

(No Model.)

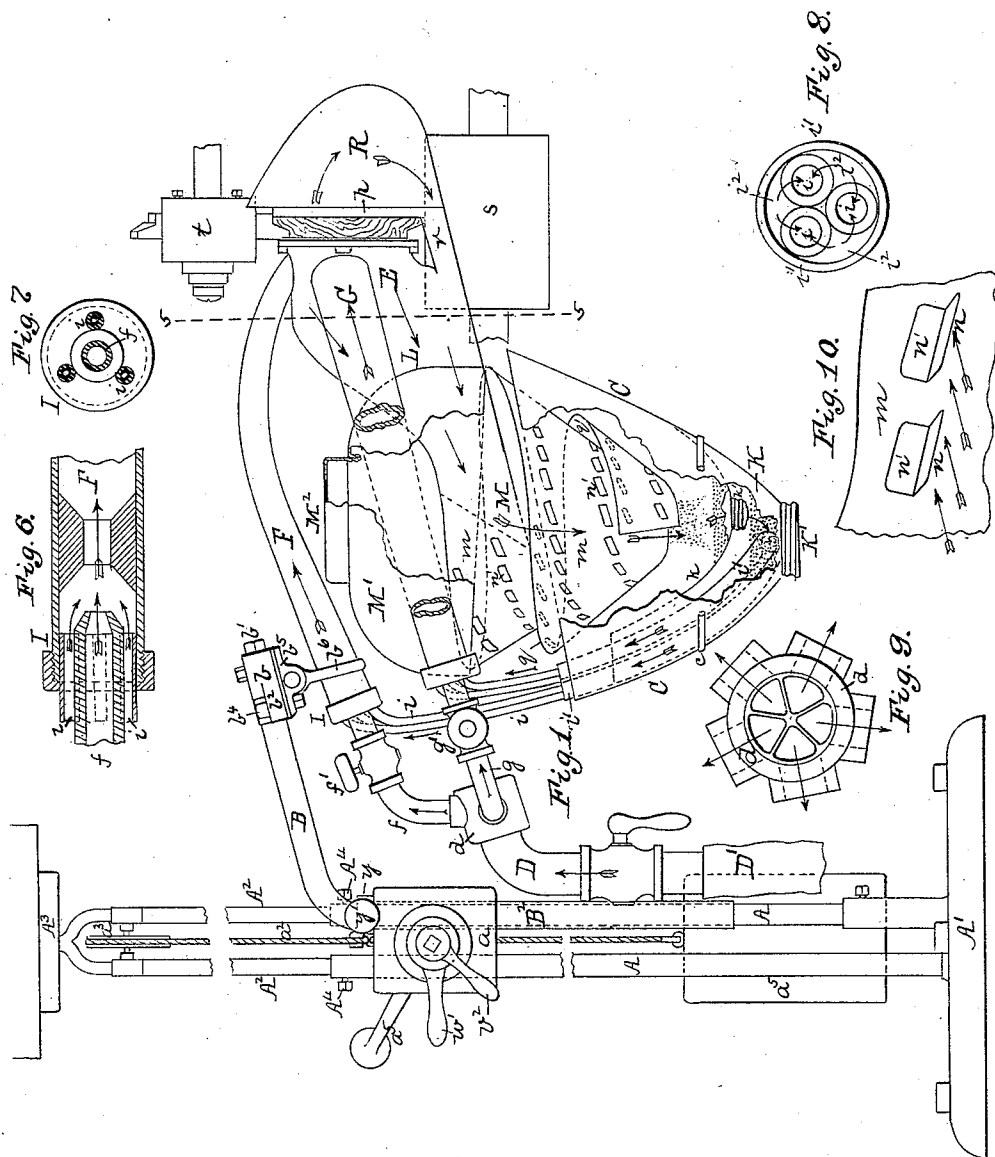
4 Sheets—Sheet 1.

A. BRYCE.

APPARATUS FOR FINISHING OR CLEANING SURFACES.

No. 446,961.

Patented Feb. 24, 1891.



Sicknesses:

J. N. Cooney.

Robt. D. Follen

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(No Model.)

