No. 636,460.

Patented Nov. 7, 1899.

G. S. SLOCUM.

SAND BLAST MACHINE.

(Application filed Apr. 15, 1898.)

(No Model.)

3 Sheets—Sheet 1.

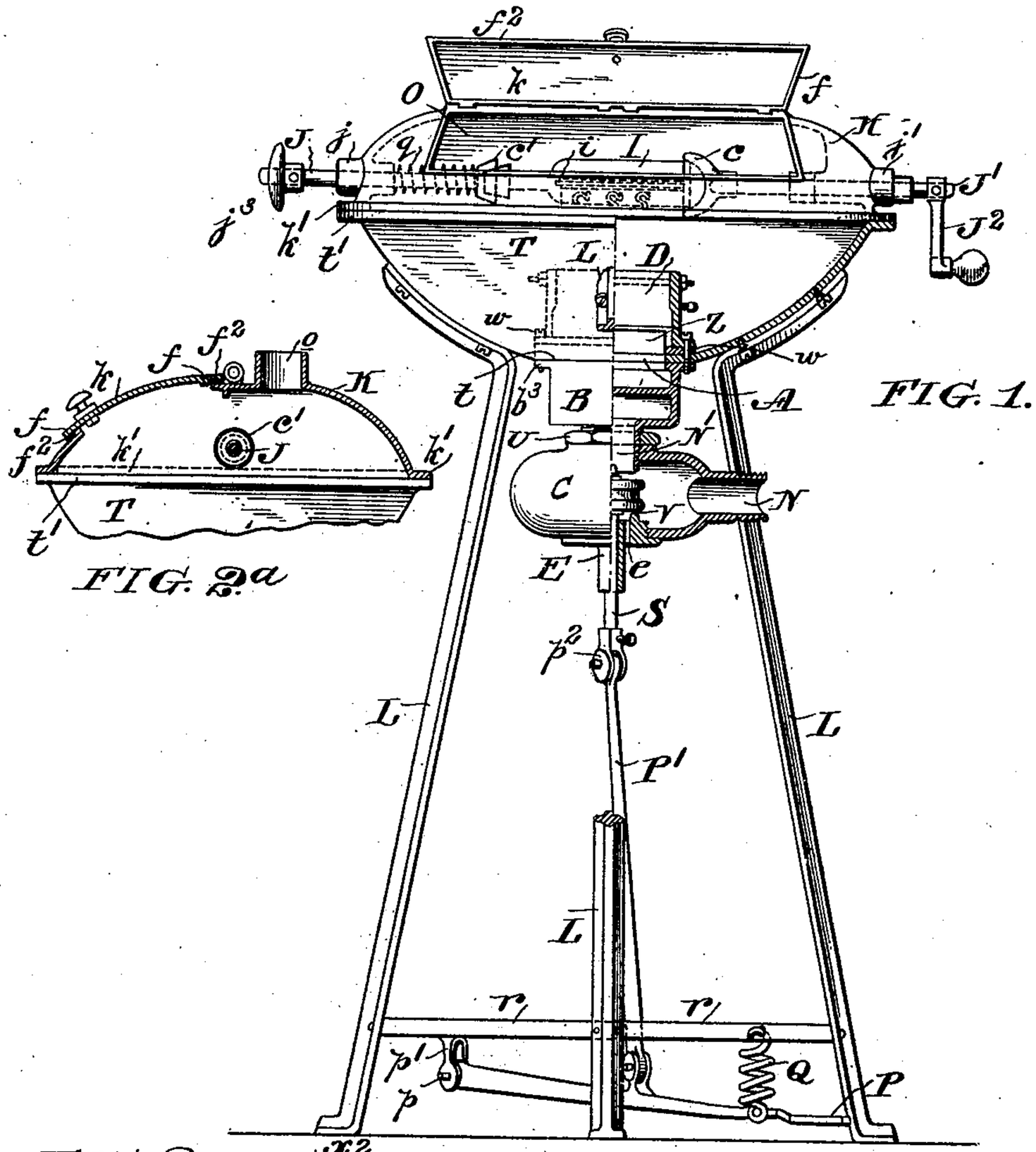

FIG. 1.



FIG. 2a

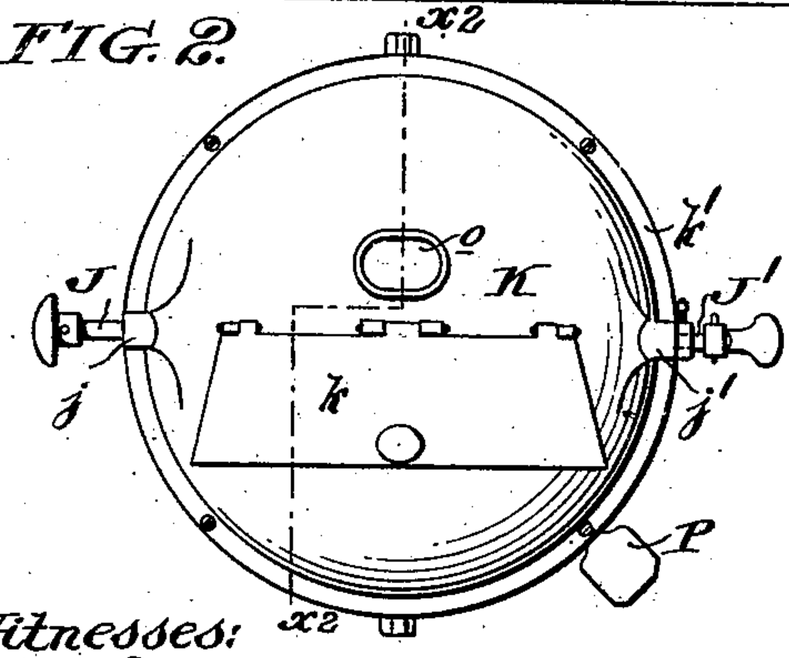

FIG. 2.

