ABRASIVE GRIT MARKING MACHINE

Fig. 1.

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This invention relates to marking machines for etching articles by the use of abrasive particles propelled by air against the article, and is for an improved machine of this type.

Many articles, particularly articles formed of glass, such as lamp bulbs, electron tubes and similar thin-walled vessels have a trademark, part number or other identification or indicia, etched into the surface thereof, and machinists have been designed heretofore for so marking an article by propelling abrasive particles at high velocity through a stencil against the surface of the article.

Frequency it is necessary to locate apparatus of this type in an environment where the air must be free of dust, and a present difficulty with existing machines for this purpose is that they may diffuse dust or fine abrasive or glass particles into the air. Another difficulty arises from the fact that the work pieces are generally supplied to the machine and removed automatically and at high speed. Under these conditions a fragile article may be broken from time to time. Suction is used to hold the work piece against the stencil, and in case of breakage a piece of broken glass may remain on the stencil, so that it interferes with a subsequent article or articles being positioned against the stencil. Since one operator attends several machines, such condition may continue through several marking cycles where the article is imperfectly marked before the trouble is discovered.

The present invention has for a principal object to provide an abrasive grit etching machine designed to substantially eliminate any diffusion of dust, glass fragments, or abrasive material into the environment in which the machine is located.

A further important object of this invention is to prevent a fragment of glass or other foreign particle from remaining on the stencil or interfering with the marking of the next work piece.

A further important object of this invention is to provide a machine for this purpose having improved feed means for assuring an adequate blast of abrasive to the blast nozzle without choking or clogging the machine.

A still further important object is to provide a machine in which spent abrasive and powdered glass are separated from the abrasive material which is continuously reused.

Another object of this invention is to provide a machine for this purpose of novel organization and construction, wherein parts normally requiring attention are readily accessible for cleaning, repair or replacement.

These and other objects and advantages are secured by this invention as will be apparent to those skilled in the art and the nature of which may be more fully understood by reference to the accompanying drawings, in which:

FIG. 1 is a vertical section through a machine constructed in accordance with my invention in the plane of line 1—1 of FIG. 2;

FIG. 2 is a top plan view of the machine;

FIG. 3 is a fragmentary vertical section in the plane of line II—II of FIG. 2;

FIG. 4 is a side elevation with the extension cover of the machine in section; and

FIG. 5 is a schematic diagram of the pneumatic circuits.

The machine as illustrated comprises a casing 2 which, as best seen in FIG. 2, is of diamond shape, and it encloses two vertical cylindrical vessels, one of which is designated 3. Vessel 3 has a flange 3a at its upper end that extends over a plate 4 at the top of the casing, suspending the vessel in the casing. A rubber gasket 5 is located between the flange 3a and the support 4. The vessel 3 has a cover 6 at its upper end which is removable held in place by tension clamps 7 (see FIG. 3) and by a clamping member 8 which is loose on a pin 9 projecting through the supporting plate with a spring 10 to resiliently urge the rod and clamping member down. This clamping member may be released by raising the pin 9 and turning the member 8 crosswise.

The cover member 6 may be formed as an integral casting having an annular ridge 11 on the top surface surrounding a well or depression 12. In the top surface of this ridge there is an annular groove 13. At the center of the depression 12 there is an opening 14. A rubber block 15 is set in the depression 12 over the opening 14, and it has openings therethrough defining the stencil or marking to be put on the article. This stencil is removable held in position by dowel pins 16 (see FIG. 3) and spring clips 16a.

Mounted on the ridge 11 is a ring 17 which surrounds the stencil-receiving cavity, and this ring in conjunction with the ridge 11, forms an annular enclosure for the stencil. The ring 17 is removably held in place by rotatable clamp elements 18 which are resiliently held against the top of the ring 17 by springs 19, but these elements can be raised against the compression of their springs and turned when it is necessary to remove the ring 17. Cemented or otherwise secured to the top of the ring 17 is a cover plate 20 preferably of clear plastic material having a central opening 21 therethrough, through which articles to be marked can be placed on the stencil and removed from the stencil after they have been marked. At the same time this plate partly covers the space within the enclosure around the die to restrict the diffusion of dust into the surrounding air.

