(No Model.) 3 Sheets—Sheet 1.

G. STITES.

PORTABLE DRILLING MACHINE.

No. 546,628. Patented Sept. 17, 1895.

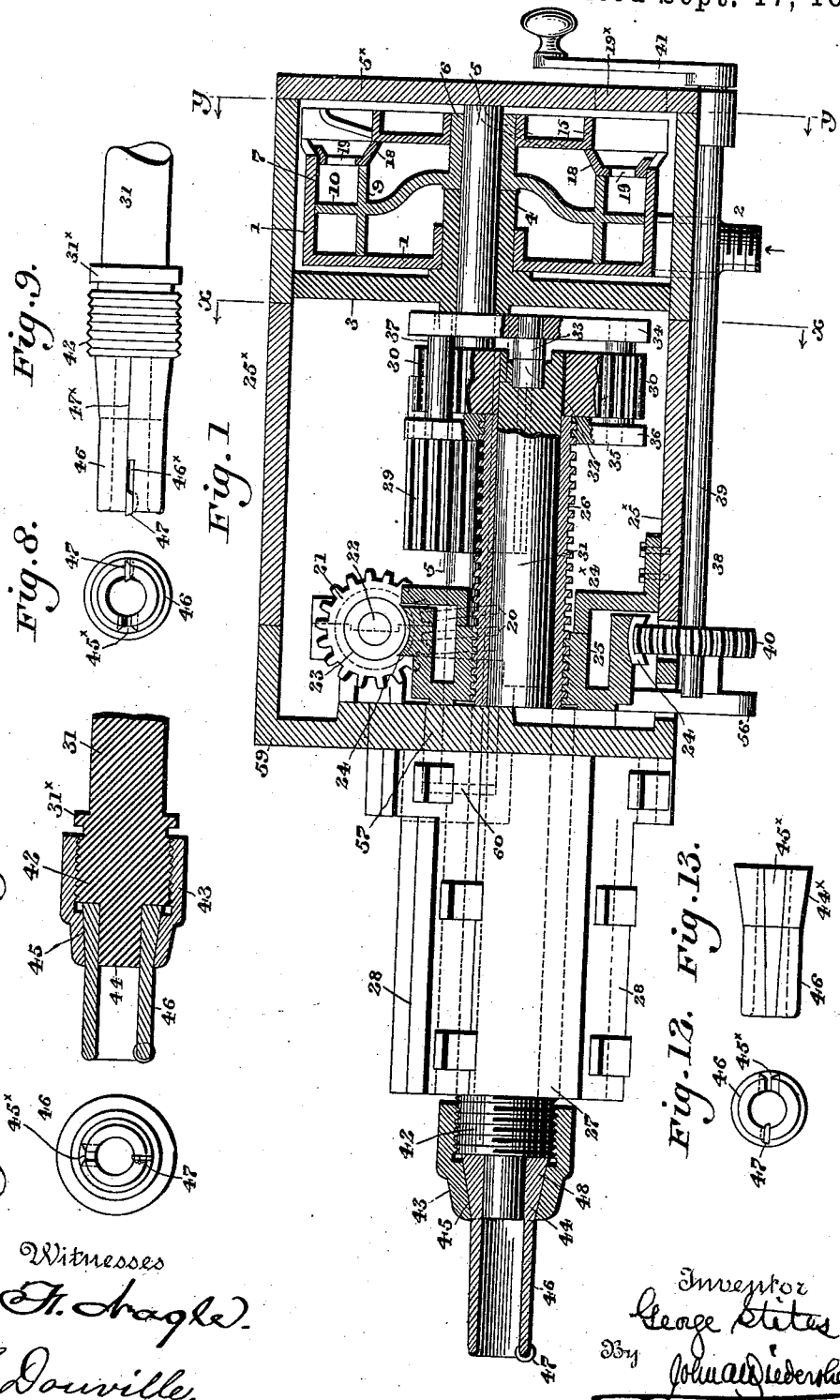

Fig. 1.

Fig. 9.

Fig. 8.

Fig. 11.

Fig. 10.

Fig. 13.

Fig. 12.

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(No Model.) 3 Sheets—Sheet 2.

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PORTABLE DRILLING MACHINE.

