, and particularly to closed hopper sand blasts, namely, sand blasts of that type in which the sand in the supply hopper is under air pressure.

One object of my invention is to provide a closed hopper sand blast apparatus which is so designed that the flow of air and sand to the blast tool or nozzle can be stopped and started instantly without varying or changing the position of the valve that governs the supply of compressed air to the sand hopper and mixing chamber, thereby effecting a great saving in the consumption of sand and air, and also eliminating the loss of time caused by exhausting the air from the sand hopper as was heretofore necessary when the blast was cut off.

Another object is to provide a sand blast apparatus which is so designed that the sand hopper can be cleaned out quickly in case damp sand becomes clogged in the discharge opening of the hopper.

Another object is to provide a sand blast apparatus comprising few parts and designed in such a manner that the parts which are subjected to the greatest wear can be renewed easily. And still another object is to provide a sand blast apparatus that comprises as an integral part thereof means for removing dust, pebbles and foreign matter from the sand that is fed to the supply hopper.

Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 is an elevational view partly in vertical section of a sand blast apparatus constructed in accordance with my invention; Fig. 2 is an enlarged vertical sectional view of the mixing chamber and the lower portion of the sand hopper; Fig. 3 is a vertical sectional view taken on approximately the line 3—3 of Fig. 2; Fig. 4 is a top plan view of the parts shown in Fig. 2, a portion of said view being in horizontal section taken on approximately the line 4—4 of Fig. 2; Fig. 5 is an enlarged detail view, partly in section, of the shut-off valve; Fig. 6 is a detail sectional view of the clean-out valve, said view being taken on approximately the line 6—6 of Fig. 4; Fig. 7 is a top plan view of the mixing chamber, said view being taken on approximately the line 7—7 of Fig. 2; and Fig. 8 is a view of a slightly modified form of operating mechanism for the shut-off valve.

Referring to the drawings which illustrate the preferred form of my invention, A designates the closed sand supply hopper which is provided at its upper end with a filling opening 1 which is normally closed by a valve 2, and at its lower end with a discharge opening 3 through which the sand flows into the mixing chamber B.

A water separator C of any preferred design is preferably arranged between the sand hopper and the compressed air supply pipe 4 so as to remove as much moisture as possible from the air before it enters the supply hopper and the mixing chamber, the compressed air being introduced into the hopper and into the mixing chamber by means of a conduit 5 leading from the upper end of the water separator to the mixing chamber, as shown in Fig. 1, and provided with a branch 5^a that is tapped into the sand supply hopper adjacent the upper end thereof.

A three-way valve D is arranged in the conduit 5 between the branch 5^a thereof and the water separator C so as to permit the air to exhaust from the hopper and from the mixing chamber when said hopper has to be refilled, and, if desired, a valve 6 can be arranged in the conduit 5 for governing the flow of air to the mixing chamber B. The hose 7 which conducts the stream of sand and air to the blast tool or nozzle 8 is connected to a sleeve 9 that is tapped into one end of the mixing chamber, as shown in Fig. 2, and a shut-off valve E is arranged in the mixing chamber so as to enable the flow of sand and air through the hose 7 to be stopped and started instantly at the will of the operator. The shut-off valve herein shown is of the piston or plunger type, and

consists of a plunger 10 reciprocatingly mounted in a stuffing-box 11 in one end of the mixing chamber and provided at its inner end with a head 12 to which a soft rubber washer 13 is connected by means of a nut 14 mounted on a screw-threaded extension 10^a on said plunger that passes through the washer, as shown in Fig. 5. A cross-piece 15, which is arranged in the mixing chamber, as shown in Fig. 2, forms a guide for the plunger 10 and also acts as a stop that limits the movement of said plunger in one direction, the plunger being moved longitudinally of the mixing chamber so as to carry the valve E into and out of operative position by means of a lever 16 whose lower end is connected to an operating rod 17 by means of links 18, said rod 17 passing through lugs 19 on the outside of the mixing chamber B and being connected to the rear end of the plunger 10 by means of a cross-piece 20, as shown in Fig. 7.

When the blast is being used the valve E will occupy the position shown in full lines in Fig. 2 so that it will not obstruct the stream of sand that is forced into the hose 7 by the pressure in the hopper and in the mixing chamber, but when it is desired to cut off the blast the valve E is moved inwardly into the position shown in broken lines in Fig. 2 so that the soft rubber part 13 thereof will bear against the inner end of the sleeve 9 and thus positively cut off the flow of sand and air to the hose 7 which leads to the blast tool.