4 Sheets—Sheet 2.

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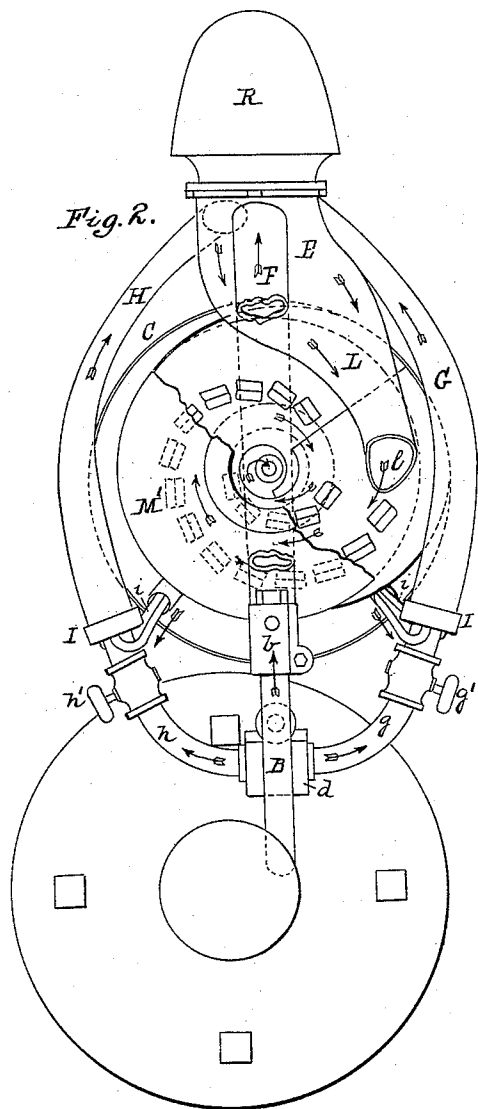


Fig. 11.

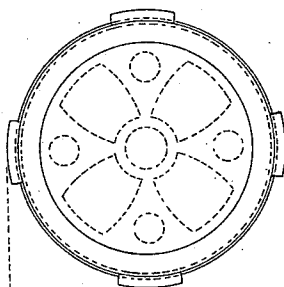
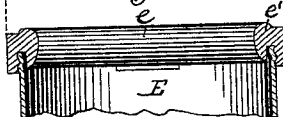
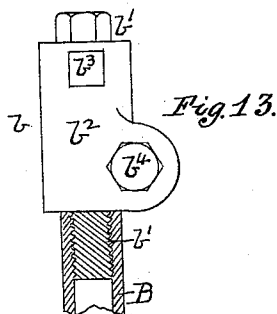
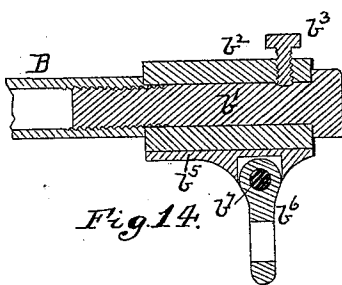


Fig. 12.



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(No Model.)

4 Sheets—Sheet 3.

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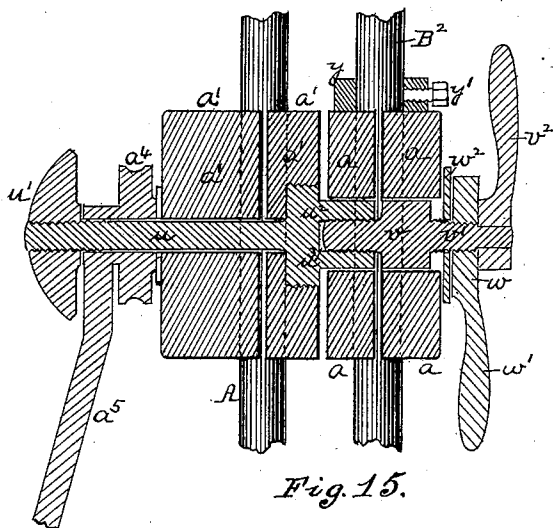


Fig. 15.

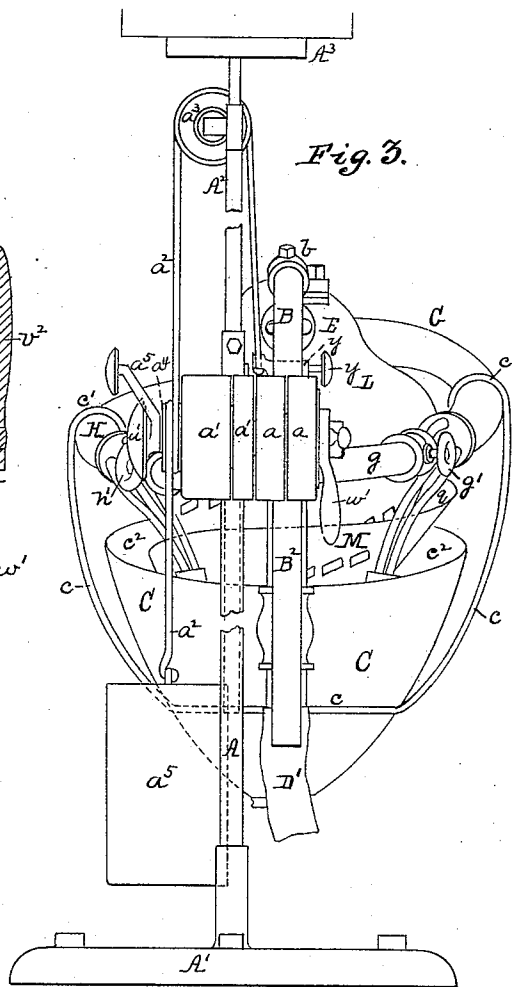


Fig. 3.

