April 29, 1952 O. A. CAUSEY 2,595,126

WELL-DRILLING MACHINE

Filed June 18, 1949 3 Sheets-Sheet 1

Fig. 1

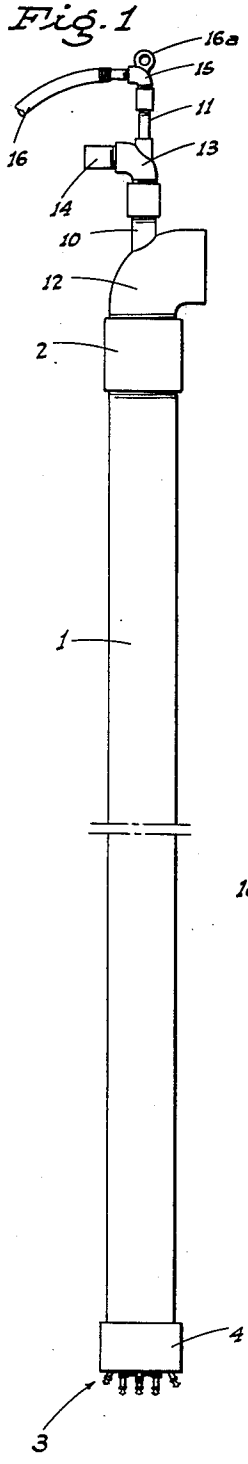
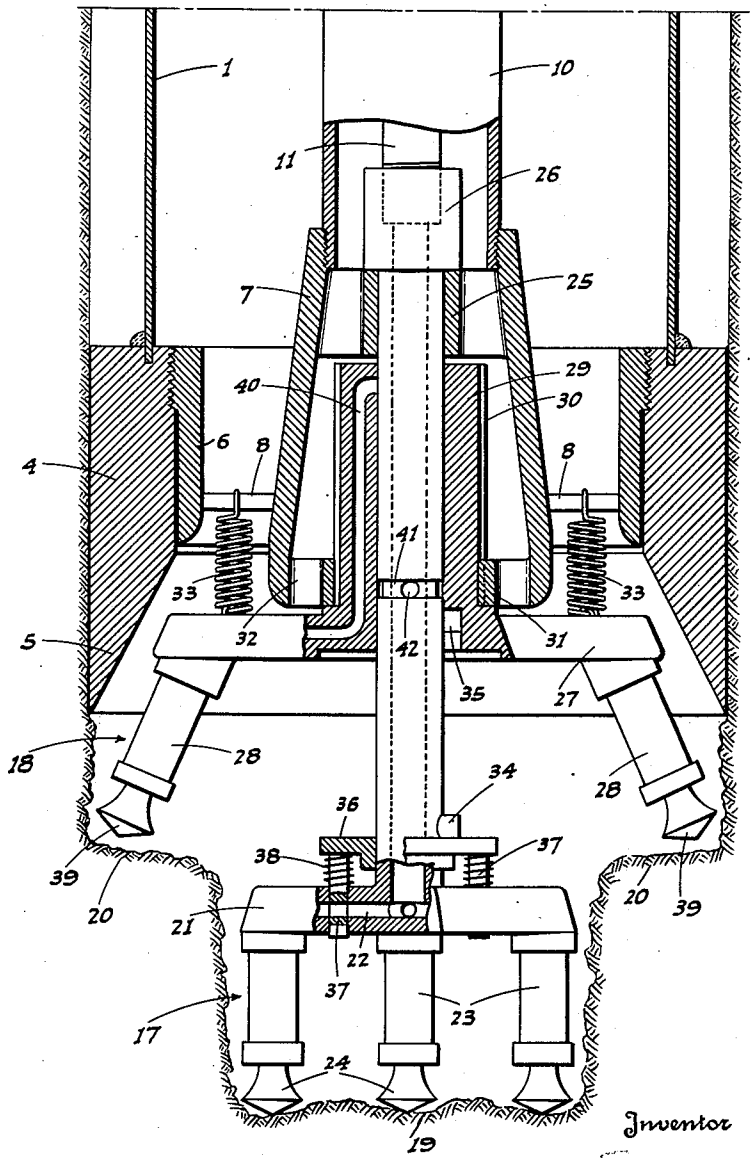