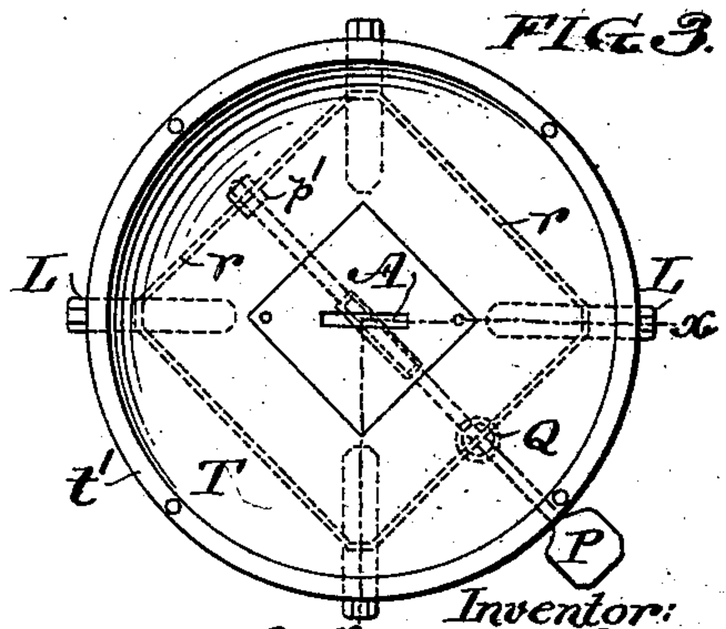

FIG. 3.

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D. Stewart

Inventor:
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W. C. Hamilton.

No. 636,460. Patented Nov. 7, 1899.

# G. S. SLOCUM.

## SAND BLAST MACHINE.

(Application filed Apr. 15, 1898.)

(No Model.)

3 Sheets—Sheet 2.

FIG. 4.

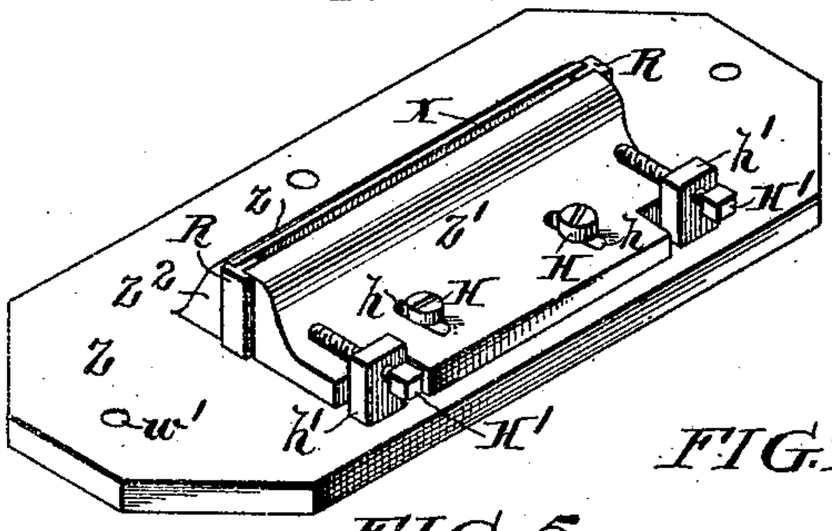



FIG. 5.

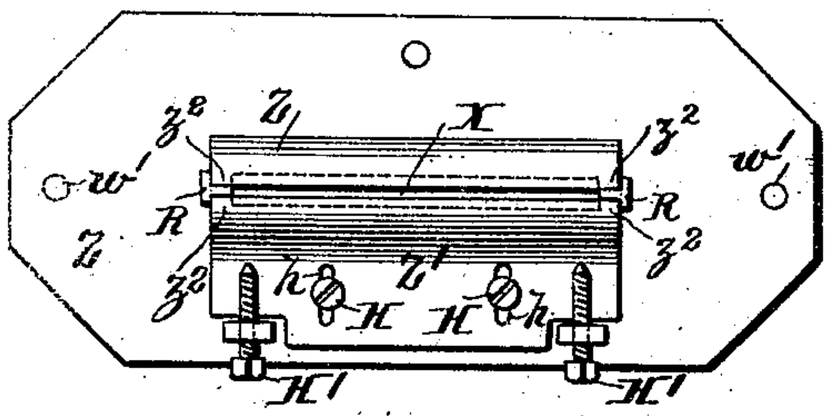



FIG. 6.

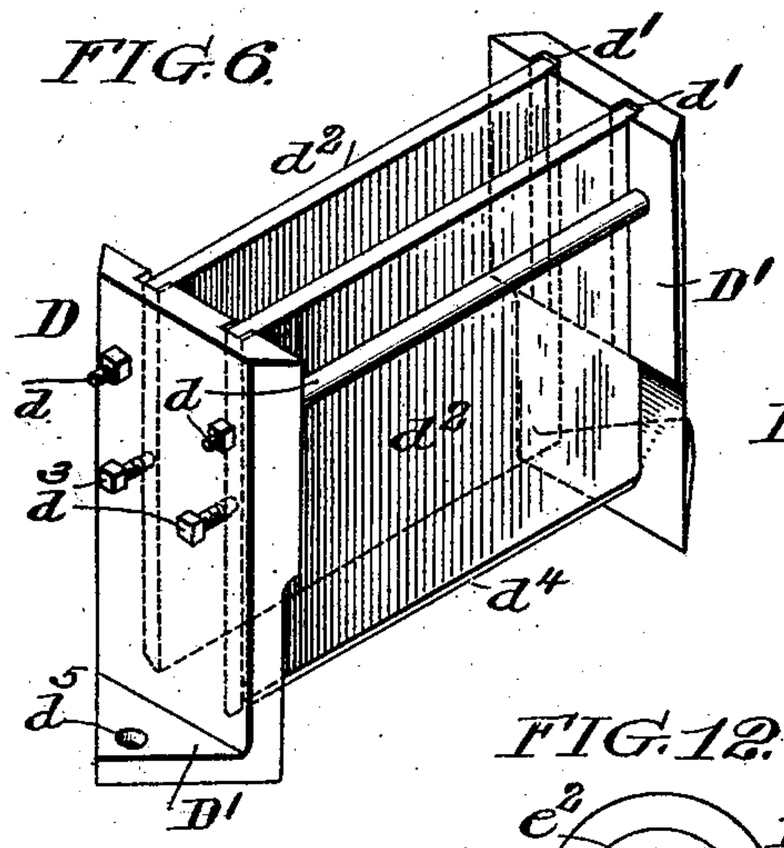



FIG. 10.