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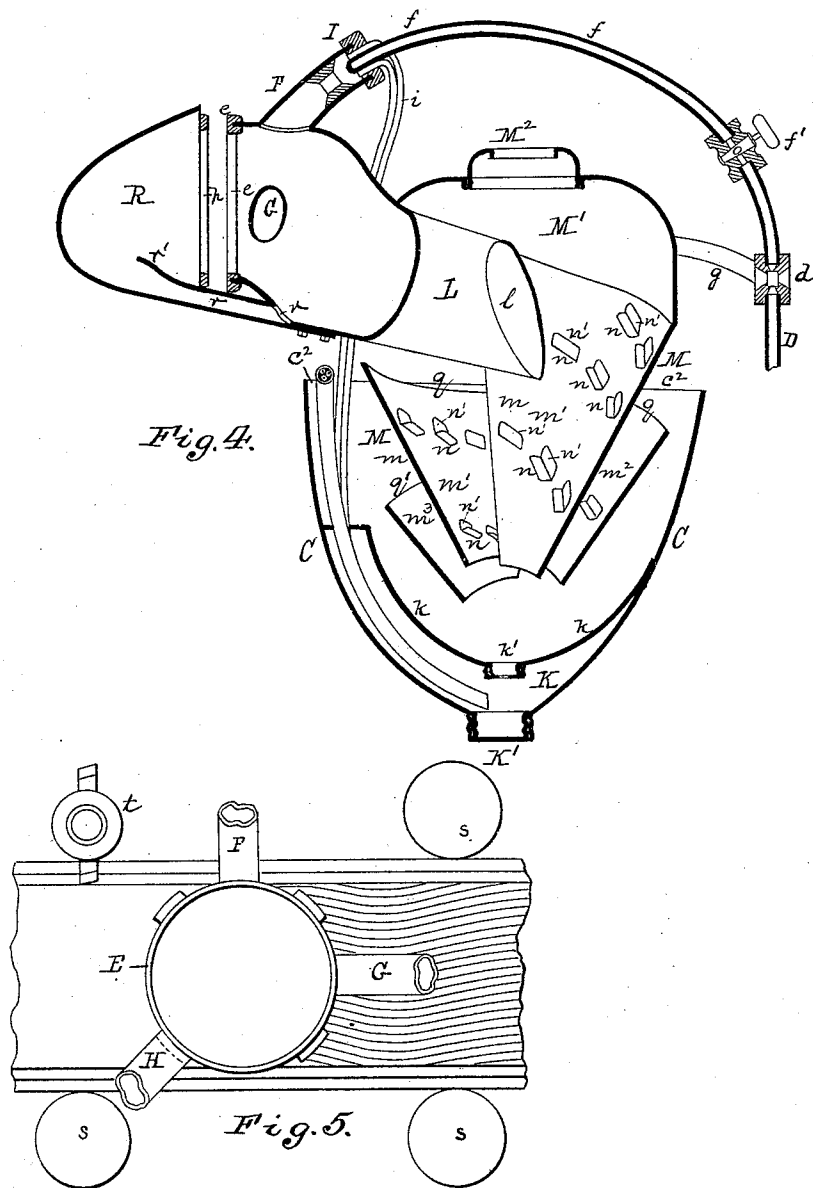
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR FINISHING OR CLEANING SURFACES.

SPECIFICATION forming part of Letters Patent No. 446,961, dated February 24, 1891.

Application filed June 26, 1890. Serial No. 356,788. (No model.)

To all whom it may concern:

Be it known that I, ANDREW BRYCE, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Finishing or Cleaning Surfaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for abrading or surface-finishing wood, glass, stone, or other like material, its object being to provide a simple form of apparatus by which, according to the uses to which it is to be put, the abrading or finishing material may be projected upon any surface—such as the face of a stone building, the wood-work of an apartment, or other like place—or the apparatus may be employed in a stationary position for the treatment of boards, slabs, or plates of wood, stone, glass, &c., while means are provided for the separation of the sand or like abrading material from the air, steam, &c., so as to retain the sand for reuse, and the air or other propelling force is permitted to escape from the apparatus.

In my improved apparatus I employ a mouth-piece, past which the object to be abraded or surface-finished is carried, or which can be carried over any stationary object to be abraded or surfaced, according to the mounting of the apparatus, this mouth-piece having the series of pipes connected therewith at different angles to the opening of the mouth-piece, so that the abrading material may be projected at different angles upon the object to be treated, and extending back from this mouth-piece is a return or exhaust pipe leading into a separator and collector, or what might be termed a "cyclone-collector," in which the air or steam is given freedom or vent, while the sand or abrading material is collected for reuse, the apparatus when used for abrading on stationary surfaces—such as the walls of buildings or wood-work of apartments—being mounted in a swinging frame in such way that its mouth-piece may be passed over the surface to be abraded and the sand or like material projected against it.