As will be best seen in FIG. 3, there is a slight gap between the face of the ridge 11 and the ring 17, this gap being indicated 22 and extending entirely around the enclosing wall. It communicates with the channel 13. There are one or more ports 23 leading from the channel 13 into tube-like extensions or pipes 24. Over the ends of the pipes 24 are rubber exhalation valves 25 which function as check valves. As long as there is a suction in the cylindrical vessel 3, air will be drawn through the annular slit 22, the channel 13, ports 23, pipes 24, and exhalation valves 25, but if there is a positive pressure in the vessel 3, the exhalation valves 25 close and prevent any bulk flow of air from the interior of the vessel 3 outwardly. The walls of the cavity 12 in which the stencil is positioned, slope upwardly to the slit-like annular ports 22. The arrangement just described enables dust, fragments of abrasive, glass, or dust-laden air to be drawn from the area within the enclosure through the slit-like port 22 into the channel 13, and down through the opening 24 into the vessel 3 by vacuum maintained within the vessel 3, but it prevents any reverse flow of dust or air from the interior of the chamber 3 back into the enclosure.

On the under side of the plate 6 there are two depending arm-like extensions 27, and the lower ends of these arms are joined by part 28 forming a spider or yoke-like support through which passes the air-abrasive blast nozzle 29. This nozzle is centered directly under the opening 14 below the stencil and is at the top of a tube 30 that extends axially down through the vessel 3. The tube 30 has a ring 31 at its lower end, the lower edge of which is slotted to provide an annular series of ports 32.

The vessel 3 has an inverted truncated conical bottom member 33 secured thereto in the center of which is a well 34, and the slotted ring 31 at the bottom of the pipe 30 rests on the bottom of this well. The sloping
inner face of the bottom closure 33 is provided with a plurality of spaced lugs or fins 35 on which is set a deflector plate 36. The periphery of the plate 36 is spaced only a very slight distance from the inner face of the sloping walls 33, leaving a narrow, substantially annular slot between the periphery of the disk 36 and the walls 33 through which abrasive may fall from the top of the pipe 38 to the bottom of the well 34. On top of the disk 36 is an abrasive distributing cone 37 which radiates outwardly and downwardly from the pipe 30.

An air pipe 38 is positioned concentrically within the tube 30 and terminates at its upper end in a nozzle 39 that is centered under the nozzle 29, the nozzle 29 having a spray- or jetted passage 29c at its lower end spaced above the air nozzle 39. The lower end of the pipe 38 passes through a bushing 40 at the bottom of the well 34, and there is a quick-release coupling 41 at the lower end of this pipe for connecting it to a source of air supply connection 42.

In operation such that when a mass of abrasive material is put on the top of the cone 37, it will flow from the periphery of the disk 36 down into the well 34, where its angle of repose, as indicated by the dotted lines, will bring a small portion of the material adjacent the slot 22 to the bottom of the ring 31, but the depth of abrasive can never reach a point where the ports 32 will be obstructed.

When a blast of high-pressure air is discharged through the pipe 38 and nozzle 39, air within the vessel 3 will be aspirated through the ports 32 and drawn up outside the pipe 38. The current of air so aspirated will pick up abrasive grains from the floor of the well 34 adjacent the slots 22 and entrain the abrasive which will be carried up with the aspirated air into the nozzle 29, whereby a blast of air and abrasive is discharged from the nozzle 29 and projected upwardly through the ports 34 and through the pattern defined by the stencil. An object to be marked is positioned on the stencil and will be struck with the abrasive that passes through the stencil, and its surface etched in accordance with the design carried in the stencil. The stencil itself is made of rubber so that it is not subject to rapid abrasion.

To assure that the abrasive is kept in a dry and free-flowing condition, a ring-type electric heater 43 is confined against the bottom face of the member 33 below the well 34 by a retaining ring 44, thereby supplying heat to the abrasive at the bottom of the well to assure of its being dry and free-flowing.

The upper member 6 for the vessel 3 has a depending annular flange 45 on the under face thereof outside the arms 27. A rubber sleeve or boot 46 is fitted about the exterior of the flange 45 and is removably held in place by an elastic ring 47. There are a number of wire rings 48 inside this sleeve to maintain its cylindrical form, and the bottom of the sleeve terminates above the cone 37. At the top of the member 33 and at the level of the bottom of the sleeve 46 there is an annular swiveling plate 49 having an annular series of sloped vanes, the purpose of which is to impart a swirling or rotational movement to a blast of air which passes through the swiveler and travels upwardly outside the sleeve 46.