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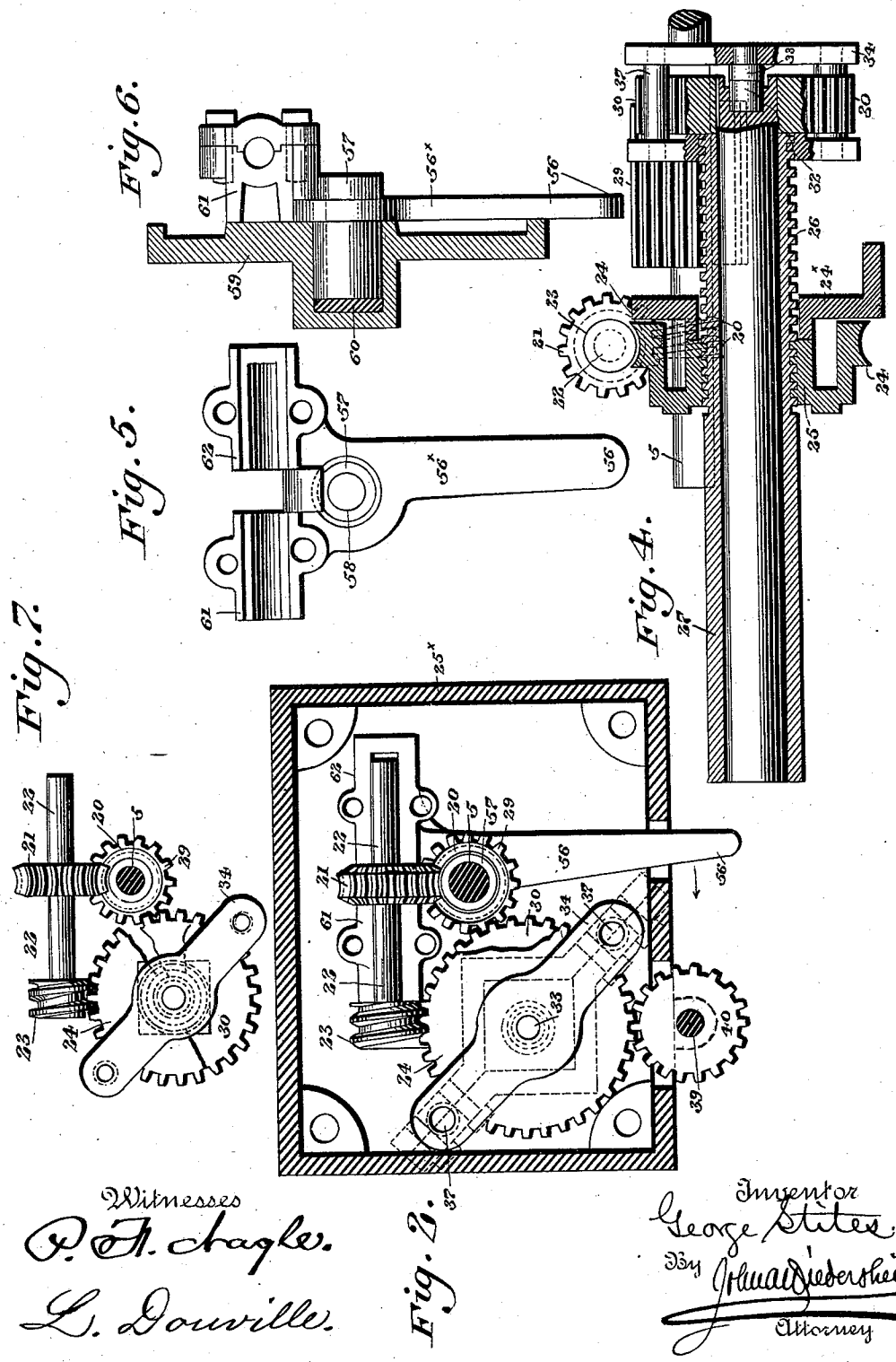

Fig. 6.

Fig. 5.

Fig. 4.

Fig. 7.

Fig. 2.

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PORTABLE DRILLING MACHINE.

No. 546,628. Patented Sept. 17, 1895.