The particular points of invention desired

to be covered will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view of apparatus embodying my invention. Fig. 2 is a top or plan view. Fig. 3 is a rear end view. Fig. 4 is a longitudinal central section, the arrangement of the pipes being somewhat changed. Fig. 5 is a cross-section on the line 5 5, Fig. 1. Figs. 6 and 7 are a longitudinal section and a rear end view of the injector with which the blast-pipe and the sand-feeding pipes communicate. Fig. 8 is an end view of one of the groups of sand-feeding pipes. Fig. 9 is a view of the coupling or socket from which the supply-pipes may lead from the main air or steam pressure pipes. Fig. 10 is a detail view showing the arrangement of the deflecting-lips in the spiral cone. Figs. 11 and 12 are end views and longitudinal section, respectively, of the end of the mouth-piece. Figs. 13 and 14 are detail views showing the universal joint provided for the movement of the apparatus over stationary surfaces, and Fig. 15 is a detail view showing the means for adjusting vertically the abrading apparatus on its stationary or supporting frame.

Like letters of reference indicate like parts in all the figures.

As the apparatus embodying my invention can be employed in the abrading or finishing of stationary surfaces—such as the wood-work of an apartment or the stone or like walls of buildings—I have illustrated it as supported on suitable standards and adapted for movement in different directions thereon, though it is evident that the main part of the apparatus may be supported in any stationary frame, such as where it is employed for treating any materials or substances which can be easily handled and brought opposite to the mouth of the abrading apparatus.

The apparatus, as illustrated in the drawings and more particularly shown in Fig. 1, is supported on the adjustable standards A, these standards extending up from a base-plate A' and being formed of tubing and

having passing down into them the bars A^2 , which are connected to a head-piece A^3 , which can be passed up against the ceiling of the apartment or against any suitable support, after which they may be locked in their position by set-screws A^4 . Sliding on the standards A are the clamping-blocks a a' , the construction of which will be hereinafter described, these clamping-blocks having attached to them a cord a^2 , passing over a pulley a^3 , which pulley is mounted in the upper standards A^2 , the wire cord passing over the same and passing around a sheave a^4 on the clamping-block a' , and thence passing down to a weight a^5 . Secured to the sheave a^4 is the crank-handle a^6 , by means of which the sheave or pulley a^4 can be turned, and, as the cord a^2 passes around this sheave and up over the pulley a^3 , upon turning the crank a^6 through the sheave a^4 the clamping-blocks will be raised or lowered in the standards A , and as said clamping-blocks support the abrading and surfacing apparatus said apparatus can be raised and lowered as desired.

In order to tighten the block a' on the standards A when the apparatus is raised to the desired height, by turning the nut u' on the shaft u the two parts of the block a' will be clamped upon the standards A . The shaft u has a cylindrical head u^2 , having a threaded socket u^3 therein, and into that socket a bolt v screws, this bolt having a cylindrical body corresponding in diameter to the head u^2 . On this cylindrical head u^2 and the bolt v the clamping-block a is mounted, so that it may turn thereon, this clamping-block carrying the crane B , the lower arm B^2 of which passes through it, so that the crane can be turned to any angle. The bolt v has the shaft v' extending out centrally therefrom and threaded to receive the nut w , and beyond said nut has the lever v^2 for turning the bolt. The nut w has the handle w' , and between said nut and the block a is the washer w^2 . By turning the nut w the two parts of the clamping-block a are forced together to clamp and hold the crane B , the nut screwing up on the bolt v and forcing the washer against the block, and by turning the lever v^2 the bolt v is screwed into the threaded head u^2 of the shaft u , so forcing the block a against the block a' and holding the same from turning on the cylindrical head u^2 and body of the bolt v . Around the lower arm B^2 of the crane is a collar y , which engages with the arm by a set-screw y' and rests on the block a , this collar supporting the arm on the block so that it may swivel therein when desired, in which case the nut w will be loosened sufficiently to permit such swiveling of the arm.

Secured to the clamping-block is the crane B , which is clamped within the clamping-block by turning the handle w' and extends out from the same in order to support the abrading apparatus, which is hung from the upper end of this crane and is arranged to

swing thereon, so as to be adjusted over the surface to which it is applied.