Fig. 2



Inventor

Otis A. Causey

By

Webster & Webster

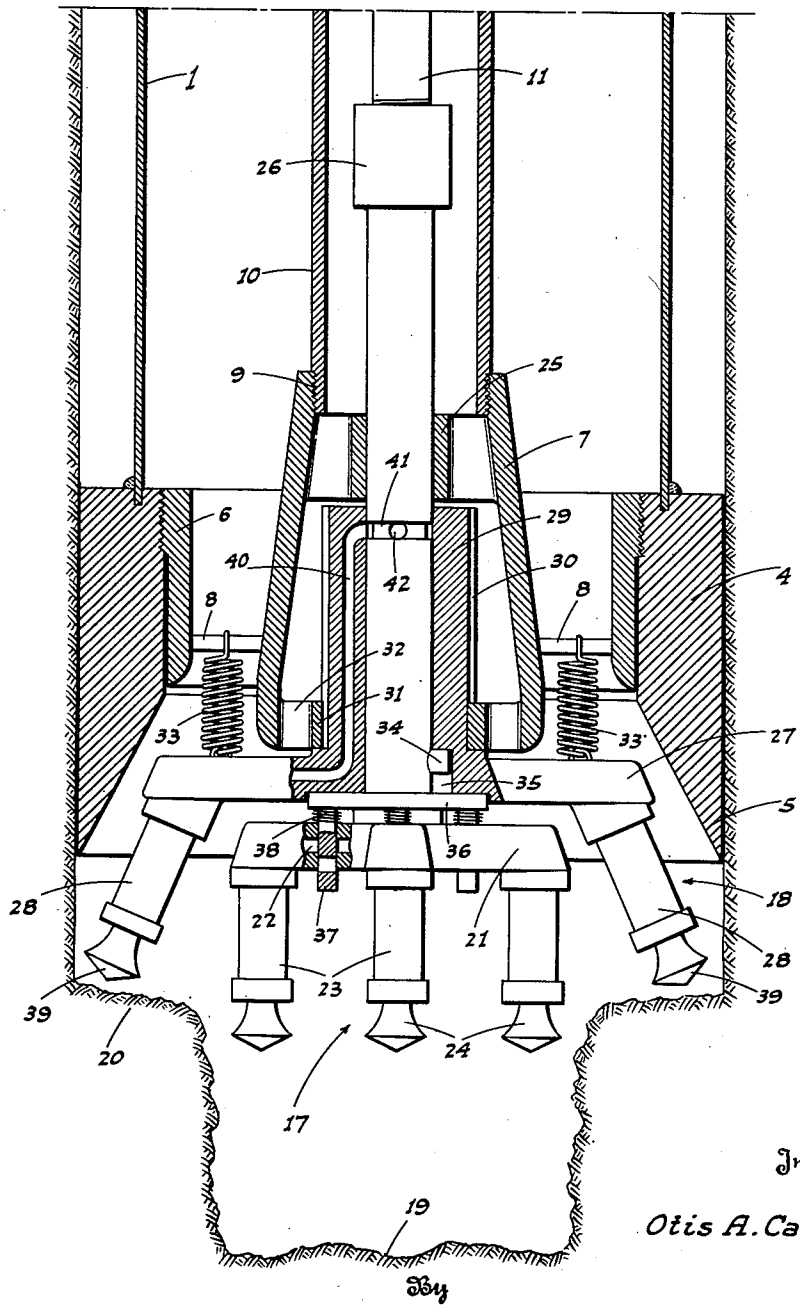
ATTORNEYS

April 29, 1952 O. A. CAUSEY 2,595,126

WELL-DRILLING MACHINE

Filed June 18, 1949 3 Sheets-Sheet 2

Fig. 3



Inventor

Otis A. Causey

By

Webster & Webster

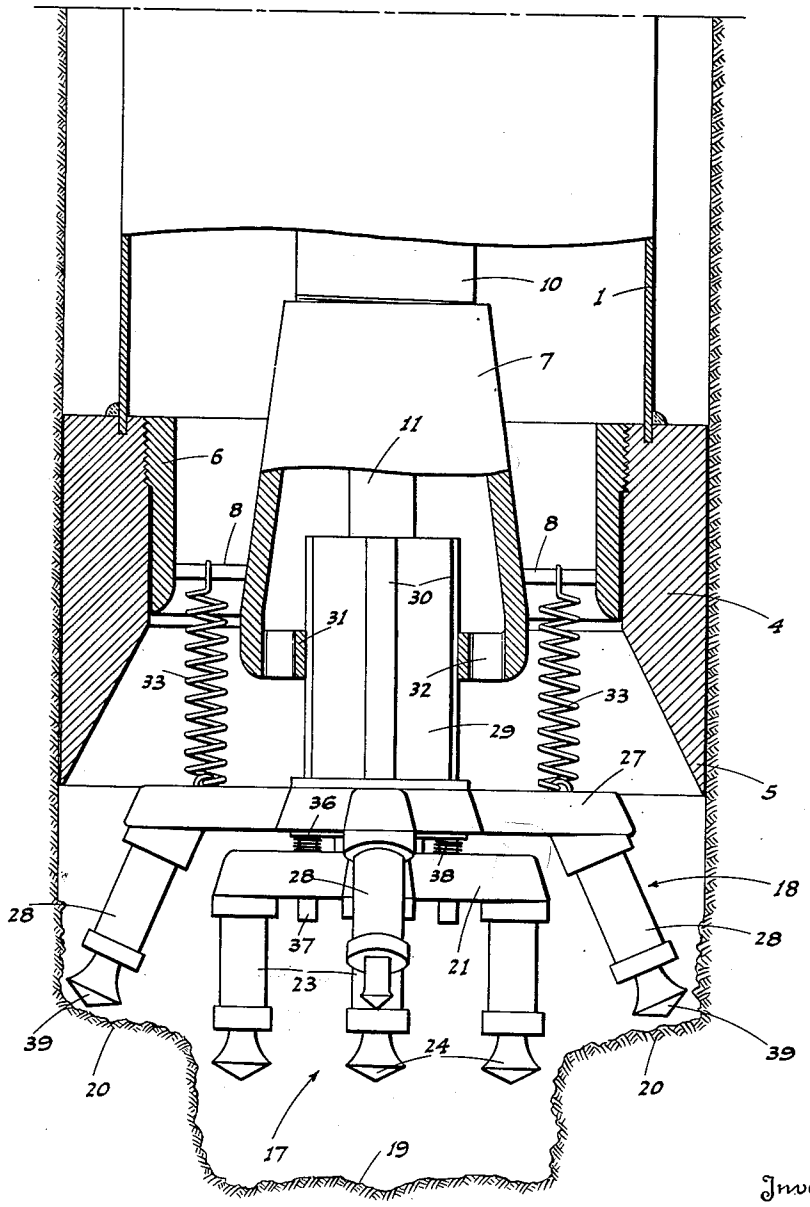
ATTORNEYS

April 29, 1952 O. A. CAUSEY 2,595,126

WELL-DRILLING MACHINE

Filed June 18, 1949 3 Sheets-Sheet 3

Fig. 4



Inventor

Otis A. Causey

By

ATTORNEYS

Patented Apr. 29, 1952

2,595,126

UNITED STATES PATENT OFFICE

2,595,126

WELL-DRILLING MACHINE

Otis A. Causey, Ceres, Calif., assignor of one-third to Leonard East, Modesto, Calif.

Application June 18, 1949, Serial No. 99,984

12 Claims. (Cl. 255—4.4)

1

This invention is directed to, and it is an object to provide, an improved well drilling machine; the latter including a novel assembly of pneumatically actuated drilling units.

Another object of the invention is to provide a well drilling machine as above wherein said assembly comprises relatively vertically adjustable inner and outer drilling units operative to cut or dig the central portion and edge or wall portion, respectively, of the well bore; such drilling units being so adjustable in order to permit one unit to first work ahead of the other and then retract for operation of the latter.