I have found that a shut-off valve of the construction above described is very efficient because when it is in its operative position, namely, closing the end of the hose 7 as shown in broken lines in Fig. 2, the pressure of the air in the mixing chamber holds it so tightly against the end of the sleeve 9 that an air-tight joint is formed, and when it is in its inoperative position, as shown in full lines in Fig. 2, it is located out of the path of travel of the sand which flows from the supply hopper and is thus not subjected to constant abrasion which would cause it to wear out quickly. I do not wish it to be understood, however, that my invention is limited to a sand blast apparatus provided with a shut-off valve of the exact construction herein shown for various other types of valves could be used for cutting off the flow of sand and air from the mixing chamber. Furthermore, instead of using the lever 16, as shown in Fig. 1, for operating the plunger of the shut-off valve said plunger could be operated by means of ropes or cables 16^a leading from a point some distance from the apparatus and connected to a T-shaped device 16^b whose vertical leg is connected by means of links 18^a to the operating rod 17^a of the valve plunger.

A sand blast apparatus of the construction above described is a decided improvement on the closed hopper sand blasts which have heretofore been in general use owing to the fact that the operator can cut off the flow of both air and sand when he desires to turn or change the position of the work being operated on. In the old type of closed hopper sand blasts the blast was stopped and started by turning the valve which controlled the supply of compressed air to the sand hopper and mixing chamber, and when said valve was closed the sand and air would flow from the blast tool for several minutes or until all of the air in the hopper had escaped. Consequently, a large amount of sand and air was wasted every time the blast was cut off, and as it took several minutes for the air to escape from the hopper a great deal of time was wasted during the course of a day in starting and stopping the blast. My improved apparatus overcomes this objectionable feature and enables the sand blast to be stopped and started instantly at the will of the operator so that he can turn or shift the work being operated on without wasting air or sand or being annoyed by the continuous action of the blast.

The bottom of the sand supply hopper is preferably tapered and the discharge opening 3 is formed in a plate 21 that is detachably connected by means of screws or other suitable fastening devices 22 to an inverted pyramidal-shaped casting 23 which forms the extreme lower end of the bottom of the sand hopper. A vertically disposed pipe 24, which is detachably connected to the casting 23 and to the mixing chamber B, serves as a conduit for the sand that flows out of the hopper, and a sliding gate or valve 25 is reciprocatingly mounted in a guideway in the casting 23 so as to regulate the flow of sand through the discharge opening 3. The head of said sand gate 25 is provided with an opening and an operating nut or wheel 26 is mounted on a screw-threaded stem 27 on said sand gate so as to move it longitudinally of the guideway in which it is mounted and thus cause more or less of the opening in the head thereof to aline with the discharge opening 3 of the hopper and the conduit 24. The stem of the sand gate passes through a stuffing-box 28 which closes the outer end of the guideway 29 in the casting in which the sand gate is mounted, and said guideway is made large enough to enable the sand gate to be entirely withdrawn from same when the stuffing-box 28 is removed. A construction of the character above described permits the sand gate, the plate 21 and the pipe 24 to be removed easily and replaced at a small cost, it being necessary to renew said parts frequently because the continual action of the sand on same causes them to wear out quickly.

The water separator C removes a great

deal of moisture from the air that is introduced into the hopper but nevertheless there is always a certain percentage of moisture remaining in the air that causes the sand to become damp, and frequently this damp sand clogs the discharge opening of the hopper. To provide for this condition I have equipped the sand hopper with a clean-out valve F that closes the outer end of the discharge pipe 30 which is tapped into one side of the casting 23 at the lower end of the hopper, as shown clearly in Figs. 4 and 6. The valve F is provided with a soft rubber pad 31 that fits tightly against the end of the pipe 30, and said valve is hinged or pivotally connected at 32 to a lug on a collar 33 which is secured to the pipe 30. A yoke 34 is pivotally connected to said collar, and an adjusting screw 35, which is mounted in said yoke, operates to hold the valve F tightly seated. When the yoke 34 is shifted so as to release the valve F the pressure in the sand hopper will cause said valve to fly open and thus permit the damp sand at the lower end of the hopper to escape through the pipe 30 in a few seconds. After the damp sand has escaped the valve F is closed and the yoke 34 is returned to its former position so that the screw 35 therein will bear against the valve and thus force the soft rubber pad of said valve tightly against the end of the pipe 30.