The means of supporting the case containing the abrading apparatus is more particularly shown in Fig. 3, in which the funnel-shaped case C fits within a wire basket c , the upper arms of the basket being secured to the side air-blast pipes, as at c' , while these pipes are connected to the coupling d of the supply-pipe D and extend over to the mouth-piece E of the abrading apparatus. The air or other actuating fluid under pressure is carried to the pipe D through the hose D' , and so provides for the free adjustment of the abrading apparatus in whatever direction is desired, this being accomplished through the swivel or universal coupling between the crane B and the top air-blast pipe F . This joint is more particularly shown in Figs. 13 and 14, the crane B being generally formed of a hollow tube or having a threaded socket at the free end thereof, into which a bolt b' is screwed, while fitting around said bolt is a collar b^2 , which swings around upon the bolt b' unless it is desired to lock it into position by means of the set-screw b^3 . Below the sleeve b^2 , and connected therewith by a bolt b^4 , is the plate b^5 , which fits against the lower flat face of the sleeve b^2 , the said sleeve and the plate b^5 being swiveled together by the bolt b^4 , so that the plate may turn upon the sleeve in whatever direction is desired. Hanging from the plate b^5 by the bolt b' is the loop b^6 , which is connected to the air-blast pipe F and so serves to support the same. On account of the different joints so obtained the abrading apparatus may be swung on its crane in any desired direction, the sleeve b^2 providing for the rocking thereof from side to side, the turn-table b^5 providing for its turning with the bolt b^4 as the center, while the loop b^6 permits its swinging back and forth. As the connection of the crane with the upright standards is such as to permit the swinging of the whole apparatus on the vertical portion B^2 of the crane, it is evident that by such apparatus means are provided for the turning of the abrading apparatus in practically any direction, according to the surface to which it is to be adjusted.

I will now proceed to describe the abrading apparatus proper, so that the operation of the same may be understood. The air-blast pipes F G H communicate with the mouth-piece E of the abrading apparatus, which is generally a heavy casting, having at the forward end thereof a thick annular ring e' to sustain the abrading action of the materials to be projected through the mouth E against the wood, stone, or other surface passing said mouth.

Any suitable number of blast-pipes may be employed, the socket or fitting d , Fig. 9, providing for five of these blast-pipes, though for general purposes two or three are all that are necessary. I may either employ sand-blast pipes F G H , extending back close to

the fitting d , as shown in Fig. 1, or these sand-blast pipes may be made short, as shown in Fig. 4, the branch air-pipes $f g h$ extending from the fitting d close to the mouth-piece E and the siphon-head I (shown more particularly in Figs. 6 and 7) being located in either case at the entrance to the sand-blast pipes, the air-blast through said siphons drawing up the sand and projecting it through the sand-blast pipes, and thence into the mouth-piece and through the mouth E against the surface to be abraded. The pipes $f g h$ are controlled by valves $f' g' h'$, so that the force of the different blasts may be properly regulated, it being desirable, according to the material to be acted on, to vary the velocity of the sand or other abrading material projected. Leading up to the siphon I at the entrance of the sand-blast pipes are the sand feeding pipes i , these pipes extending down into the sand-reservoir K at the base of the case C of the collector and opening within the sand-reservoir, so that the blast will raise the sand through the pipes and project it through the injector and then through the sand-blast pipes into the mouth-piece.

I generally provide three sand-feeding pipes to each injector, so as to feed the sand thereto in the proper manner, though any number may be employed, and, as it is desirable to supply air to the reservoir to form a current for drawing up the sand, I inclose the lower ends of the sand-feeding pipes in a larger pipe i' , this pipe being made of metal or rubber, as desired, the group of pipes i being so inclosed within the larger pipe i' , and the spaces i^2 between the said group of pipes and the outer pipe forming an air-feeding space, so that the air may pass down around the lower ends of the feeding-pipes into the mass of sand in the reservoir, and then pass up through said feeding-pipes with the sand, this being more clearly shown in Fig. 8, which is an end view of the group of sand-pipes at the base thereof.

As it is desirable to reuse the sand for abrading, and also to prevent the escape of the same, especially where it is used in an apartment or in the dressing of the walls of a building, I form the rear end of the mouth-piece E into what may be termed a "return-pipe," this return-pipe L opening at l into any suitable form of a collector and separator, such as shown at M—that is, opening into what might be termed a "cyclone-collector," in which the air or steam is given its freedom, so that it may escape, while the sand or other abrading material is separated therefrom and passes down into the sand-reservoir K.

The form of cyclone-collector shown is what might be termed an "inverted spiral cone," this cone being formed of a leaf or plate m , of wrought or cast metal, curved spirally, so as to have two or more conical chambers m' m^2 m^3 , the upper conical chamber having a cover M' extending above the same and pro-