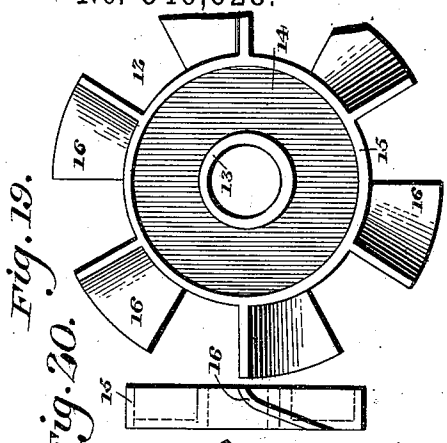

Fig. 19.

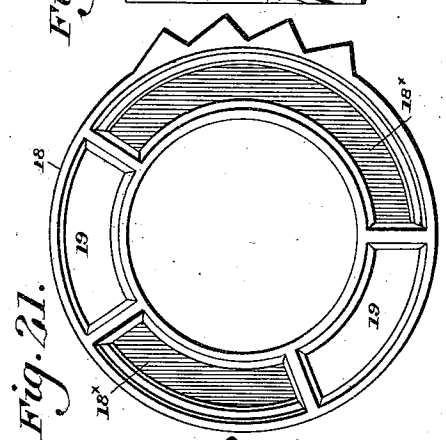

Fig. 20.

Fig. 21.

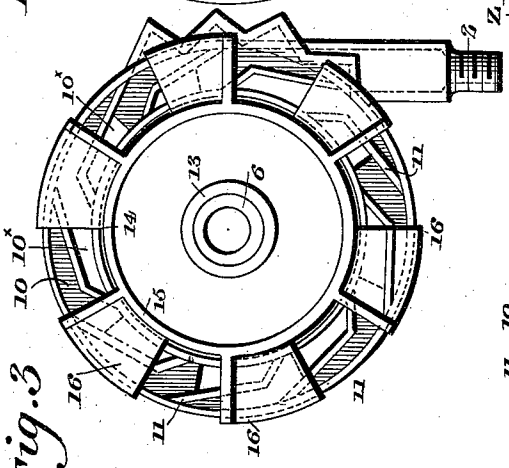

Fig. 3.

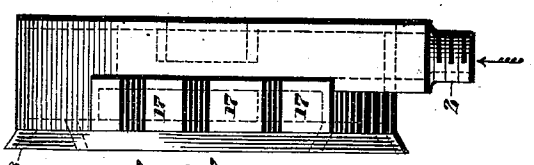

Fig. 15.

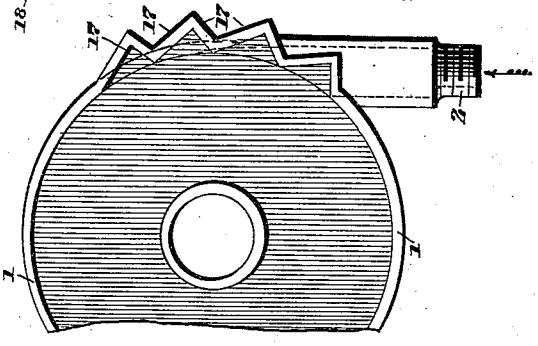

Fig. 14.

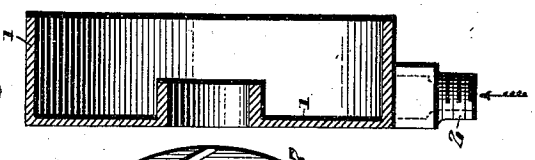

Fig. 16.

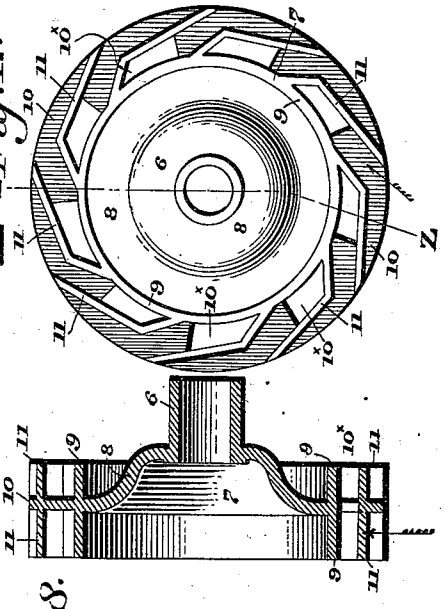

Fig. 17.

Fig. 18.

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UNITED STATES PATENT OFFICE.

GEORGE STITES, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF FIVE-EIGHTHS TO JAMES B. THOMAS, OF SAME PLACE, AND CHARLES C. THOMAS, OF WAYNE, PENNSYLVANIA.