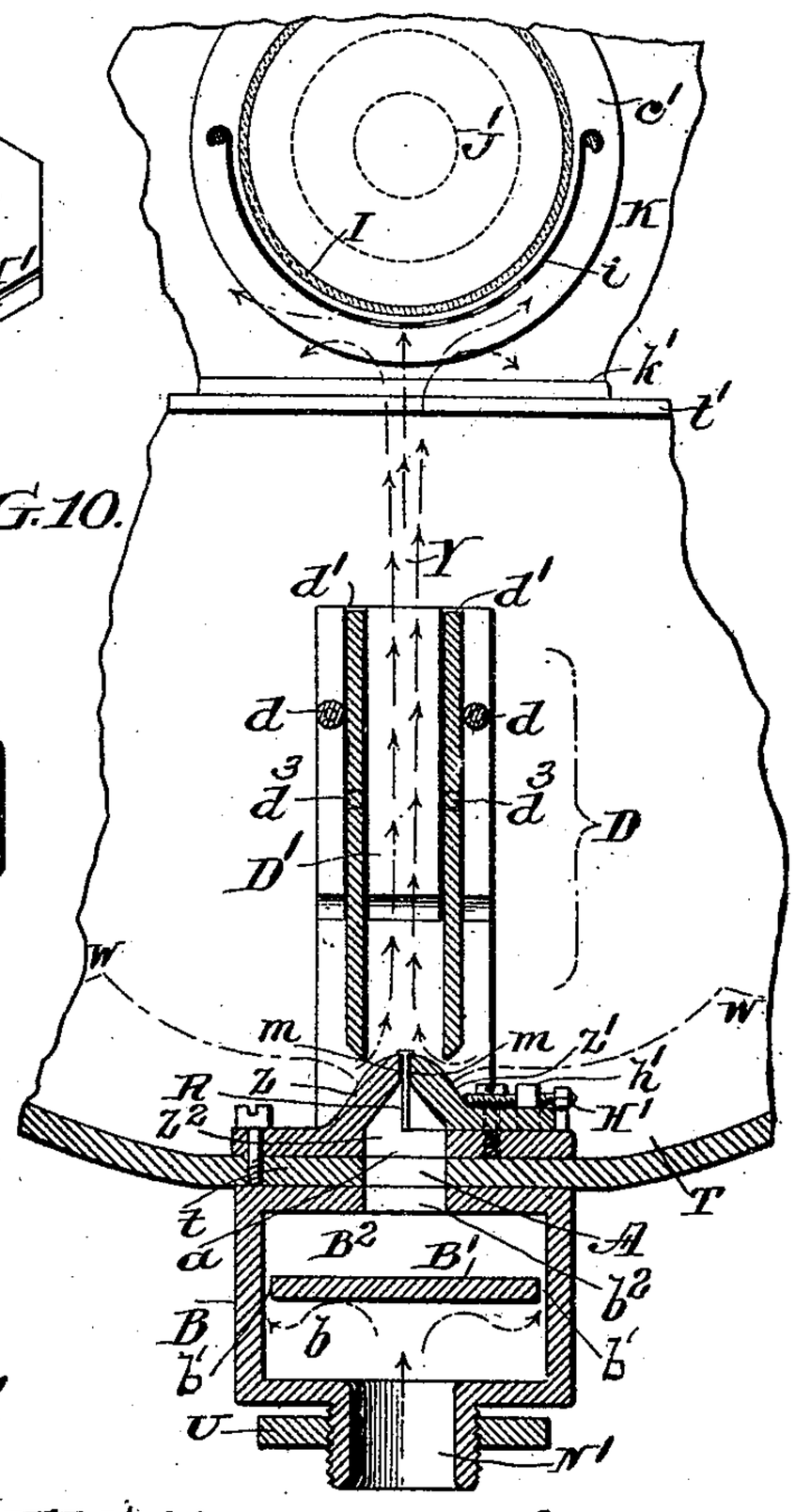



FIG. 11.

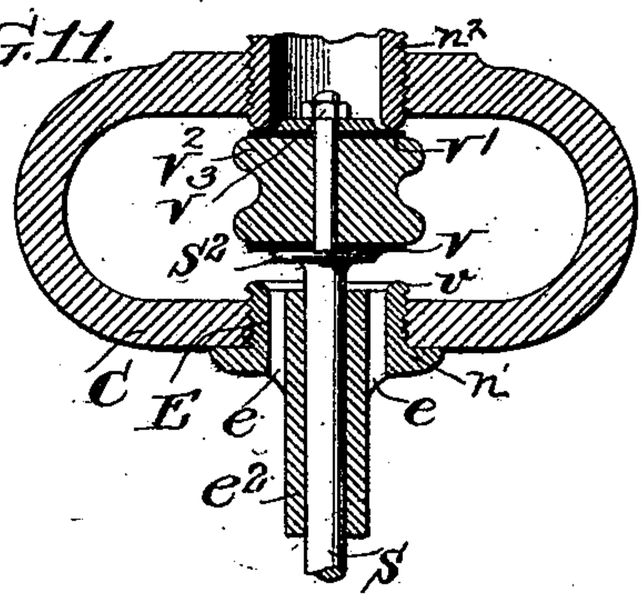
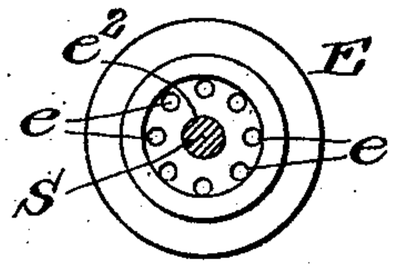



FIG. 12.

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No. 636,460. Patented Nov. 7, 1899.

# G. S. SLOCUM.

## SAND BLAST MACHINE.

(Application filed Apr. 15, 1898.)

(No Model.) 3 Sheets—Sheet 3.

FIG. 7.

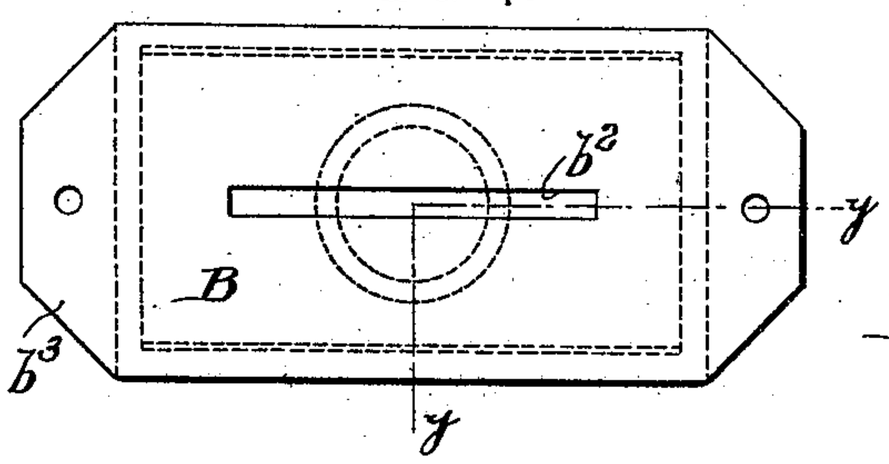



FIG. 9.