vided with an outlet M^2 , through which the air can escape, the lower edge of this cover M' being secured to the portion of the spiral plate m forming the upper conical chamber m' and to the return-pipe L, so that where the current from the return-pipe enters the collector a free escape for the greater part of the air will be provided through the outlet M^2 of the cover. The air enters the collector through the opening l of the return-pipe L at such an angle that a swirl is imparted thereto, the air striking the inner wall of the conical chamber and being forced around therein and into the surrounding conical chambers m^2 m^3 , and so obtaining its freedom either through the outlet of the cover or through the spaces $q q'$ at the upper ends of the conical chambers m^2 m^3 , from which a free outlet is given to the same, and also having a free escape through the upper end of the funnel-shaped case C, which is open, as at c^2 . The sand or other abrading material, being heavier than the air, will naturally descend as soon as the air is given its freedom and the current holding the sand in suspension is overcome, so that a separation is obtained between the sand and the air, and to accelerate the separation of the air and sand I form on the plate m one or more rows of deflecting-lips n , so arranged that the sand passing out from the opening l from the return-pipe will strike against these deflecting-lips n and be deflected down into the conical chamber thereby, as more clearly shown in Fig. 10, these deflecting-lips n being set at such an incline with relation to the movement of the air that any sand carried by the air will naturally strike against the deflecting-lips and be deflected downwardly, as above stated. Where the spiral plate n is formed of wrought metal, these lips are formed by cutting and bending from the spiral plate m , and they thus form in said plate the openings n' , through which the air can escape, such openings so giving further freedom for the escape of the air through the plate forming the conical chamber. The sand deflected down by the lips n passes into the lower portion of the surrounding case C, surrounding the lower portion of the conical chambers, the case C being open at its upper end, as are the several conical chambers m^2 m^3 , as above stated, so that the air can have free escape. The lower portion of the case C forms the sand-reservoir K, and in order to prevent any action of the air upon the sand in the reservoir I provide the partition k across the lower part of the case C, this partition being cup-shaped, so as to hold the sand, and having in the case thereof the opening k' , through which the sand collected can pass into the reservoir. The sand-reservoir K is closed at the base by the screw-cap K' , which can be unscrewed to permit the removal of the sand from the reservoir.

When the apparatus is employed for treating slabs, plates, or boards, which can be fed

thereto, it is supported in a stationary position on any suitable frame, and a guide-piece *p* is employed to hold the slab or board in contact with the mouth *E*, and as in the operation of the apparatus it is not desirable to cut off the blast as each slab or board is fed through the machine I provide a nose-piece *R*, into which the sand may be projected through the mouth *e*, and from which it will pass back to the mouth-piece and thence into the return-pipe, so as to be fed to the separator or collector. This nose-piece *R* is formed hollow, as shown in Fig. 4, and is cup-shaped, so that the sand and air passing into it through the mouth-piece will be deflected down to the base thereof and pass through the opening *r* into the mouth-piece *E*, a plate *r'* being generally employed within the nose-piece, around which the sand is carried by the blast, so that it will pass into the passage *r*. This nose-piece and the guide *p* may be made removable, so that when the apparatus is employed for abrading any stationary object—such as wood-work of an apartment—the nose-piece and guide can be removed and the mouth-piece of the abrading apparatus employed close to the surface to be treated. When employed for treating movable bodies, such as slabs or boards, any suitable feeding mechanism for feeding the same past the mouth-piece can be employed, that shown in the drawings being the rollers *s*, in proper line with the guideway *p* and bearing on the slab or board, so as to carry it through, these rollers being rotated by any suitable mechanism. In treating boards the apparatus may be located close to the planing machinery, the boards being planed or their edges finished, and while passing through such machinery their surfaces abraded by the apparatus, which may be properly located in relation thereto. In this connection I have illustrated an edge-cutter *t*, (see Figs. 1 and 5,) it being understood that such apparatus may be located at any suitable point, as may be desired. In the operation of the apparatus I employ air, dry steam, or other fluids under pressure, the same being intended to be included in the term "air-blast." In some cases water or other suitable liquid may be used, though under such circumstances the sand-collecting apparatus would require to be changed. It will also be understood that in treating any stationary objects, such as the wood-work of an apartment, the supporting-frame will be mounted within the room in any desirable position, so as to bring the abrading apparatus close to the wood-work, and through the mechanism above described it may be moved over the same, being so manipulated that the mouth-piece may be gradually moved over the stationary object, so that the blast of sand or other abrading material may operate thereon. When employed for treating slabs, plates, or boards, the apparatus is mounted in any suitable stationary frame and the pieces fed

thereto, as above stated. In either case the blast passes up through the pipe *D*, and thence through the branch air-pipes *f g h*, entering the injectors *I* at the entrance of the sand-blast pipes *F G H* and drawing up the sand through the sand-feeding pipes *i* and forcing it through said sand-blast pipes into the mouth-piece *E* and through the mouth *e* thereof against the surface to be abraded as it passes said mouth.