As best shown in FIG. 4, the vessel 3 has an outlet 50 in the side wall thereof near the top, over which is fitted an exhaust pipe 51, the exhaust pipe having a flange 52 that bears against the surface of the vessel 3, and which is releasably clamped in place by fasteners 53. The exhaust pipe 50 has a downwardly-turned end which is connected through a hose or coupling 54 with the upwardly-turned end of a similar pipe fitting 55 which leads to a port 56 in the side wall of the second of the two cylindrical vessels referred to being housed within the casing. This second cylindrical vessel is designated generally as 57, and it constitutes the vacuum unit by means of which air and dust are exhausted from the interior of the vessel 3. The vessel 57 has a top flange 57a that rests on the top plate 4 of the machine, and by which the vessel 57 is suspended within the casing. It is provided with a cover 58 which is held in place by pull-down clamps like those which hold the cover plate 6 in the vessel 3 in place, and it is also held down by the clamp 8 which also bears against the cover plate 6. There is a gasket 59a between the flange 57a and the top 4. Intermediate the top and bottom of the vessel 57 is a flange 59 for supporting the vacuum pump and motor which is constructed as a unit. The motor is designated 60, and 61 designates a vacuum pump or blower of any known or preferred design with this device forming a part of the present invention per se, but at the bottom of the vacuum unit 61 is a perforated plate 62 through which air is drawn by a fan or blower driven by the motor 60. Surrounding the vacuum pump 61 is a spreader or wire frame 63 about which is placed a cloth filter bag 64, the arrangement being such that air which is exhausted from the vessel 3 and enters the port 56 in the vessel 57 may flow entirely around the cloth bag 64.

The air will be drawn through the cloth and pass through the exhaust fan, while dust particles and glass fragments will be caught on the outside of the bag. The whole assembly of the motor, vacuum pump, spreader and cloth bag are 64 are supported on the flange 59 so that they can be removed as a unit. The air which is exhausted from below the flange 59 escapes through a downwardly-turned elbow 65 (see FIG. 2) into the space within the casing. A separator plate is indicated around the motor at 66, and cooling air to the motor is admitted through a vent cap 67 in the cover 58.

At the bottom of the vessel 57 is a removable tray 68 that is fractionally retained in place and held by spring clips 69. It has a handle 70 on its under surface, by means of which this tray may be removed from time to time to empty any dust or other waste materials.

The exhaust line comprising the pipes 51 and 55 is desirably provided with a butterfly valve 70 which may be adjusted to regulate a desired degree of vacuum in the chamber 3.

The suction which is created in the vessel 3 not only serves to draw in dust through the channel 13 as above described, but it is also effective through the opening in the stencil for holding an article which is to be marked in position on the stencil until the instant that the air-abrasive blast is turned on. Usually the article to be marked will be placed on the stencil and removed by machinery, and if these articles are large in size may occasionally break. For removing broken fragments from the stencil there are provided one or more, preferably two, air nozzles 71 mounted in the ring 17 and positioned so as to blow a current of air across the top surface of the stencil. Air is supplied to these nozzles through pipes 72 (see FIG. 5), the terminals of which are screwed into sockets 73 in the ring 17 as best shown in FIG. 1. However, since there is a vacuum in the vessel 3 which is effective through the stencil to hold a light piece of glass in position on the stencil, so that the air nozzles alone cannot be relied upon to effect removal of any such fragment. As pointed out above, a fragment which would be retained on the stencil would interfere with the proper marking of succeeding articles. Therefore the present invention provides a shutter which moves under the stencil after each sand blasting apparatus, and while air is being delivered to the nozzles 71 so that the suction through the stencil is broken to prevent any fragment from being held by suction on the stencil. For this purpose there is provided a slide way 74 in the plate 6 under the stencil along which a shutter plate or valve 75 (see FIG. 2) is movable from a position to one side of the opening through the stencil to the position to close the stencil opening. This shutter 75 is actuated by a radial rod 76 slidably mounted in the plate 6, and which constitutes a piston rod having a piston (not shown) within a double-acting pneumatic cylinder 77. When
air is admitted to one end of the cylinder, the shutter is thrust forwardly under the opening through the stencil, and when air is supplied to the opposite end of the cylinder, the shutter is retracted to its inoperative position to one side of the stencil opening. The pipe 78 indicates the air supply pipe to the cylinder 77 for removing the shutter into position under the stencil, and the air pipe 79 admits air to the opposite end of the cylinder for retracting the shutter.