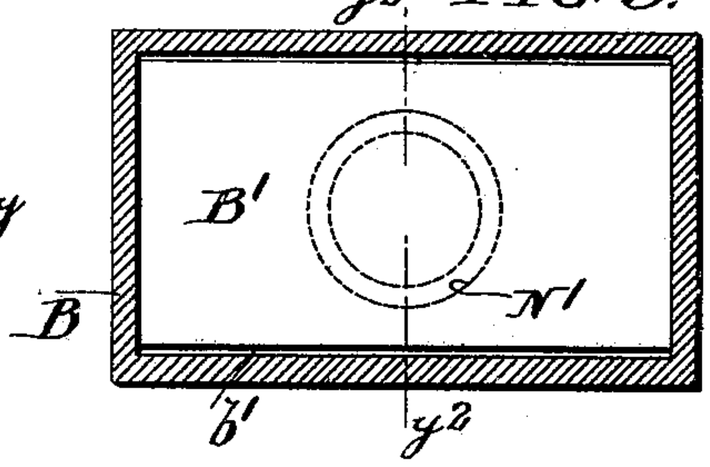



FIG. 8.

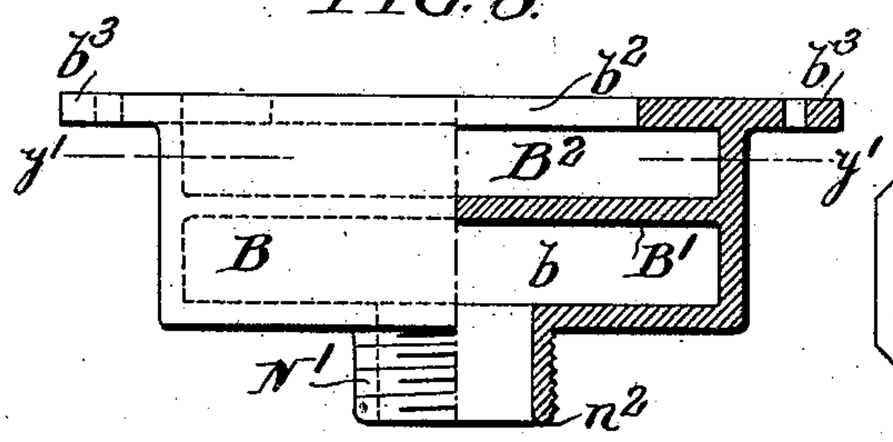



FIG. 21.

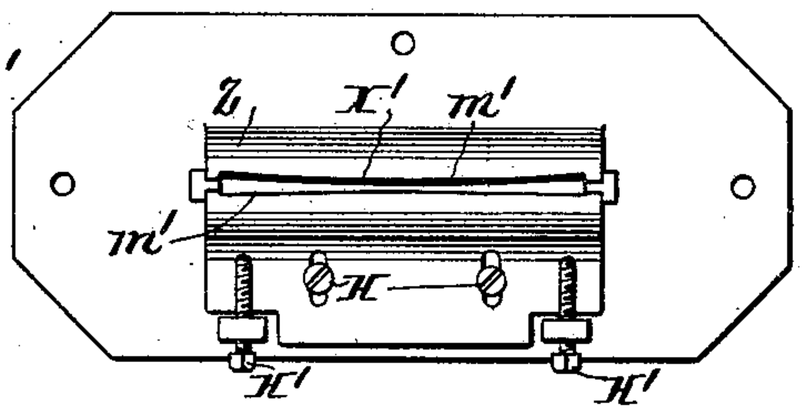



FIG. 13.

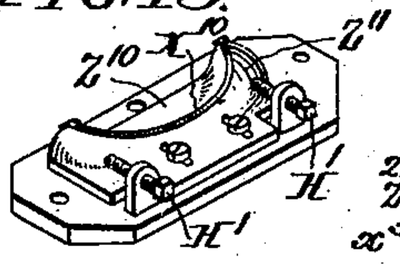



FIG. 16.

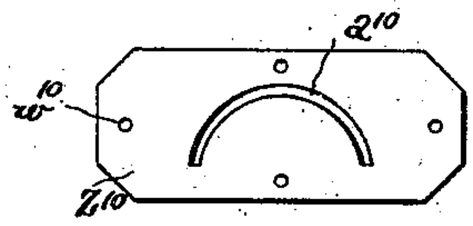



FIG. 17.

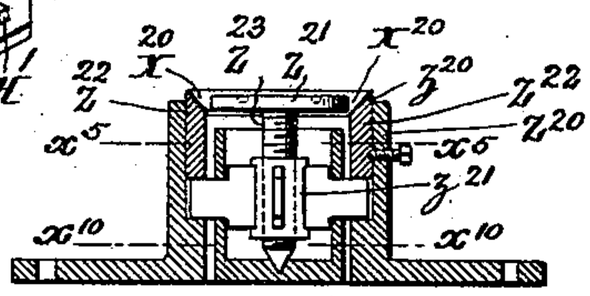



FIG. 14.

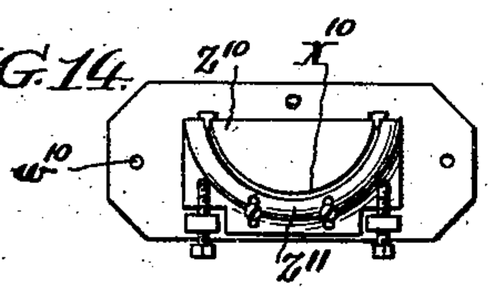



FIG. 18.

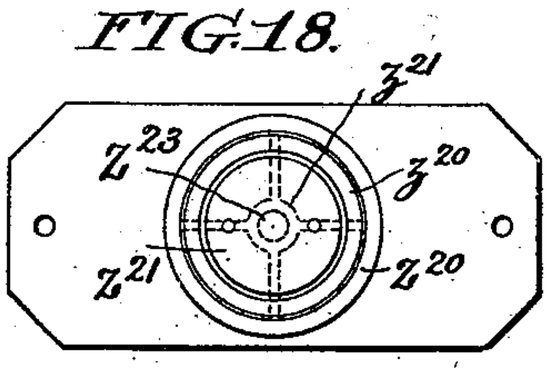



FIG. 15.

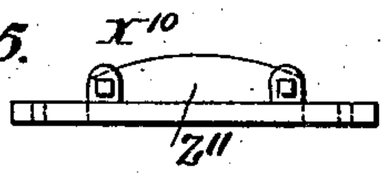



FIG. 20.