PORTABLE DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 546,628, dated September 17, 1895.

Application filed March 21, 1895. Serial No. 542,602. (No model.)

To all whom it may concern:

Be it known that I, GEORGE STITES, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Portable Drilling-Machines, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of a novel construction of portable drilling-machine which is capable of general application, but is especially adapted for drilling hard metals upon which ordinary drills cannot be used, compressed air being employed as the motive fluid and provision being made for communicating the rotation of a suitable motor or power wheel to a drill-chuck by means of a suitable intervening gearing or other mechanism, and for simultaneously imparting motion to the feeding mechanism of said chuck from the same source of power.

It also consists of means for assisting the creation of a partial vacuum in the motor-chamber by means of an air-fan attachment, whereby substantially all the energy of the compressed air is utilized.

It also consists of novel means for instantly stopping the feeding mechanism when desired.

It further consists of novel details of construction, all as will be hereinafter set forth.

Figure 1 represents a side elevation, partly in section on different planes, of a portable drilling-machine and its adjuncts embodying my invention. Fig. 2 represents a section on line *x x*, Fig. 1, viewed in the direction of the arrows. Fig. 3 represents a section on line *y y*, Fig. 1, viewed in the direction of the arrows. Fig. 4 represents a longitudinal sectional view of the chuck-spindle and the means for actuating the same. Figs. 5 and 6 represent front and side views, respectively, of a lever mechanism detached, which is employed for throwing the feeding device out of operation, as will be explained. Fig. 7 represents a detached view of the gearing which actuates the feed and driving mechanism, certain of the parts being also shown in Fig. 2. Figs. 8 and 9 represent plan and side elevations, respectively, of the end portion of the chuck-spindle and cutter. Figs. 10 and 11 represent, respectively, plan and longitudinal sectional views of said spindle and chuck. Figs. 12 and 13 represent plan and side elevations of the cutter and chuck detached. Figs. 14, 15, and 16 represent plan, side, and sectional views, respectively, of the casing which incloses the motor-wheel. Figs. 17 and 18 represent plan and sectional views, respectively, of the motor-wheel employed, the section being taken on the line *z z*, Fig. 17. Figs. 19 and 20 represent plan and side elevations of an exhaust-fan employed in conjunction with the power or motor wheel, the contour of one blade only of said fan being shown in Fig. 20. Fig. 21 represents a plan view of a diaphragm dividing the motor-wheel casing and the exhaust-fan casing.

Similar numerals of reference indicate corresponding parts in the several figures.

Referring to the drawings, the device for imparting motion to the drill-chuck will first be described, reference being had to Figs. 1, 3, and 14 to 21, inclusive.

1 designates a casing, and 2 the inlet for the compressed air.

3 designates a partition which is provided with the hub 4, which serves as a bearing for the driving-spindle 5, which revolves therein, the outer portion of the hub 4 supporting said casing 1, which latter is stationary, as is also the partition 3.

The driving-spindle 5 has mounted thereon the hub 6 of the motor-wheel 7, Figs. 17 and 18, said hub having the web 8 attached thereto and meeting the circular flange 9, the latter having the substantially right-angled flange 10 extending therefrom.

11 designates blades suitably attached to said flanges 9 and 10, the preferred shape of which is best seen in Fig. 17, said blades being on each side of the flange 10, and after leaving the flange 9 being deflected in more nearly a tangential line toward the perimeter of the flange 10, at which point they terminate. The flange 10 has a number of openings or ports $10^{\times}$ through it, whose extent is

limited by the flange 9 and the blades 11, the function of which openings will be explained.

12 designates the exhaust-fan, whose hub 13 has the web 14 attached thereto, while the annular flange 15 is attached to said web.

16 designates wings or blades which are attached to the flange 15, the shape of one of said blades being shown in Fig. 20, the same beginning at the side of the flange 15 and curving or sloping down toward the other side.

The construction of the casing 1, which incloses the motor-wheel, will be understood from Figs. 14 to 16, said casing having a portion of its surface provided with the alternate projections and depressions 17, which are removed to one side of the compressed-air inlet 2, one side of the casing being closed and the other being open.