An additional object of the invention is to provide a well drilling machine in which each of the pneumatically actuated drilling units includes a novel arrangement of pneumatic jack hammers or chisels to accomplish the digging of the related portion of the well bore.

A further object of the invention is to provide a well drilling machine, of the type described, wherein the finely dug earth or rock is carried to the surface in a continuous flowing air stream of relatively great volume.

It is also an object of the invention to provide a well drilling machine which is fast and efficient in operation.

A still further object of the invention is to provide a practical and reliable well drilling machine, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is an exterior elevation of the well drilling machine, foreshortened.

Fig. 2 is an enlarged fragmentary sectional elevation of the assembly of drilling units, with the inner drilling unit in lowered working position.

Fig. 3 is a similar view, but shows said inner drilling unit in its raised or retracted position preparatory to use of the outer drilling unit.

Fig. 4 is similar to Fig. 3, but shows the outer drilling unit in use.

Referring now more particularly to the characters of reference on the drawings, the novel well drilling machine includes a sectional drill casing, indicated at 1; such casing having the sections thereof suitably detachably connected together by fittings; the uppermost one of which is indicated at 2.

At the lower end the drill casing 1 is fitted

2

with an assembly, indicated generally at 3, of pneumatically actuated drilling units, hereinafter described in greater detail.

At its lower end the drill casing 1 is affixed to an annular head 4, whose outside diameter is substantially the diameter of the well bore to be drilled; the lower portion of the annular head 4 being tapered, as at 5.

The upper portion of the annular head 4 has an insert ring 6 threaded thereinto, and such ring supports, in spaced centered relation therein, a vertically elongated bell 7; the connection between the insert ring 6 and bell 7 being circumferentially spaced cross pins 8.

At its upper end the elongated bell 7 is threadingly connected, as at 9, to the lower end of an outer air tube 10 of substantially lesser diameter than the drill casing 1; such outer air tube in turn surrounding an inner air tube 11, and the latter being relatively small compared to said tube 10. In other words there is substantial spacing radially between the drill casing 1 and outer air tube 10, and between the latter and the inner air tube 11. Additionally, the inner air tube 11 is rotatable and axially movable relative to the outer tube 10.

The tubes 10 and 11 extend full length of the drill string and project, at their upper ends, through and out of an outlet elbow 12 on the upper end of the drill casing 1. In turn, the inner air tube 11 projects through and above an elbow 13 on the upper end of the outer air tube 10.

The outer air tube 10 is connected, at its upper end, by the elbow 13, with a pipe 14 which leads from a constant high volume air supply. Similarly, the upper end of the inner air tube 11 is connected by means including an elbow 15 to an air hose 16 which supplies air at an extremely high pressure, but of lesser volume than supplied by the pipe 14. The elbow 15 includes a lift eye 16a for selective raising or lowering of the inner air tube 11, as is necessary during operation of the well drilling machine, as will hereinafter appear.

The drilling unit assembly 3 is mainly below the elongated bell 7 and comprises an inner drilling unit, indicated generally at 17, and an outer drilling unit, indicated generally at 18; the inner drilling unit being adapted to dig or drill a central portion 19 of the well bore, while the outer drilling unit 18 is adapted to dig or drill the edge or wall portion 20 of said bore.

The inner drilling unit 17 comprises a horizontal mounting spider 21 fixed centrally in con-

nection with the lower end of the inner air tube 11; such horizontal mounting spider 21 having passages 22 in the legs thereof which communicate between the bore of the inner air tube 11 and relatively small jack hammers 23 which are mounted in connection with, and project downwardly from, the outer ends of said legs. Each jack hammer 23 includes an earth working chisel 24.

The inner air tube 11 works through a guide 25 spider-mounted in the upper end portion of the elongated bell 7; there being a stop 26 on said inner air tube 11 above the guide 25 whereby to limit the extent to which the inner drilling unit 17 may be run downwardly or advanced, alone or in connection with the outer drilling unit 18, as will hereinafter appear.