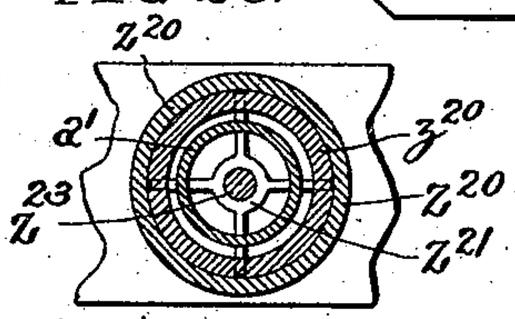
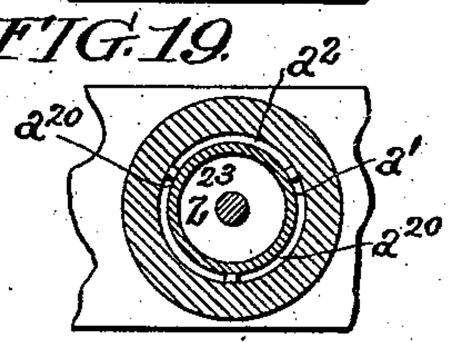



FIG. 19.

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Inventor:
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# UNITED STATES PATENT OFFICE.

GEORGE S. SLOCUM, OF NEWPORT, RHODE ISLAND.

## SAND-BLAST MACHINE.

SPECIFICATION forming part of Letters Patent No. 636,460, dated November 7, 1899.

Application filed April 15, 1898. Serial No. 677,663. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE SCOTT SLOCUM, a citizen of the United States of America, residing in the city and county of Newport, in the State of Rhode Island, have invented a certain new and useful Improvement in Sand-Blast Machines, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

While my present invention in many of its new and useful features relates to sand-blast machines in general, it as a whole combines to form a machine especially adapted for sand-blasting arabesques, labels, &c., upon bottles, tumblers, and similar quasi-cylindrical work, the sand being carried by a blast of air or equivalent mobile vehicle and the work preferably housed.

The chief object of my invention is to produce between the thing to be blasted and the point of issue or nozzle a carrying-jet of air or equivalent mobile vehicle, wherein throughout any plane passed square across said jet's working plane the volume and velocity of said jet shall be substantially constant or, if variable, the extent of such variation to be designate and controllable.

Also it is a part of my chief object to effect the above independent of the form of the conduit which connects the source of blast—namely, blower, &c.—with the parts by which I control and form the jet.

Further objects of my said invention are to regulate the form, diffusion, &c., of the carrying-jet; to contrive that the particles of sand may be caught up and fed to the jet by means of an induced current or currents and, when so fed, substantially to follow in velocity, diffusion, and form the like characteristics which my invention, as above mentioned, gives to the vehicle that carries them to and impinges them upon the work; to provide improved opportunity for inserting, removing, and replacing the work, and in these acts instead of interposing a shield to a continuing current of sand, as heretofore has been the case, to temporarily suspend the activity of both jet and sand, and to the latter end to divert the blast from its otherwise prescribed course before it has pursued the same to the point when it becomes charged with sand, and by affording the blast a by-pass and escape to remove both blast and sand from the machine's field of action, and also to contrive to do so without either stopping the blower, &c., shutting off the conduit, or unduly checking or raising the pressure in either conduit or source of blast, blower, &c.; also, such further objects, including cheapness of construction, rapidity of action, adjustability of parts, and accuracy of control, as will be apparent from this specification as a whole.

In practice I accomplish the above objects by certain new and useful combinations of mechanism segregated in the concluding claims and illustrated in their preferred union by a machine which, reference now being had to above-mentioned drawings, I proceed to describe.

Figure 1 is a front elevation of the machine, parts thereof, hereinafter designated, being quarter-sectioned. Fig. 2 is a plan view of the same upon a somewhat-reduced scale. Fig. 3 is a plan view of a portion of the machine, the scale corresponding to that of Fig. 2. Fig. $2^a$ is a sectional side elevation of a portion of the machine. In Fig. 2 the staggered broken line $x^2\,x^2$ denotes the plane of section. In the following figures the scale is merely approximate, but in all cases considerably enlarged over that in Figs. 1 to 3. Fig. 4 is an isometric view of a portion of the machine. Fig. 5 is a plan view of the portion shown in Fig. 4. Fig. 6 is an isometric view of another portion of the machine. Fig. 7 is a plan view of still another part, the angular broken line denoting of section in the next following figure, viz: Fig. 8 is a front elevation, partially in section, of the part shown in Fig. 7. Fig. 9 is a sectional plan view of so much of the part shown in Fig. 8 as is below the broken line $y'\,y'$. Fig. 10 is diagrammatic, but also shows in central cross-section a side elevation of the parts shown in Figs. 4, 5, and 6 and 7, 8, and 9, respectively, when assembled. Fig. 11 is a sectioned side elevation of still further portions of the machine. Fig. 12 is a plan view of part of the structure shown in Fig. 11. Figs. 13, 14, 15, and 16 are respectively an isometric view, top plan, front elevation, and bottom plan view of a modification of the nozzle part illustrated in the preceding figures. Figs. 17, 18, 19, and 20 are respectively a sectioned

front elevation, a plan view, and plan sections on the broken lines $x^5$ $x^5$ and $x^{10}$ $x^{10}$ of Fig. 17. Fig. 21 is a plan view of a further preferred modification of the nozzle part indicated in Figs. 1 to 10 above.

Referring to Figs. 1, 2, 3, and $2^a$, the machine therein illustrated stands upon four legs L, screwed fast to a bowl-shaped table T and tied together near their feet by a band or tie-rod $r$. Table T (which is of cast-iron) has a flanged rim $t'$, to which there is united by screws the corresponding flange $k'$ of a hollow dome-like cast-iron cover K. In the front of this cover K there is a large opening O, along the upper edge of which is hinged a lid $k$, whose margin $f$, being formed to overlap the outer margin of said opening O, is provided with packing-strips $f^2$ and closes thereon with a substantially dust-tight joint. There is also near the summit of the cover-dome K an upwardly-flanged chimney eye-hole or dust-escape opening $o$. Integral lateral bosses $j$ $j'$, bored out in common alinement, project both within and without the walls of said cover and afford on either side long bearings for the shafts of the bottle-chucking, bottle-turning, and stencil-holding parts of the apparatus. (Designated in Fig. 1 by J, J', and $i$, respectively.) The work—in this case bottle I—is "chucked" between the hollow-cone-provided inner chuck ends $c$ $c'$ of shafts J J'; but as these or similar parts are old "and well understood in the art" they need no further explanation or detail than above given, together with their figures, in order to connect them intelligibly with my novel combinations hereinafter set forth.