The pneumatic system for the machine may best be seen by reference to FIG. 5, which is a schematic diagram. Air from a compressor (not shown) is supplied to pipe 80. The air passes through a filter 81 into a T 82. A flexible pipe 83 78 for passing through the one side of this T to an air pressure regulator 84, and the air from the regulator passes out through connection 85 to a second T 86. One branch of the connector 86 leads to a two-way solenoid-actuated valve 87, and from the valve 87 there is a connection 88 leading to the coupling 42 at the bottom of the air blast tube 38 in the vessel 3. When the solenoid valve 87 is operated, a blast of air is delivered to the pipe 38 and to the nozzle 39, aspirating additional air from the vessel 3 and picking up abrasive in the manner hereinbefore described. When the solenoid valve 87 is closed, no air can flow to the abrasive nozzle. There is a pipe 89 leading from the T 82 to the two-way solenoid valve 87 to assure positive closing of this valve, the valve being a well-known piece of equipment constituting no part of the present invention. There is also a pipe 90 which leads from the outlet of the pressure regulator to a four-way solenoid valve 91. One connection from the four-way solenoid valve is designated 92, and is connected to pipe 93 which leads to a branch 94 from which there are three separate lines 95, 96 and 97. Lines 95 and 97 connect to the nozzle 71 through connections 72 for blowing air across the top of the stencil. Line 96 is a continuation of pipe 78 for operating the shutter to the position where the shutter is over the stencil. Another outlet of valve 91 leads through pipe 98 to pipe 79 which actuates the shutter to its inoperative or retracted position. A fourth position of the four-way valve vents either the pipe 79 and its connections, or the pipe 93 or its connections to the atmosphere.

The machine may be manually operated or may be operated automatically through an electric control system (not shown), and which forms no part of the present invention. The general operation of the machine is as follows: In starting up the machine, the cover 6 is removed from the vessel 3 and a quantity of fine abrasive grit is dumped into the top of the vessel 3. It falls down to the plate 36 where it accumulates on top of the cone 37 and gradually sifts down through the space between the plate 36 and the inner wall of the bottom closure 33 into the well, reaching its angle of repose in the manner above described so that the grains are near the ports 32, but cannot choke these ports. Having charged the abrasive into the machine, the cover 6 is replaced and the vacuum pump is energized. A piece to be marked, as for example a vacuum tube, is placed through the opening 21 in the plate 20 onto the top of the stencil and the suction through the stencil holds the piece in position on the stencil. When the piece has been properly positioned, a blast of air is admitted to the pipe 42 and is discharged from the nozzle 39, thereby aspirating abrasive grains from the bottom of the well 34 into the nozzle 29. The air and abrasive are projected at high velocity from the end of the nozzle 29 against the under side of the stencil. Those particles which pass through the stencil impinge against the object so placed on the stencil and etch the pattern of the stencil on the glass. The blast is then shut off and the shutter 75 is moved to position under the stencil to break the suction through the stencil, releasing the suction against the piece which has been etched, and at the same time a blast of air is blown through the nozzle 31 to blow any fragments of abrasive, glass, or other foreign material from the surface of the stencil into the enclosure about the stencil. During all of this time, air within the enclosure containing the stencil will be drawn by vacuum through the check or exhaustion valves 15 into the space inside the rubber boot or sleeve 46, except for the short instant during which the blast is effecting the etching. When the blast is on, a positive pressure is created in the upper part of the vessel 3, including the interior of the boot 46, which will immediately close the exhaustion valves to prevent any reverse flow of air. As soon as the air blast is turned off, there will again be a negative pressure that will draw air from the enclosure around the stencil, bringing with it any particles of dust, abrasive or solids that might ordinarily drift out into the room or which the machine is located. Any broken pieces of glass that are too large to be blown through the annular port or passageway 22 will simply be retained in the cavity around the stencil until such time as the operator finds it convenient to remove the rings 17 and clean out this area.

The abrasive which strikes the glass or other article to be etched, as well as that which hits the stencil, falls back through the sleeve 46 to the surface of the cone 37 to be reused. Shattered abrasive, abrasive dust, and glass dust which is lighter than the usable abrasive also falls down through this sleeve or boot 46, but as it reaches the bottom of the boot, is caught by the up-draft of air through the swirlers 49. Heavy usable particles of abrasive that might be so caught have the opportunity of dropping back while the dust and fragments are drawn out through the exhaust system and carried over into the exhaust vessel 57 where they are trapped by the filter bag 64 or drop into the removable tray 68.