The outer drilling unit 18 comprises a horizontal mounting spider 27 disposed above, and of greater diameter than, the mounting spider 21 of the inner drilling unit 17; such horizontal mounting spider 27 having relatively small jack hammers 28 secured to, and projecting downwardly from, the outer ends of the legs of such spider 27. If desired, the jack hammers angle outwardly slightly so as to work closer to the enclosed wall of the well bore.

The horizontal mounting spider 27 of the outer drilling unit 18 is supported by a central upstanding neck 29 which is splined, as at 30, for vertical sliding motion in a guide hub 31 fixed by circumferentially spaced webs 32 in the lower end of the bell 7.

The outer drilling unit 18 is normally maintained in its fully upwardly retracted position by tension springs 33 which connect between the legs of the mounting spider 27 and the cross pins 8.

The inner drilling unit 17, when in its fully upwardly retracted position, can be releasably locked to the outer drilling unit 18 by means of a lateral pin 34 on the inner air tube 11, adjacent but above the mounting spider 21, adapted to engage in a bayonet slot 35 cut in the mounting spider 27 and opening to the bottom thereof. This pin and bayonet slot lock is controlled from the surface by upward, followed by rotary, motion of the inner air tube 11.

When the pin 34 is engaged in a bayonet slot to lock the drilling units together, the air supply from the inner air tube 11 for the jack hammers 23 is cut off; this being accomplished by a depressible valve-control disc 36 slidable on the inner air tube 11 between the drilling units. When the inner drilling unit 17 is retracted, the disc 36 is engaged by the mounting spider 27 and forced downwardly, urging plunger valves 37, which intersect the passage 22, to closed position, as in Fig. 3, from an open position, as in Fig. 2. Springs 38 normally maintain the plunger valves 37 open.

The jack hammers 28 of the outer drilling unit 18 include earth working chisels 39 on their lower ends, and said jack hammers are adapted to receive air pressure from corresponding passages 40 in the neck 29 and legs of said mounting spider 27; said passages being adapted to communicate at their upper ends with a groove 41 in the inner air tube 11. There is a port (or ports) 42 into the bore of such tube from the groove 41.

The groove 41 is disposed on the inner tube 11, so that the passages 40 register therewith only when the inner air tube 11 is raised to a position to fully upwardly retract the inner drilling unit 17, and at which time the valve control disc 36 has closed the plunger valves 37.

In use of the above described well drilling machine, the drill casing 1 is suitably suspended for vertical motion, and the assembly 3 of the drilling units works into the ground in leading relation to the annular head 4 with its tapered lower edge 5.

For each limited length of drilling, the inner drilling unit 17 is first run downwardly, with the jack hammers 23 in operation, from a retracted position to a fully advanced position, thus digging the central portion 19 of the well bore; high air pressure, during such operation, being supplied to the inner drilling unit 17 through the inner air tube 11, with the outer drilling unit 18 then not operative by reason of the valve arrangement hereinbefore described.

After each central portion 19 of the well bore is dug, the inner drilling unit 17 is fully upwardly retracted by the inner air tube 11, whereupon the valves 37 are closed and the passages 40 register with the groove 41 so that the air pressure from the inner air tube 11 delivers through said passages 40 to the jack hammers 28 of the outer drilling unit 18.

With the inner drilling unit 17 locked to the outer drilling unit 18 by the described pin and bayonet slot arrangement identified by the numerals 34 and 35, the inner air tube 11 is slowly run downwardly, advancing the outer drilling unit 18, as in Fig. 4, to the end that the edge or wall portion 20 of the well bore is effectively dug to the depth of the previously dug central portion 19. Such motion is against the tension of the pull-up springs 33, and is guided by the splined neck 29.

For each section of the well bore which is dug, the above described operation is repeated.

During all of the drilling or digging operations a constant, relatively high volume of air flows downwardly in the outer air tube 10, through the elongated bell 7, about the assembly 3 of the drilling units, and thence escapes upwardly in the drill casing 1, carrying with it earth or rock which has been reduced to small particles by the drilling action. In this way the bottom of the well bore is continuously cleaned or evacuated; the material carried upwardly in the air stream in the drill casing 1 discharging from the outlet elbow 12, or being carried off in a suitable conduit (not shown) connected thereto.