Turning to the bottom $t$ of the bowl-shaped table T, Figs. 1 and 3, it will be seen upon both in and out side to be flattened in plan into a preferably diamond shape. Along the center line of this flat and lying vertically under a line connecting the axes of the work-holding shafts J J', I form a mortise, slit, or port A. To the bottom or outside of the flat or diamond $t$ I fix, as by screws to its flanges $b^3$, (see Figs. 1, 7, and 8,) a hollow box or shell B and, coupled to it, a preferably movable valve-chamber C, with their certain associate parts. Within the bowl and upon the top of flat $t$ I fix, as by screws, a jet-former or nozzle part Z Z' and also a combined jet-chimney and sand weir D, together with their associate parts, as hereinafter detailed; but for the moment passing from the parts near the bowl T to the standards of the machine L it will be seen, Figs. 1 and 3, that to the tie-rod $r$ I pivotally connect, through gudgeon-block $p'$, a treadle P, and between rod $r$ and treadle P, I link a treadle-raising spring Q, and also that rigid link or pitman P', through knuckle $p^2$, pivotally connects the treadle P with the stem S of blast-switching valves V V'. Surrounding these valves there is the preferably spheroidal chamber C aforesaid. From a side of this chamber, which brings the description bac[illegible]s near the bowl T, a tubular conduit connection or "nipple" N' protrudes. The upper and lower ends $n^2$ $n'$, respectively, of the chamber C (see Fig. 11) are preferably flattened, and in the lower end $n'$ there is a concentric screw-threaded opening $s'$ and screwed therein a concentric elongated screw-plug E. This plug has an axial hole $e^2$. In this hole the valve-stem S aforesaid is jointed and guided to slide endwise, and also from it the said stem projects both above and below. Surrounding this central hole $e^2$ the plug E is pierced with other holes $e$ $e$ $e$, (see also Fig. 12,) which holes, subject to the control of the valve next to be described, form outlets to the blast. Around these openings $e$ in the plug E and concentric to and squared with the axis of the hole $e^2$ is a preferably raised annular valve-seat $v$. Directly opposite thereto and in line with the valve-stem hole $e^2$ I form in the valve-chamber C another screw-threaded aperture. This aperture has screwed into it the tubular union or nipple N', which projects from the bottom and communicates with the hollow inside of the box or shell B aforesaid. The muzzle of this nipple N' being "trued" and appropriately formed is screwed down the aperture $n^2$ until it projects within the walls of chamber C and there forms, as shown in Fig. 11, an opposite counterpart $v'$ to the valve-seat $v$ aforesaid. Between these seats $v$ $v'$ and fixed upon the inner or chamber-projecting end of the stem S are preferably leather-faced pot-lid valves V V'. These valves, being kept to place by the spool $v^2$ and cap-screw $v^3$, Fig. 11, register with the seats $v$ $v'$ and have their outside acting faces spaced at a less distance than intervenes between the said seats, and this relative proportion in distances is always maintained, although the distance between the valve-seats $v$ $v'$ is variable, a matter, however, which, save for the mention of it, is better postponed to a later part of this description. By making full up-and-down strokes with the valve-carrying stem S the by-pass holes $e$ $e$ and nipple N' are alternately open and shut, through chamber C, to the cavity of conduit-nipple N.

Above the chamber C, I extend the threading on the body of the nipple N' for more than a distance sufficient to screw upon it a "faced" lock-nut U, Figs. 1 and 11. By this means I provide that chamber C may, with unimportant variations in the distance between valve-seats $v$ $v'$, be swiveled about the nipple N and brought to and locked in any desired angular position with reference to the machine's aspect—a matter which often enlarges the machine's possible range of positions in a plant or simplifies the piping of its conduit, especially so should more than one such machine be served from a common source of blast, (single blower, reservoir, &c.)

Above the chamber C and connected therewith by the cavity of the nipple N', I locate the shell B aforesaid. This shell contains two communicating compartments, viz:

first a forebay or diffusion-chamber $b$, separated, except by narrow side slits $b'$ $b'$, by a partition or baffle-plate $b'$ from, second, a reservoir-chamber $B^2$, which chamber, as shown in Figs. 1 and 10, being located below the flat $t$, communicates by a corresponding port $b^2$ with the table-port A aforesaid.

The nozzle consists of a fixed part Z and an adjusting part Z'. It is located in the maw or belly of the bowl T upon the flat $t$, and, being similarly alined, also communicates its hollow interior $a$ with the port A. The nozzle is preferably fixed to the flat $t$ by screws $w$, Fig. 1, which, passing through holes $w'$ in the foot-flange $z$ of the nozzle part Z, pierce the table T and screw into the top flanges $b^2$ of shell B aforesaid, thus securing together the three parts with which they engage. The adjustable nozzle part Z' is in cross-section (see Fig. 10) very like the cross-section of a railway-rail's "fish-bar" and is attached to the fixed part L as follows: The shanks of broad-headed holddown-screws H H pass freely through slots $h$ $h$, Fig. 5, formed crosswise through the foot-flange of Z', and screw into the underlying foot-flange $z$ of the fixed part Z, (see Fig. 10,) by which means the nozzle part Z' may be clamped to the fixed nozzle part Z at any desired adjustment within the range of said slots and bolts. Set-screws H', screwed through lugs $h'$, formed integral with and rising out of the foot-flange $z$, bear their points onto the back body of said adjustable part Z' and combine with india rubber packing-dams R R to control such adjustments, for these dams, being nipped between wing-like and inwardly-projecting ends $z^2$ $z^2$ of the nozzle parts Z Z', serve the double duty of completing the box-like structure of the nozzle as well as of assisting, by their naturally resilient nature, the opening movement thereof should the set-screws H' be slackened. The interior $a$ of the nozzle formed by the parts Z Z' will be seen, upon inspection of its cross-section, Fig. 10, to consist of a tapering or wedge-like cavity $a$, merging near the lips $m$ into a narrow prismatic opening or slit X. The lips $m$ serve to establish as well as, under adjustments of the movable nozzle part Z', to modify the form of the jet which issues between them—approached near together a narrow sheet-like jet, and withdrawn to any degree a proportionately thicker and less intense jet issues, and herein lies my preference for slightly narrowing the jet at its center part, viz: By a preferred inward bowing of the lips $m'$ $m'$ (see modification Fig. 21) I give a trifle, but an established or predetermined trifle, less intensity to the center of the jet X' than it otherwise would have and so, substantially, cause it to be uniform in action with the margins thereof, for margins of sheet-jets experience has taught me to be, as a rule, less active or intense in action than is the middle of such a jet, especially when issuing from a crevice in the form of a narrow "right parallelepiped," such as is the crevice X in Figs. 4, 5, and 10.