18 designates the diaphragm which separates the motor-wheel and exhaust-wheel chambers, said diaphragm having the exhaust-openings 19 therein, through which the compressed air escapes to the exhaust-fan after imparting its energy to the motor-wheel, the portions $18^{\times}$ of said diaphragm being solid, it being understood that there is a suitable exhaust-port $19^{\times}$ through the cover $5^{\times}$ for the final exit of the air.

20 designates a worm on the driving-spindle 5, which meshes with and actuates the worm-wheel 21, which is mounted upon the shaft 22, which revolves in suitable bearings, and has secured thereon the worm 23, which meshes with the feed gear-wheel 24, which latter is suitably attached to an internally-threaded collar 25, which engages the threaded portion 26 of the bush 27, which in the present instance is square and is movable longitudinally in the boxes 28, which latter are split diagonally, as will be understood from Fig. 2. In case the said bush is made cylindrical throughout a feather and groove will be employed to prevent the same from rotating.

29 designates a pinion mounted on the driving-spindle 5 and meshing with the gear 30, which is attached to the chuck-spindle 31, which revolves in the bush 27. The end of said spindle 31 nearest the motor-wheel has the portion 32 of its thrust tightly driven thereinto, so as to be revolved in unison with the spindle, the other portion 33 of said thrust being attached to the adjacent section 34 of the yoke 35, the latter consisting of the two bars 34 and 36, which are held together by means of the studs 37, the pinion 30 revolving within said yoke and being mounted on the chuck-spindle 31, as stated, while the bar 36 of the yoke 35 is suitably secured to the threaded portion 26, which latter, it will be understood, does not revolve.

38 designates the device for returning the chuck-spindle 31, the same consisting of the rod 39, rotatably mounted in suitable bearings and carrying the pinion 40, which meshes with the gear 24, which latter is held in position by means of the keeper $24^{\times}$, which is attached to a suitable portion of the casing $25^{\times}$, said rod being actuated by means of the crank 41.

The extremity of the chuck-spindle 31 has a shoulder $31^{\times}$, beyond which extends the threaded portion 42, which has the tang 44 of reduced diameter, said threaded portion being engaged by the internally-threaded socket-nut 43, which has a taper at 45, the smallest diameter being at the outer end.

46 designates a chuck, which is a hollow cylindrical shell, made preferably of steel, in one extremity of which is the diamond-cutter 47, the other end 48 of said chuck slipping over the tang 44, while the exterior has a taper $44^{\times}$, corresponding with the taper of the socket-nut 43, so that when the parts are assembled in the position seen in Figs. 1 and 11 said socket-nut 43 will hold the chuck tightly in position, the tapered surfaces being in contact with each other, as is evident.

The chuck is constructed as follows, reference being had to Figs. 8 to 13, inclusive. The hollow shell 46 has a slot $46^{\times}$ near the extremity thereof, in which is said diamond 47. The chuck is then split or cut longitudinally on the line $47^{\times}$, Fig. 9, while diametrically opposite the wedge $45^{\times}$ is inserted in a slot whose contour corresponds to a slot in the chuck, said wedge having been cut from a similar cylindrical shell, and the latter having a bore of uniform diameter, as is evident.

In Figs. 5 and 6 are shown detail views of the device which is employed to temporarily throw out the feeding mechanism 56, designating the handle of the operating-lever $56^{\times}$, which latter has passing through and projecting beyond it a bushing 57, which has the internal bearing 58, in which rotates the end of the shaft 5, said bushing being supported in the head 59 and having the steel plate 60 interposed between its extremity and said head. The extremity of said lever, opposite its handle, has attached at an angle thereto the boxes 61 and 62, which are provided with suitable caps held in place in the usual manner, said boxes serving as bearings for the shaft 22, which carries the worm-wheel 21 and the worm 23, which latter actuates the feed-gear 24, Figs. 1 and 7. It will thus be seen that by rocking the lever $56^{\times}$ in the proper direction the boxes 61 and 62, in which rotate the shaft 22, will be oscillated about the shaft 5 as a center, so as to lift the worm 23 out of mesh with the gear 24, and thus the rotation of the latter can be instantly stopped, and consequently the feed, whenever desired, it being understood that the head 59 is suitably attached to the casing $25^{\times}$.