The filling opening 1 at the upper end of the sand hopper is preferably formed in a casting 36, and the valve 2 that normally closes said opening is hinged or pivotally connected at 37 to said casting, said valve being provided with a soft rubber pad that bears against the under side of the casting 36 and thus forms an air-tight joint when said valve is closed. Any suitable means may be provided for retaining the valve 2 in position, such, for example, as an arm 38 on a manually-operated rock shaft 38^a which extends transversely through the hopper A, as shown in Fig. 1. When it is desired to fill the hopper this rock shaft is moved in a direction to cause the arm 38 to pass out of engagement with the valve 2 and thus permit said valve to swing downwardly, and when said rock shaft is returned to its former position the arm 38 will engage the valve 2 and move it tightly against its seat. A dust-removing chamber G is arranged above the filling opening of the supply hopper, and a jet pipe 39 is arranged at one end of said chamber so as to cause a plurality of jets of air to pass longitudinally of said chamber, in the direction indicated by the arrows in Fig. 1 and thus cause the dust and undersized particles of sand to be separated from the stream of sand that flows through the grate-bars 40 of the charging hopper 41 which is arranged above said dust-separating chamber, said charging hopper being provided with a screen 42 that prevents gravel and other foreign matter from entering said hopper when sand is being introduced into same. This dust-separator and gravel-removing mechanism forms an integral part of the sand blast and it eliminates the possibility of the blast nozzle becoming clogged or from discharging particles of sand which are too small to be of any use as a cleaning agent. The member or casting which constitutes this dust-separating chamber G is provided with a flange 43 that fits in an opening in the casting 36 in the top wall of the sand hopper, and said member is provided at its upper side with a flange 44 which receives the lower end of the charging hopper 41, the compressed air being conducted to the jet pipe 39 by means of a pipe 45 which is tapped into the air supply pipe that leads from the upper end of the water separator.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A sand blast apparatus, comprising a closed sand hopper whose contents is under fluid pressure, a conduit for establishing communication between said hopper and a blast tool, means for supplying fluid under pressure to said conduit so as to cause a stream of sand under pressure to emerge from the blast tool, and means for cutting off the flow of sand and fluid pressure from the blast tool without disturbing or varying the supply of fluid pressure to the sand hopper.

2. A sand blast apparatus, comprising a closed hopper or container that is adapted to hold sand under air pressure, a conduit for conducting a stream of sand from said hopper to a blast tool, means for supplying air under pressure to said conduit, and a shut-off valve for starting and stopping the flow of sand and air through said conduit.

3. A sand blast apparatus, comprising a closed hopper or container that is adapted to hold sand, a mixing chamber communicating with the discharge opening in said hopper, means for supplying compressed air to said hopper and to the mixing chamber, a conduit communicating with said mixing chamber for conducting a stream of sand and air to a blast tool, and means for stopping and starting the flow of sand and air from said mixing chamber to said conduit without disturbing the supply of compressed air that is admitted to said hopper and mixing chamber.

4. A sand blast apparatus, comprising a closed hopper or container that is adapted to hold sand, a mixing chamber communicating with the discharge opening in said hopper, means for supplying compressed air to said hopper and to said mixing chamber, a conduit communicating with said mixing cham-

ber for conducting a stream of sand and air to a blast tool, and a shut-off valve under control of the operator for controlling the flow of sand and air that passes from said mixing chamber into said conduit.

5. A sand blast apparatus, comprising a closed hopper or container that is adapted to hold sand, a mixing chamber communicating with the discharge opening in said hopper, means for supplying compressed air to said hopper and mixing chamber, a conduit communicating with said mixing chamber for conducting a stream of sand and air to a blast tool, and a shut-off valve in said mixing chamber for controlling the flow of air and sand from said mixing chamber into said conduit, said shut-off valve being so designed that when it is closed the pressure of the air in the mixing chamber operates to hold it seated.

6. A sand blast apparatus, comprising a closed hopper or container for holding sand, a mixing chamber communicating with said hopper, means for introducing compressed air into said hopper and mixing chamber, said mixing chamber having a discharge opening through which sand and air flows, a reciprocating valve arranged in said mixing chamber for closing said discharge opening, and manually-operated means for moving said valve into operative and inoperative position.

7. In a sand blast apparatus, a mixing chamber provided with an opening through which sand enters same, and an opening through which compressed air enters, a conduit leading from said mixing chamber for conducting a stream of sand and air to a blast tool, a shut-off valve arranged in said mixing chamber intermediate the sand-supply opening and the air-supply opening, and means for moving said valve into closed position so as to cut off the escape of said sand and air from the mixing chamber into said conduit.

8. In a sand blast apparatus, a sand hopper provided at its lower end with a member which constitutes a portion of the bottom of the hopper, a gate or valve slidingly mounted in said member for controlling the discharge of sand from the hopper, said member being provided with a guideway of sufficient dimensions to permit the sand gate to be drawn out of same, a closure for the outer end of said guideway, and a stem on said sand gate of less cross sectional area than the gate that passes through an opening in said closure.