The screws $w$, Fig. 1, which pass through the holes in the nozzle, table-flat $t$, and flange of shell B, and also by passing through holes $d^5$ in the foot-flanges of brackets D', serve to secure about the nozzle-opening X a combined chimney and sand weir D. This chimney-weir, Figs. 1, 6, and 10, consists, first, of two grooved brackets D', forming ends, (the grooves $d$ thereof face each other,) are parallel and vertically disposed, and, second, of movable quadrangular side plates $d^2$, adjustably clamped by set-screws $d^3$. Screw-tipped and shouldered tie-rods $d$ serve to clamp and brace the otherwise free-standing upper parts of said brackets. The movable side plates $d^2$ of the chimney thus formed about the nozzle preferably have their lower edges chamfered and adjusted, (by means of the bracket set-screws $d^3$,) so as to leave narrow slits or crevices between them and the underlying ridge of the nozzle parts Z Z'. They also parallel and adjoin the jet-crevice X. Such crevices are indicated in Fig. 10 by the curved arrows which pass through them. In the case of the modification of the nozzle, Figs. 17 to 20, the chimney is presumed to be of cylindrical instead of rectangular box-like form; but such change being self-evident and within the skill of any mechanic who reads this is not illustrated nor further to be described.

Now passing from the detail of the parts to a description of the action of the machine it will be apparent from the foregoing that when a conduit is connected to the nipple N and a suitable blast—such, say, as of dry air under a pressure of two to fifty pounds to the square inch—is turned on should the treadle P be depressed, as shown in Fig. 1, the spring Q will be stretched and allow pitman P' to fall until the valve V seats upon the valve-seat $v$. At the same time the valve V' having moved down leaves its seat $v'$ and the nipple N' is opened, and the blast of air under pressure then fills the chamber C and through N' passes to the forebay $b$. Dashing upon it it diffuses and fills this forebay, and thence mounting through the crevices $b'$ $b'$ fills the reservoir-chamber $B^2$ and, through the ports $b^2$ A, enters the cavity $a$ of the nozzle Z Z', and finally escapes in a sheet-like jet from the crevice X. Passing up the box-like chimney D (whose sides $d^2$, it will be remembered, do not come completely down to meet the outer walls of the nozzle parts Z Z') the issuing jet excites on either side an induced draft, which draft, as indicated by aforesaid curved arrows, Fig. 10, comes into the base of the chimney (which is otherwise substantially tightly jointed) by the crevices under the sides $d^2$ and in sweeping inward toward the chimney-crevices over the maw or belly of the table T picks up and carries with it sufficient particles of such sand, &c., as said table's belly may be charged with and feeds them to the jet, which jet then becomes their carrying-vehicle, and at last im-

pinges them upon the stencil *i* in such manner as to search out its openings and define their pattern upon the work or bottle I. If leveled off, the charge of sand or equivalent material should be sufficient to fill the table-bowl part way up the combined chimney and sand-weir D. Gravity alone, however, is not, as I prefer to contrive and adjust the machine, the active agent in carrying the sand from the bowl under the chimney-crevices, but the induced draft is the agent. In the round of action, after impinging upon the work, glancing from the same or from the dome-like cover's walls, gravity assists in effecting the return to the bowl's maw of the sand. I find in practice with a machine such as herein illustratively described the mass of sand forms in a ring-like ridge or annulus outlying the nozzle, and under its natural subsidence, coupled with the influence and withdrawal by the induced draft of the chimney-crevices, has within said ring a crater-like central plateau. Such contour I have indicated in Fig. 10 by dot-and-dash line W. As the sand carried by such a sheet-like jet approximates it in form, velocity, &c., and therefore acts in a narrow or substantially linear area, it is essential, should the stencil's pattern extend over a broader area, to pass said stencil, with the work which it covers, across said jet's line of action, and to do so at the best working level. Such passage, with quasicylindrical work, like the bottle I of Figs. 1 and 10, is best done by a rotary movement. For this purpose I have incorporated in the illustrated machine the chucks *c c'*, fixed to the shafts J J'. Said latter shaft being circular in section, but collared from sliding endwise and provided on its protruding end with a crank-handle *j*, permits such rotation of the bottle. The shaft J, carrying fixed to it the chuck *c* under the influence of a girdling and inwardly-thrusting spring *q*, presses the bottle I against the driver-chuck *c'* and presents the bottle in the proper axis. At the same time shaft J, being free to rotate in boss *j*, reduces friction to a minimum and does not prevent said shaft's retraction by means of knob $j^3$ when unchucking of bottle I is desired.

The lid *k* of the cover K is shown open in Fig 1, the spring Q stretched, the treadle P depressed, and the nozzle-leading valve V' consequently "open;" but as the nozzle N is in said view shown disconnected there is presumably no blast on, and consequently no sand promiscuously flying. Therefore there is no objection to showing such a view, which for obvious reasons has facilitated the above description. It may, however, be proper to here state that the dust-eyehole *o* should preferably be piped (whence the upstanding flange shown around it) and also that when conduit is connected and the blast on the lid *k* should be closed. After inserting a piece of work, closing the lid *k* is, in fact, an indispensable prelude to pressing on the treadle P, switching the blast to chamber C and its consequent blast-jet, induced draft, sand-feed, sand distribution, &c., all of which should now be so clear as not to need further description.

To remove the work, the operator takes his foot off of the treadle P and the self-acting recoil of the spring Q causes the rise of pitman P', "reverses" the valves V V', and switches the blast to the by-pass holes *e e*. Then, raising the lid *k* and grasping the bottle I, the operator, by the knob $j^3$, pulls endwise the shaft J, and taking out and setting down the bottle replaces it with another, then, closing the lid *k*, depresses the treadle P and repeats the sand-blasting act, and so on. During these acts the operator has every facility. For example, while the lid *k* is open, both blast and sand cease their activity within the maw of the table T, and it all being simple the operator soon acquires a most desirable rapidity of action.

A striking advantage of my invention is to be found in the fact that (especially in the case of the machine by which I have illustrated it) a large number of the parts composing it, and they the larger ones, can be made of cast-iron—viz., the table T, lid *k*, shell B, chamber C, nozzle part Z Z', chimney-weir D, legs $L_1$ and treadle P—also that the small parts—such as valve-stem S, shafts J J', screws, and preferably the machined meeting faces of the several adjoining parts—can all be cheaply, accurately, and rapidly produced by the lathe or drill, machines of continuous action.