The machine as described prevents contamination of the air in the place where the machine is used by reason of the suction system for withdrawing air from the enclosure around the die, assuring that air is drawn into the enclosure instead of being expelled therefrom. There is a work piece over the stencil at all times when there is a positive pressure under the stencil to prevent dust from blowing out through the stencil. The abrasive material is constantly reused, but by the vacuum system is kept free of shattered particles, dust and glass fragments. The suction can be so regulated that only the lighter materials and particles are drawn over to the exhaust unit. The machine does not require constant attention by the operator, because it is assured that the surface of the stencil is always free of any broken pieces of glass or any foreign body that would prevent proper contact of a work piece with the stencil. The exhaust unit may be lifted bodily from its vessel. The stencil itself is readily replaced, and removal of the cover 5 allows a diameter and depth to receive the work piece and which has an opening in the top thereof through which the work piece
may be placed in the enclosure on the stencil and removed from the enclosure, the enclosure having an annular dust-removing channel extending horizontally around it and opening into the space within the enclosure, and a suction pipe opening into the channel whereby dust-laden air may be withdrawn from the area within the enclosure.

2. An abrasive-grit marking machine as defined in claim 1 in which there is a plate at the top of the enclosure overhanging the space within the enclosure, the opening through which articles to be marked are placed on and removed from the stencil being provided in said plate directly above the stencil.

3. An abrasive-grit marking machine as defined in claim 1 in which the stencil is mounted over a vacuum chamber and the suction pipe leads into the vacuum chamber, the said means for projecting abrasive grit through the stencil being positioned in the vacuum chamber below the stencil, said vacuum chamber constituting the means surrounding the blast-projecting means into which the abrasive falls after striking the object to be marked.

4. An abrasive-grit marking machine as defined in claim 3 in which there is a shutter movable in a plane below the stencil and above the abrasive projecting means into and out of position under the stencil to break the suction through the stencil when the shutter is in position under the stencil.

5. An abrasive-grit marking machine as defined in claim 4 wherein there is a nozzle arranged to direct an air blast within the enclosure across the top of the stencil, a source of air pressure connected with the nozzle and valve means for controlling the flow of air from said source to the nozzle and across the stencil only when the shutter is in position to break the suction through the stencil to the vacuum chamber whereby fragments may be blown clear of the stencil after an article has been marked.

6. An abrasive-grit marking machine comprising a casing, a pair of cylindrical vessels in the casing in side-by-side relation, one vessel having a cover in which there is an opening with a stencil below the opening, means below said stencil for projecting a blast of air and grit against the stencil, a sleeve suspended from the cover surrounding said blast means and terminating in the lower portion of said vessel, and spaced from the inner walls of the vessel, said vessel having an outlet port in the upper portion thereof, a suction duct leading from said port to the other vessel, said other vessel having a suction device therein, and an air-filtering means in the second vessel operatively interposed between the suction device and the suction duct.

7. An abrasive-grit marking machine as defined in claim 6 wherein there is a shutter movable under the stencil from a retracted position where it is clear of the stencil to an extended position where it breaks the suction through the stencil, an air nozzle connected with an air supply line carried by the enclosure for directing an air blast over an article of the stencil, and valve means in the air supply line controlled concomitantly with the operation of the shutter for admitting air to said nozzle only when the shutter is in its extended position.

8. An abrasive-grit marking machine comprising a casing, a structure in which the stencil is positioned providing an enclosing wall around the casing, and the casing on which the stencil is mounted, the vessel having an inverted truncated conical bottom, a tube having a blast nozzle at its upper end, the nozzle being spaced below and centered under the stencil, the bottom of said tube terminating at the truncated conical bottom with radial openings at the bottom through which abrasive may enter the tube from the bottom, an air blast tube concentrically positioned in the first tube having a nozzle directed toward the nozzle of the first tube for aspirating a flow of air upwardly through the first tube from the bottom, an abrasive-distributing and abrasive flow-control means surrounding the first tube above the bottom defining at its periphery a slit between said means and the walls of the casing through which abrasive may pass into the bottom in a restricted volume and for preventing abrasive from accumulating about the radial openings in the lower end of the first tube.

9. An abrasive-grit marking machine as defined in claim 8 in which the abrasive-distributing means comprises a cone surrounding the first tube and at its periphery defining a slit between the periphery and the inner wall of the vessel through which there is a restricted flow of grit from above the cone into the bottom of the truncated inverted conical bottom.

10. An abrasive-grit marking machine as defined in claim 8 wherein the cover is removable from the vessel, with clamps on the cover for releasably holding the cover on the vessel.

11. An abrasive-grit marking machine as defined in claim 8 in which there is a sleeve extending from the cover downward to a level adjacent said abrasive-distributing and flow-control means, the sleeve being concentric about and spaced from the first-mentioned tube and being spaced from the walls of the vessel, and means for withdrawing air from the vessel at a level near the top thereof, the sleeve confining the flow of air downwardly within the sleeve and upwardly outside the sleeve.