9. In a sand blast apparatus, a sand hopper provided at its lower end with a member which constitutes a portion of the bottom of the hopper, a gate or valve slidingly mounted in said member for controlling the discharge of sand from the hopper, said member being provided with a guideway of sufficient dimensions to permit the sand gate to be drawn out of same, a stuffing-box on said member that closes the outer end of said guideway, and a stem or plunger on the sand gate of less cross sectional area than the gate that passes through said stuffing-box.

10. In a sand blast apparatus, a sand hopper provided at its lower end with a member that constitutes part of the bottom of the hopper, a removable plate detachably connected to said member and provided with a discharge opening through which the sand passes from the hopper, and a removable sand gate or valve arranged in said member underneath said plate for controlling the passage of the sand through the discharge opening in said plate.

11. In a sand blast apparatus, a sand hopper provided at its lower end with a member that constitutes part of the bottom of the hopper, a removable plate detachably connected to said member and provided with a discharge opening through which the sand passes from the hopper, a removable sand gate or controlling valve arranged in said member underneath said plate, a mixing chamber arranged under the hopper, and a detachable connection between said mixing chamber and the member at the lower end of the hopper for establishing communication between said mixing chamber and the discharge opening of the hopper.

12. A sand blast apparatus, comprising a closed hopper that contains sand and air under pressure, said hopper being provided with a feed opening and a clean-out opening, a valve for normally closing said clean-out opening and which opens automatically when it is released, and means for holding said valve seated.

13. A sand blast apparatus, comprising a closed hopper or container for holding sand and air under pressure, said hopper having a tapered bottom in which an opening is formed for permitting the sand to escape from said hopper, a clean-out opening in the tapered bottom of said hopper of sufficient dimensions to permit damp or wet sand to be forced through same by the pressure in the hopper, a valve for said clean-out opening which is adapted to be opened automatically by the pressure in said hopper, and means for holding said valve seated.

14. A sand blast apparatus, comprising a closed hopper or container for holding sand and air under pressure, said hopper having a tapered bottom in which an opening is formed for permitting the sand to escape from said hopper, a clean-out opening in the tapered bottom of said hopper of sufficient dimensions to permit damp or wet sand to be forced through same by the pressure in the hopper, a pivotally mounted valve for said opening which opens automatically when it is released, and a device

that normally bears against said valve and holds it seated.

15. A sand blast apparatus, comprising a closed hopper or container for receiving sand and air under pressure, said hopper having a tapered bottom in which a discharge opening is formed, a clean-out pipe projecting outwardly from the inclined bottom of the hopper, a hinged valve that normally bears against the end of said pipe and which opens automatically when it is released, and a yoke-shaped device mounted on the end of the pipe and provided with an adjusting screw that bears against said valve and holds it seated.

16. A sand blast apparatus, comprising a closed hopper or container for receiving sand, a mixing chamber communicating with said hopper, means for introducing air under pressure into said hopper and mixing chamber, a conduit leading from said mixing chamber for conducting a stream of sand and air to a blast tool, a shut-off valve under the control of the operator for starting and stopping the flow of sand and air through said conduit, and means for regulating the flow of sand from the hopper into the mixing chamber.

17. A sand blast apparatus, comprising a closed hopper or container for receiving sand, a mixing chamber communicating with said hopper for receiving sand therefrom, a water separator, means for causing air under pressure to pass through said water separator and then into the hopper and into the mixing chamber, a valve independent of the filling opening in the hopper for permitting the air to exhaust from said hopper and mixing chamber, a conduit leading from the mixing chamber for supplying a stream of sand and air to a blast tool, and an independent valve for governing the flow of air and sand through said conduit.

18. A closed hopper sand blast provided with means for regulating the flow of sand out of the sand hopper, said means consisting of a removable metal plate detachably connected to the hopper and provided with an aperture and a horizontally disposed gate valve coöperating with said plate, a mixing chamber under said gate valve that is connected to the source of compressed air supply, said mixing chamber having an outlet for the combined sand and air stream that flows from the mixing chamber, and a yielding stopper for closing said outlet at will so as to cut off the flow of sand and air from the mixing chamber.

19. In a closed hopper sand blast, a sand hopper, a mixing chamber connected to the sand hopper and to the source of compressed air supply, a sand valve in the connection between the mixing chamber and hopper for regulating the flow of sand to the mixing chamber, said mixing chamber having an outlet for the combined stream of air and sand, a stopper in said mixing chamber for cutting off the flow of sand and air from the mixing chamber, said stopper being so designed that when it is in an open position it will be out of the path of the sand which escapes from the hopper into the mixing chamber, and a means for operating said stopper at will.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this 28th day of May 1910.

GEORGE F. STEEDMAN.

Witnesses:
JOHN S. REEDER,
R. E. WINKLER.