The above described well drilling machine works fast and effectively, and provides a very practical and reliable apparatus for the digging or drilling of wells.

From the foregoing description it will be readily seen that there has been produced such a well drilling machine as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A well drilling machine comprising a drill casing, an air pressure supply tube depending in the drill casing to adjacent the lower end of the latter, and a pneumatically actuated drilling assembly mounted adjacent the lower end of the drill casing in communication with said air pressure supply tube; said drill assembly including a pair of vertically movable drilling units movable relative to each other, one being adapted to work

a central portion and the other an edge portion of the well bore, the air pressure supply tube being vertically movable, said one drilling unit being mounted on the lower end of the tube for downward movement thereby from an upwardly retracted position, and means to releasably lock the other drilling unit to said one drilling unit for simultaneous movement of said units downward from an upwardly retracted position.

2. A well drilling machine, as in claim 1, in which the tube and said one drilling unit are turnable relative to the other drilling unit, said locking means being a pin and bayonet slot connection between said units operative upon predetermined upward motion followed by part-circle rotation of the tube and said one unit.

3. A well drilling machine comprising a drill casing, an air pressure supply tube depending in the drill casing to adjacent the lower end of the latter, a pair of independently vertically movable pneumatically actuated drilling units mounted adjacent the lower end of said drill casing, one drilling unit being mounted on the lower end of the tube in communication therewith and for downward motion thereby from an upwardly retracted position, means supporting the other drilling unit from the casing and yieldably urging said other unit to a normally upwardly retracted position, means controllable from the top of the machine operative to lock said other drilling unit to said one unit for conjoint downward motion therewith, and passage means to supply air pressure from the tube to said other unit when said units are locked together.

4. A well drilling machine comprising a drill casing, an air pressure supply tube depending in the drill casing to adjacent the lower end of the latter, a pair of independently vertically movable pneumatically actuated drilling units mounted adjacent the lower end of said drill casing, one drilling unit being mounted on the lower end of the tube in communication therewith and for downward motion thereby from an upwardly retracted position, means supporting the other drilling unit from the casing and yieldably urging said other unit to a normally upwardly retracted position, means controllable from the top of the machine operative to lock said other drilling unit to said one unit for conjoint downward motion therewith, and passage means to supply air pressure from the tube to said other unit; there being valve means between the tube and the other drilling unit operative to permit air pressure to flow from the tube to said other drilling unit only when locked to said one unit.

5. A well drilling machine comprising a drill casing, an air pressure supply tube depending in the drill casing to adjacent the lower end of the latter, a pair of independently vertically movable pneumatically actuated drilling units mounted adjacent the lower end of said drill casing, one drilling unit being mounted on the lower end of the tube in communication therewith and for downward motion thereby from an upwardly retracted position, means supporting the other drilling unit from the casing and yieldably urging said other unit to a normally upwardly retracted position, means controllable from the top of the machine operative to lock said other drilling unit to said one unit for conjoint downward motion therewith, passage means to supply air pressure from the tube to said other unit when the units are locked together; passage means from the air supply tube to the one drilling unit, normally open valve means in said last named passage means, and means to close said valve means upon movement of said one drilling unit to a locked position with the other unit.

6. A well drilling machine comprising a drill casing having an annular head on its lower end, an air flow supply tube depending centrally in spaced relation in the drill casing, means securing the air flow supply tube in connection with the annular head without materially affecting air flow downward from said tube and thence upward between the latter and the drill casing, an air pressure supply tube depending centrally in spaced relation in the air flow supply tube and terminating adjacent said annular head, and a pneumatically actuated drilling assembly mounted adjacent said annular head; the drilling assembly including one drilling unit mounted on and movable with the air pressure supply tube in communication therewith, another drilling unit mounted in connection with the annular head for downward motion from a normally upwardly retracted position, the air pressure supply tube being vertically movable and rotatable in a horizontal plane, and means to releasably lock said units together for conjoint downward motion, there being passage means then establishing communication between the air pressure supply tube and said other unit.