As the different sand-blast pipes enter at different angles, the sand-blast will act upon the surface to be abraded in different directions, according to the angles at which the sand-blasts enter the mouth-piece. For the finishing of the wood surfaces, as described in an application of even date herewith, Serial No. 356,789, I prefer to arrange the sand-blast pipes so that the blast therefrom will strike the surface of the wood at different angles—say, for example, that the sand is fed by two or more of the pipes across the fiber of the wood, so as to cut out the pithy or softer portion thereof, the blast being so regulated that it will act but little on the harder grain or fiber of the wood, while the other pipe feeds the sand longitudinally of the grain of the wood, said blast acting to smooth or polish the grain or fiber of the wood, so as to form a fine finished surface thereon, said action leaving the surface of the wood with the harder grain or fiber raised in relief, while the softer or pithy portions are removed therefrom. As the sand or other abrading material strikes against the surface it is deflected back into the mouth-piece *E* and passes thence into the return-pipe *L* and thence into the collector or separator *M*, passing into the same in such direction as to impart a swirl to the air, so that it will pass with a swirling motion into the collector and obtain its freedom therein, the sand carried by the air striking against the deflecting lips or plates *n* and being deflected down within the inverted cone of the separator and the larger portion of the air rising within the cover *M'* and escaping through the outlet *M*². Part of the air, however, will pass downwardly within the collector, part escaping through the upper part of the conical chambers *m*² *m*³, formed by the spiral plate *m*, part through the openings *n'* in the said plates, a part of it escaping through the upper part of the case *C*, freedom for all the air being thus obtained, while the sand passes down by its own gravity or is deflected onto the cup-shaped partition *k* thereof, and this sand then passing through the opening *k'* into the reservoir *K*, forming the base of the case *C*, in position to again pass into the sand-feeding pipes and be carried up through the same to the sand-blast pipes, as above described. In operating on movable slabs or boards as the one board passes out from in front of the mouth-piece the sand projected through the sand-blast pipes will be caught by the nose-piece *R*, and will pass thence through the pas-

sage *r* back into the return-pipe L and into the collector, so that the major part thereof is not permitted to escape.

Any suitable material may be employed as the abrading material, finer or coarser materials or harder or softer materials being employed, according to the purpose for which the blast is used, and in this same way the apparatus may be employed simply for removing paint from wood surfaces, for cutting or removing the softer or pithy portions from wood surfaces, leaving the grain in relief, as above described, for cutting or abrading stone, glass, iron, or other such surfaces, for cleaning any such surfaces, or for filling in wood surfaces, a light filling material projected with a slight blast being of course employed for this purpose; or in the same way paints or oils or like liquid materials may be projected against wood or other surfaces, the apparatus having many such uses, all of which it is not necessary to mention here, the materials employed and the blast for projecting the same being regulated according to the work to be performed by the apparatus.

My invention therefore provides an apparatus suitable for many uses either when stationary or when adjustable over a stationary surface, as may be found desirable.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In surface-abrading apparatus, the combination of the mouth-piece through which the abrading material is projected and a series of blast-pipes communicating with the mouth-piece at different angles thereto and close to the mouth thereof, so as to project the several streams at different angles through said mouth-piece, substantially as and for the purposes set forth.

2. In surface-abrading apparatus, the combination of a mouth-piece through which the abrading material is projected and a series of blast-pipes communicating therewith, said mouth-piece having a ring extending inwardly to form the mouth thereof, substantially as and for the purposes set forth.

3. In surface-abrading apparatus, the combination of the mouth-piece, a series of blast-pipes communicating therewith, and a hollow nose-piece opposite the mouth-piece to receive the sand passing through the mouth and return it to the apparatus, substantially as and for the purposes set forth.

4. In surface-abrading apparatus, the combination of a mouth-piece through which the material is to be projected, blast-pipes communicating therewith, a return-pipe leading from the mouth-piece, and a separator and collector into which the return-pipe opens, substantially as and for the purposes set forth.

5. In surface-abrading apparatus, the combination of a mouth-piece, blast-pipes communicating therewith, a return-pipe extending from the mouth-piece, a separator and collector into which the return-pipe opens, and a hollow nose extending in front of the

mouth-piece and having a return-passage leading therefrom and opening into the return-pipe, substantially as and for the purposes set forth.

6. In surface-abrading apparatus, the combination of the mouth-piece, blast-pipes communicating therewith, a guide rigid with and extending in front of the mouth-piece, and feeding apparatus for carrying the material past the mouth-piece, substantially as and for the purposes set forth.

7. In surface-abrading apparatus, the combination of the mouth-piece, a guideway over which the material to be operated on is fed, a blast-pipe communicating with the mouth-piece at an angle to the course of the material fed thereto, and a blast-pipe communicating with the mouth-piece in line with the course of the material fed thereto, substantially as and for the purposes set forth.

8. In surface-abrading apparatus, the combination of a mouth-piece, blast-pipes communicating therewith, a return-pipe leading from the mouth-piece, and a collector with which said return-pipe communicates, said collector being formed of a hollow cone, substantially as and for the purposes set forth.

9. In surface-abrading apparatus, the combination of a mouth-piece, blast-pipes communicating therewith, a return-pipe leading from the mouth-piece, and a collector with which said return-pipe communicates, said collector being formed of a hollow cone and a cover extending over the same and having an outlet in the upper end thereof, substantially as and for the purposes set forth.