The construction of the nozzle modifications, Figs. 13 to 20, is as follows: In Figs. 13 to 16 the fixed part $Z^{10}$ has on its table-adjoining side a curved opening, $a^{10}$ of Fig. 16. Upon its top a transversely-sliding part $Z^{11}$ is attached and adjusted by hold-down and set screws corresponding to screws H H', &c., described in connection with parts Z Z'. Ridges on these parts $Z^{10}$ $Z^{11}$ have a double curvature—viz., in plan, (see Fig. 14,) in front elevation, Fig. 15—and form between them a curved jet-crevice $X^{10}$. In Figs. 17 to 20 the fixed nozzle part has a central hollow cylindrical projection $Z^{20}$, the upper inner wall of which is chambered, and in said chamber supports a winged or spoke-shored vertical nut $z^{21}$, also a tubular liner $Z^{22}$, which liner being held to place, as by a set-screw piercing $Z^{20}$, holds the ends of the nut-wings from rising. The inner edge $z^{20}$ of the liner is chamfered or flares, and adjoining that part lies the disk-like head $Z^{21}$ of a screw $z^{23}$, which forms the adjustably-movable and in this case self-locking nozzle part, which part working in the nut $z^{21}$ aforesaid forms between the disk $Z^{21}$ and the chamfered edge $Z^{23}$ an annular jet-crevice $X^{20}$. The wings or spokes of the nut $z^{21}$, being shouldered, also act as distance-pieces to hold in place a cavity-filling cylinder *a'*, which cylinder, being of smaller diameter, leaves between its outer surface and

the interior of the fixed nozzle part $Z^{20}$ a cylindrical blast-passage $a^{20}$, which latter passage, like the opening $a^{10}$, Fig. 16, is to be presumably fed by proper and correspondingly annular shaped modifications of the table flat and reservoir-shell openings A $b^2$, respectively. Of the action of these modifications, Figs. 13 to 20, it is only necessary to say that they both form thin or sheet-like jets. In the sort Figs. 13 to 16 the jet-forming crevice $X^{10}$ is curved both in plan and profile and is adapted for special work. In the sort Figs. 17 to 20 the jet-forming crevice $X^{20}$ is continuous and annular and the jet formed by it tubular, the thickness, &c., of the walls thereof being controllable by the up and down adjustments of the adjustably-movable part $Z^{21}$ in combination with the bell-nozzle $z^{20}$ of the liner part $Z^{22}$.

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

1. The combination with a blast-conduit of a nozzle having a slot or elongated crevice, said crevice being of reduced central section whereby a jet of sheet-like form and substantially uniform sand-carrying power is produced substantially as and for the purposes hereinbefore described.

2. The combination with a blast-conduit and a sand-feed, an intermediately-located nozzle, said nozzle having a fixed and a movable part, and mechanism for adjusting and clamping said parts so as to form between them a narrow slot or crevice whereby a jet of variable thickness but substantially sheet-like form is produceable, substantially as described.

3. The combination with a blast-conduit of a nozzle and a chimney, said chimney adjoining thereto, and having crevices through which, upon the issuing of a jet from said nozzle, drafts are induced, substantially as and for the purposes hereinbefore described.

4. The combination with a blast-conduit of a nozzle and a chimney, said chimney adjoining thereto, and having an adjustably-movable side or sides, or their equivalent, forming openings or crevices through which, upon the issuing of a jet from said nozzle, drafts are induced, substantially as and for the purposes hereinbefore described.

5. The combination of a blast-conduit a nozzle adapted to form a jet, a forebay, a baffle-plate, and a reservoir-chamber, substantially as and for the purposes hereinbefore described.

6. The combination of a blast-conduit a nozzle having a slot or elongated crevice adapted to form a sheet-like jet, a forebay, a baffle-plate having a lateral crevice or crevices communicating with a reservoir-chamber, and said reservoir-chamber, substantially as and for the purposes hereinbefore described.

7. The combination of a blast-conduit a nozzle adapted to form a jet, a valve, a forebay, a baffle-plate and a reservoir-chamber, said valve being adapted to throttle or open at will said conduit substantially as and for the purposes hereinbefore described.

8. The combination of a blast-conduit a nozzle adapted to form a jet, of a by-pass, a passage and valves adapted to open and close passages to said nozzle, and to said by-pass in their communication to said conduit substantially as and for the purposes hereinbefore described.

9. The combination of a blast-conduit connection and a nozzle adapted to form a jet, with a passage leading to said nozzle, a by-pass, and valves adapted to open and close communication of said conduit connection with said passage and by-pass respectively, substantially as and for the purposes hereinbefore described.

10. The combination of a blast-conduit, a nozzle adapted to form a jet, a passage intermediate to said conduit and nozzle, a by-pass, and valves V V′ adapted to move in interdependence, and by a common movement, to open and close alternately said passage to and said by-pass from said nozzle, substantially as and for the purposes described.

11. The combination of a blast-conduit connection and a nozzle, adapted to form a jet, with a nozzle-communicating passage, a swiveling valve-chamber, means for locking the latter, the nut U and threaded nipple N′, a valve or valves, and a valve-stem, located in the axis of said chamber's swiveling and operative, whatever the adjustment of said swiveling chamber, to move said valve or valves, substantially as and for the purposes hereinbefore described.

12. The combination of a blast-conduit connection and a nozzle adapted to form a jet with a valve-chamber having a passage communicating with said conduit connection, and nozzle, also a by-pass, holes *e*, and connected reciprocating valves V V′ operative to open and close alternate communication of said conduit connection with said nozzle-passage and said by-pass respectively, substantially as and for the purposes hereinbefore described.

13. The combination of a blast-conduit connection and a nozzle, adapted to form a jet, with a valve-chamber, said chamber having passages communicating with said nozzle and conduit connection, and also, a by-pass, the holes *e*, valves V V′, operative to open and close alternate communication of said conduit with said nozzle-passage and said by-pass, a sand-receptacle, T, and a work-housing, K, substantially as and for the purposes hereinbefore described.

14. The combination of a blast-conduit and a nozzle, adapted to, form a jet, with a valve-chamber, said chamber having passages communicating with said nozzle and conduit, and also, a by-pass, the holes *e*, valves V V′, operative to open and close alternate communication of said conduit with said nozzle-passage and said by-pass, a sand-receptacle, T,

a work-housing, K, and a dust-tight movable lid, *k*, substantially as and for the purposes hereinbefore described.

15. The combination of a blast-conduit connection N; a nozzle Z Z′ adapted to form a jet; a swiveling valve-chamber C provided with valve-seated orifices leading to said nozzle and to a by-pass respectively; means for locking said chamber at angular adjustments; a shell B, having a forebay, a baffle-plate, and marginal ports communicating said forebay with a reservoir-chamber; a table T provided with supports and a port A; a chimney having lateral crevices adjoining said nozzle; a sand-receptacle, a housing or cover K having an opening; a movable dust-tight lid *k* fitting said opening; mechanism for supporting and moving a piece of stencil-covered work within range of said nozzle; and treadle P, spring Q, pitman $P^8$ and stem S, for operating said valves, substantially as and for the purposes hereinbefore described.

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