7. A well drilling machine comprising a drill casing having an annular head on its lower end, an air flow supply tube depending centrally in spaced relation in the drill casing, a bell secured on the lower end of the air supply tube, an insert ring in the annular head spaced from the bell, circumferentially spaced connection elements between the insert ring and bell, a vertically movable air pressure supply tube depending centrally in the air flow supply tube and projecting through the bell, one pneumatically actuated drilling unit mounted on the lower end of the air pressure supply tube in communication therewith and for downward motion thereby from an upwardly retracted position, another pneumatically actuated drilling unit mounted in connection with the annular head for downward motion from a normally upwardly retracted position, means to releasably connect said units together for conjoint downward motion, and passage means to feed air pressure to said other unit from said air pressure supply tube.

8. A well drilling machine comprising a drill casing having an annular head on its lower end, an air flow supply tube depending centrally in spaced relation in the drill casing, a bell secured on the lower end of the air supply tube, an insert ring in the annular head spaced from the bell, circumferentially spaced connection elements between the insert ring and bell, a vertically movable air pressure supply tube depending centrally in the air flow supply tube and projecting through the bell, one pneumatically actuated drilling unit mounted on the lower end of the air pressure supply tube in communication therewith and for downward motion thereby from an upwardly retracted position, another pneumatically actuated drilling unit in generally surrounding relation to said one unit, an upstanding neck on said other unit, means spline-connecting the neck to the bell without materially restricting air flow therethrough, the air pressure supply tube being relatively slidable through said neck, spring means yieldably urging said other unit to an upwardly retracted position, the air pressure sup-

ply tube being vertically movable and rotatable in a horizontal plane, means to releasably lock said units together for conjoint downward motion, and passage means arranged to establish communication between the air pressure supply tube and said other unit when the units are so locked together.

9. A well drilling machine, as in claim 8, including a normally open valve assembly between said air pressure supply tube and said one unit; said valve assembly being automatically closed when the units are locked together.

10. A well drilling machine comprising a drill casing, an air pressure supply tube depending in the drill casing to adjacent the lower end of the latter, a pair of pneumatically actuated drilling units each including a spider mount having jack hammers depending from the legs thereof, one mount being below the other and the jack hammers of the separate mounts being radially spaced, said one mount being fixed to the lower end of the tube and the latter projecting through the other mount, said other mount being secured in connection with the casing for downward motion from a spring-urged, normally upwardly retracted position, the tube being vertically movable relative to the drill casing and independently rotatable, passage means to feed air pressure from the tube to the jack hammers on said mounts, and means to releasably lock said mounts together for conjoint downward motion of the units upon predetermined relative movement of the tube.

11. A well drilling machine comprising a drill casing, a vertically movable member depending into the casing to adjacent its lower end, a pneumatic drill assembly on the lower end of the member to work the central portion of the well bore, another pneumatic drill assembly to work the edge portion of the well bore, means supporting said other assembly from the casing for

lowering movement relative thereto from a normally raised position, releasable means to lock the assemblies together for conjoint raising and lowering movement, means to supply air to said other assembly only when the assemblies are thus locked together, and means included in part with the first named air supply means to supply air to the first named assembly only when the latter is unlocked from said other assembly and is lowered relative thereto.

12. A well drilling machine comprising a drill casing having an annular head on its lower end, an air flow supply tube depending centrally in spaced relation in the drill casing, means securing the air flow supply tube in connection with the annular head without materially effecting air flow downward from said tube and thence upward between the latter and the drill casing, said securing means including a bell on the lower end of the air flow supply tube, and circumferentially spaced connection elements between said last named tube and the annular head, an air pressure supply tube depending centrally in spaced relation in the air flow supply tube and terminating adjacent said annular head, and a pneumatically actuated drilling assembly mounted adjacent said annular head in communication with said air pressure supply tube.

OTIS A. CAUSEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
899,729	Hardsocg	Sept. 29, 1908
1,287,477	Simpson	Dec. 10, 1918
1,461,713	Gilman et al.	July 10, 1923
1,612,338	Wilson et al.	Dec. 28, 1926
2,033,527	Kitching	Mar. 10, 1936