12. An abrasive-grit marking machine as defined in claim 11 in which there is an annular swirler plate near the lower end of the sleeve in the space between the sleeve and the walls of the vessel.

13. An abrasive-grit marking machine comprising a casing, a pair of cylindrical vessels in the casing in side-by-side relation, one vessel having a cover in which there is an opening with a stencil below the opening, means below said stencil for projecting a blast of air and grit against the stencil, a sleeve suspended from the cover surrounding said blast means and terminating in the lower portion of said vessel, and spaced from the inner walls of the vessel, said vessel having an outlet port in the upper portion thereof, a suction duct leading from said port to the other vessel, said other vessel having a suction device therein, and an air-filtering means in the second vessel operatively interposed between the suction device and the suction duct.

14. An abrasive-grit marking machine as defined in claim 13 in which the second vessel has a removable tray forming the bottom thereof.

15. An abrasive-grit marking machine as defined in claim 13 in which the covers of both vessels are releasably clamped in place, the suction device and filter are removable as a unit through the top of the second vessel.

16. An abrasive-grit marking machine comprising a casing, a structure on which the stencil is mounted, an enclosure with an opening directly above the casing through which articles may be placed on and removed from the casing, means for withdrawing air from the interior of the enclosure, and an air nozzle in the enclosure for directing a blast of air across the stencil to clear the same of any foreign particles or broken pieces of articles.

17. An abrasive-grit marking machine as defined in claim 16 in which the casing is positioned on a vessel, means for creating a negative air pressure in the vessel, a shutter movable from a retracted position to a position under the casing for periodically closing communication between the surfaces of the casing and the interior of the vessel, an air cylinder for moving the shutter to a position, and means for admitting air to one end of the cylinder to so move the shutter and supply air to said nozzle, and for admitting air under pressure to the opposite end.
of said cylinder when the air supply to the nozzles is shut off.

18. A machine for the abrasive etching of articles comprising an enclosed chamber having a top closure with an opening therethrough, a stencil over said opening above which an article to be etched is placed, nozzle means in the chamber terminating below the top closure at a level spaced below the stencil for projecting a blast of air and abrasive upwardly therefrom through the stencil, a shutter in the top closure member movable horizontally in a plane below the stencil and above the nozzle from an open position where a blast from the nozzle may be projected through the stencil to a closed position where air may not flow through the stencil into the chamber, means for operating the shutter, means for exhausting air from the chamber, means at the bottom of the chamber for collecting and retaining a supply of abrasive and into which abrasive may fall after striking the stencil, and means at the bottom of the chamber for mixing air and abrasive to be projected through said nozzle means.

19. A machine for the abrasive etching of articles comprising an enclosed chamber having a top closure with an opening therethrough, a stencil over said opening above which an article to be etched is placed, nozzle means in the chamber terminating below the top closure and below the stencil for projecting a blast of air and abrasive upwardly therefrom through the stencil, a shutter in the top closure member movable horizontally in a plane below the stencil and above the nozzle from an open position where a blast from the nozzle may be projected through the stencil into the chamber, means for operating the shutter, means for exhausting air from the chamber, means at the bottom of the chamber for collecting and retaining a supply of abrasive and into which abrasive may fall after striking the stencil, means at the bottom of the chamber for mixing air and abrasive to be projected through said nozzle means, a second nozzle above the stencil for blowing a blast of air across the surface thereof to clean the same, means for supplying an air blast to said second nozzle, and means for simultaneously moving the shutter to closed position and supplying air to the second nozzle and for cutting off said air supply to the second nozzle and effecting movement of the shutter to open position.

20. An abrasive grit marking machine comprising a vessel having a suction chamber therein, a work piece-supporting stencil at the top of said vessel with the stencil opening from the interior of the chamber upwardly through the stencil, means in the suction chamber in fixed spaced relation below the stencil for projecting abrasive grit upwardly through the stencil, an enclosure over the top of the vessel having a bottom in which the stencil is supported and having side walls extending upwardly and surrounding the stencil, the enclosure being open at its top above the stencil whereby work pieces may be placed on and removed from the stencil, the enclosure having an annular dust-removing channel extending around it and opening within the space within the enclosure, and a suction pipe leading from said chamber into the channel whereby dust-laden air may be withdrawn from the area surrounding the enclosure into the chamber.

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