The operation is as follows, reference being first had to Figs. 1, 3, and 14 to 21, inclusive: The compresed air or other motive fluid is conducted by a hose or other conduit to the inlet 2, impinging on the blades 11 of the motor-wheel 7, as indicated by the arrows in Figs. 17 and 18,

whereupon the wheel will be caused to rapidly rotate, and it is evident that a portion of the compressed air will escape through the ports or openings $10^{\times}$ to the other side of the flange 10, and upon reaching the small chambers formed within the elevations and depressions 17 will suddenly expand, and in so expanding will impart a portion of its energy to the adjacent blades 11, whereby the velocity of the rotation of the wheel will be greatly augmented. The said compressed air will then pass through the ports 19 in the diaphragm 18, after which it will be taken up by the peculiarly-shaped wings or blades 16 of the fan 12, which latter it will be noticed revolves in unison with the power or motor wheel 7, being attached to the hub thereof, the office of said fan 12 being to cause a suction and thus assist the creation of a vacuum, and thereby facilitate the exhaust of the dead air from the motor-casing, the final exhaust thereof being out of the port $19^{\times}$ in the cover $5^{\times}$.

The motor-wheel is mounted on the driving-spindle 5, from which latter the rotation is imparted to the pinion 29, mounted thereon, said pinion meshing with the gear 30, mounted on the chuch-spindle 31, which revolves in the non-rotating bush 27, to an end of which latter the yoke 35 is attached, within which yoke said gear 30 rotates.

The rotation of the chuck 46 is effected by means of the spindle 31, as is evident, and it will be apparent that if said chuck is advanced into the metal to be drilled, that a round core and a hole of uniform diameter will be produced.

The feeding mechanism is actuated as follows: The driving-spindle 5 has a worm 20 thereon, which actuates the worm-wheel 21, mounted on the shaft 22, which latter extends at substantially a right angle to the spindles 5 and 31. The shaft 22 has the worm 23 thereon, which meshes with the feed gear-wheel 24, which latter has the internally-threaded hub or collar 25, which engages the threaded portion 26 of the bush 27, whereby it will be seen that the rotation of the feed-gear 24 will impart a longitudinal movement to the bush 27, thus advancing the chuck 46 by reason of the relations of the yoke, thrust, gear 30 and chuck-spindle 31 to each other, as will be understood from Figs. 1 and 4. To stop the rotation of the feed-gear 24 it is only necessary to move the handle $56^{\times}$ in the direction of the arrow, Fig. 2, whereupon it will be seen that the worm 23 will be lifted out of mesh with the feed-gear 24, the boxes 61 and 62, which are attached to the lever $56^{\times}$, being oscillated about the shaft 5 as an axis, as will be apparent.

The construction of the chuck and the manner of inserting the diamond and holding the sections of the chuck in position have already been explained, as well as the means for returning or recovering the bush and also the chuck-spindle, and the manner of assembling the motor-wheel, its casing, the air-exhaust fan, and the diaphragm between said fan and wheel will be understood from Fig. 1.

It will be further understood that the sections of the casing, which inclose the operative parts of the device, may be of different construction from that shown, and that slight changes may be made in the manner of mounting and assembling the various elements of the machine other than that shown, which will come within the scope of my invention, and I do not, therefore, desire to be limited to the exact constructions I have herein shown and described.

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

1. In a drilling machine, a rotary motor or power wheel, a casing or chamber therefor, a driving spindle upon which said power wheel is mounted, in combination with an auxiliary fan also mounted upon said spindle, said fan tending to assist in the creation of a vacuum in said chamber, substantially as described.

2. In a drilling machine, a rotatable power wheel, a driving spindle on which the same is mounted, an auxiliary fan also mounted upon said spindle, a chuck spindle separate from said driving spindle mounted in a suitable bush, and adapted to carry a chuck, a bearing for said bush, an internally threaded collar engaging the latter, and gearing mounted on said driving spindle and meshing with other gearing which rotates and feeds said chuck spindle, substantially as described.

3. In a drilling machine, a chuck spindle, a bush in which the same is mounted, an internally-threaded collar engaging said bush, gearing for rotating and thus feeding the same, a pinion mounted on a shaft having suitable bearings, and means for moving said shaft and pinion out of engagement with said feed gear, substantially as described.

4. In a drilling machine, a driving spindle, a motor or power wheel mounted thereon, a casing for said power wheel, an auxiliary fan mounted so as to rotate in unison with the latter, a diaphragm intermediate said wheel and fan, a chuck spindle, a shaft arranged transversely thereto, and gearing intermediate the above spindles, and shaft, substantially as described.