10. In surface-abrading apparatus, the combination of a mouth-piece, blast-pipes communicating therewith, a return-pipe, and a collector with which said return-pipe communicates, said collector being formed of a spirally-laid plate, forming a spiral cone, the spirals forming separate conical chambers having spaces between them at their larger ends for the escape of the air, substantially as and for the purposes set forth.

11. A surface-abrading apparatus having a return-pipe opening into a collector, said collector being formed of a cone provided with a series of inclined deflecting-lips arranged spirally therein, substantially as and for the purposes set forth.

12. A surface-abrading apparatus having a return-pipe opening into a collector, said collector being formed of a cone provided with a series of inclined deflecting-lips arranged spirally therein and having openings above the lips, substantially as and for the purposes set forth.

13. A surface-abrading apparatus having a return-pipe opening into a spiral cone, the spirals thereof forming separate chambers having spaces between them for the escape of the air, and said spirals being provided with a series of inclined deflecting-lips, substantially as and for the purposes set forth.

14. A surface-abrading apparatus having a

return-pipe and a collector into which it opens, said collector being formed of an inverted hollow cone and a funnel-shaped case inclosing the lower part of the cone, substantially as

5 and for the purposes set forth.

15 15. A surface-abrading apparatus having a return-pipe and a collector into which it opens, said collector being formed of an inverted hollow cone and a funnel-shaped case inclosing
20 the lower part of the cone, said funnel-shaped case being provided with a reservoir for the collection of the abrading materials at the base thereof, substantially as and for the purposes set forth.

15 16. A surface-abrading apparatus having a return-pipe and a collector into which it opens, said collector being formed of an inverted hollow cone and a funnel-shaped case inclosing
20 the lower part of the cone, said funnel-shaped case being provided with a reservoir for the collection of sand at the base thereof and having a cup-shaped partition above said reservoir and below the cone provided with an opening in the base thereof communicating
25 with the reservoir, substantially as and for the purposes set forth.

17. In surface-abrading apparatus, the combination of the mouth-piece, a sand-blast pipe communicating therewith, an injector at the
30 entrance of said sand-blast pipe, an air-pipe communicating centrally with the injector, and sand-feeding pipes communicating with the space in said injector around the air-pipe, substantially as and for the purposes set
35 forth.

18. In surface-abrading apparatus, a mouth-piece having a sand-blast pipe communicating therewith, said sand-blast pipe having an injector at the entrance thereof with which
40 an air-pressure pipe communicates, a series of sand-feeding pipes communicating with the injectors, and a sand-reservoir at the base of the sand-feeding pipes, substantially as and for the purposes set forth.

45 19. In surface-abrading apparatus, a mouth-piece having a sand-blast pipe communicating therewith, said sand-blast pipe having an injector at the entrance thereof with which an air-blast pipe communicates, a series of
50 sand-feeding pipes communicating with the injector, and a sand-reservoir at the base of the sand-feeding pipes, said sand-feeding pipes being arranged in a group and having a tube surrounding the lower portion of said
55 pipes, substantially as and for the purposes set forth.

20. In surface-abrading apparatus, the combination of a supporting-frame, a crane extending out therefrom, a surface-abrading apparatus having a mouth-piece and a blast-
60 pipe leading thereto, and a universal-joint connection between said crane and the abrading apparatus to provide for the movement of the apparatus over the surface to be
65 abraded, substantially as and for the purposes set forth.

21. In surface-abrading apparatus, the combination of a supporting-frame and the abrading apparatus hung therefrom, the crane and the abrading apparatus being connected by
70 the universal joint b , formed of the sleeve b^2 , mounted on the shaft b^1 , and the turn-plate b^3 , swiveled to the sleeve by bolt b^4 and having the swinging loop b^6 depending therefrom, substantially as and for the purposes
75 set forth.

22. In surface-abrading apparatus, the combination of hollow vertical standards A A , bars A^2 A^2 , entering the same, a clamp engaging with the standards, a crane supported in
80 said clamp, and abrading apparatus hung from said crane, substantially as and for the purposes set forth.

23. The combination of the standards A A , the clamping-blocks a' , the shaft u , extending
85 through the same and having the head u^2 , provided with the threaded socket u^3 , the nut u' , the bolt v , screwing into the socket u^3 and having a cylindrical body, the clamping-block
90 a , mounted on the bolt v , and the crane B , clamped by the blocks a , substantially as and for the purposes set forth.

24. The combination of the standards A A , the clamping-blocks a' , the shaft u , extending
95 through the same and having the head u^2 , provided with the threaded socket u^3 , the nut u' , the bolt v , screwing into the socket u^3 and having a cylindrical body, the clamping-block
100 a , mounted on the bolt v , the handle w' , secured to the bolt v , the nut w , screwing onto the bolt v , and the crane B , clamped by the blocks a , substantially as and for the purposes set forth.

In testimony whereof I, the said ANDREW BRYCE, have hereunto set my hand.

ANDREW BRYCE.

Witnesses:

JAMES I. KAY,
J. N. COOKE.