5. In a drilling machine, a driving spindle, a motor or power wheel mounted thereon, a casing for said power wheel, an auxiliary fan attached to a suitable portion of the latter, and a diaphragm intermediate said wheel and fan, substantially as described.

6. In a machine of the character described, a power wheel having the hub 6, the web 8, the flanges 9 and 10, the blades 11, and the ports $10^{\times}$ through said flange 10, in combination with a casing for said wheel, said casing having one side open and the other partially closed, a portion of said casing being alternately elevated and depressed, an inlet nozzle

adjacent to said elevated and depressed portions, a partition in said casing, a spindle rotatably mounted in the latter, and an auxiliary fan mounted on said spindle, substantially as described.

7. In a drilling machine, a driving spindle, a motor or power wheel mounted thereon, a casing for said power wheel, an auxiliary fan attached to a suitable portion of the latter, in combination with a diaphragm intermediate said wheel and fan, said diaphragm being open at its central portion, and having openings and solid portions alternating, with each other, substantially as described.

8. In a drilling machine, a driving spindle, a bearing therefor, a rotatable power wheel mounted on said spindle, a casing for said wheel, an auxiliary fan constructed substantially as shown, and mounted on the hub of said wheel, an apertured diaphragm intermediate of said wheel and fan, and a cover or head adjacent said fan and provided with a port for the final exhaust of the motive fluid, substantially as described.

9. In a drilling machine, a chuck consisting of a hollow cylindrical shell having its exterior surface provided with a taper at one end, said shell being cut longitudinally and provided with a longitudinally-extending wedge, and a cutter of hard material secured in an end of said shell, substantially as described.

10. A chuck consisting of a hollow shell, cut longitudinally and provided with an external taper at one end, and having a longitudinally-extending slot and wedge, and a diamond cutter suitably secured in said slot, substantially as described.

11. In a drilling machine, a driving spindle, a chuck spindle, intermediate gearing for actuating and feeding the latter, said chuck spindle having on its extremity the shoulder $31^{\times}$, the threaded portion 42, and the tang 44, adapted to receive a hollow chuck and means for holding said chuck in position, substantially as described.

12. In a drilling machine, a chuck spindle, means for rotating and feeding the same, the end of said spindle having a shoulder thereon, a portion of said spindle being threaded and having a tang projecting therefrom, a hollow divided chuck having an external taper at one end, and adapted to fit on said tang, a cutter of hard material inserted in said chuck, and a socket nut for holding the latter in position on said spindle, substantially as described.

13. In a drilling machine, a driving spindle, a chuck spindle, a shaft mounted transversely to said spindles, gearing intermediate the latter and said shaft, movable boxes for the latter, and a lever common to said boxes, and having a portion adapted to serve as a bearing for said driving spindle, said lever being suitably fulcrumed, substantially as described.

14. In a drilling machine, a driving spindle, a chuck spindle, a bushing suitably supported in which one end of said driving spindle rotates, a lever secured to said bushing, suitable boxes or bearings attached to said lever, and a shaft having gearing thereon meshing with gearing on said spindles, substantially as described.

15. In a drilling machine, a driving spindle having a pinion and worm thereon, a chuck spindle, a gear mounted thereon, a yoke inclosing said gear, a thrust in said chuck spindle and yoke, non-rotating bushing in which said chuck spindle rotates, a portion of said yoke being attached to said bush, a portion of which latter is threaded, a threaded collar engaging said bush, and means for rotating said collar, substantially as described.

16. In a drilling machine, a chuck spindle, a driving spindle, a shaft mounted transversely to the same, a threaded bush, a collar engaging the latter, a keeper and means for causing said collar to rotate in either direction, substantially as described.

17. In a drilling machine, a chuck spindle, a driving spindle, a shaft mounted transversely to the same, a threaded bush, a collar engaging the latter, a keeper, gearing intermediate said spindle and shaft for rotating said collar and chuck spindle, means for stopping the rotation of said collar at will, and means for rotating the same in an opposite direction, substantially as described.

18. In a drilling machine, a driving spindle having mounted thereon a power wheel, and an auxiliary fan, an apertured diaphragm intermediate the same, a chuck spindle, gearing intermediate said spindles, means for feeding said chuck spindle, in either direction, and means for stopping the feeding of said chuck spindle, in combination with a suitable casing inclosing the above parts, substantially as described.

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