

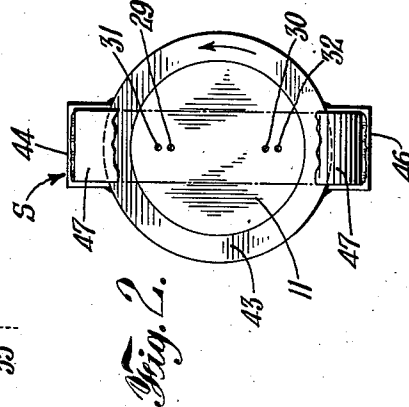
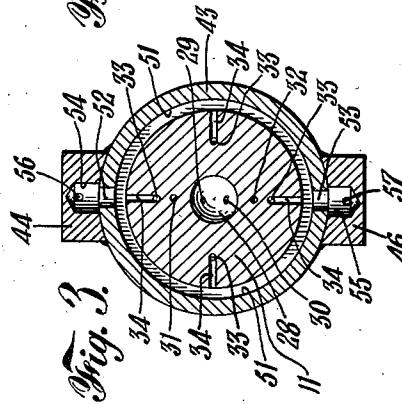
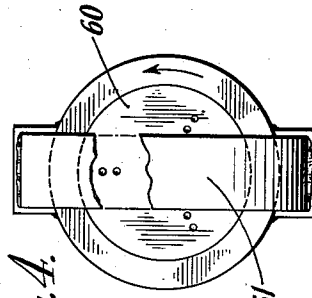
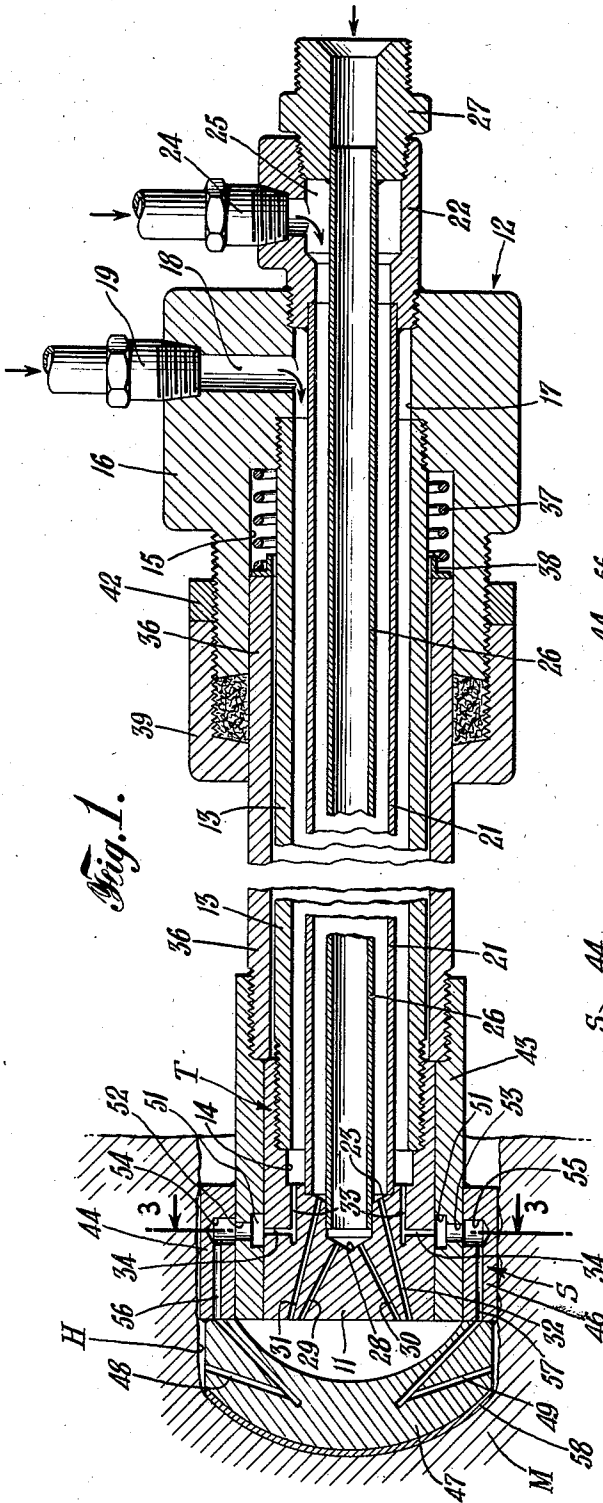
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J. R. CRAIG

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BLOWTORCH

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INVENTOR
JAMES R. CRAIG
BY *Feinewald*
ATTORNEY

UNITED STATES PATENT OFFICE

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BLOWTORCH

James R. Craig, Ben Avon, Pa., assignor to The
Linde Air Products Company, a corporation
of Ohio

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12 Claims. (Cl. 255-1.8)

This invention relates to a novel blowtorch especially suitable for thermally piercing holes in semi-spallable rock, such as granite. More particularly, the invention relates to such a blowtorch which is adapted for automatic operation.

Some mineral materials are characterized by a predominant tendency to spall in response to heat, but have a minor proportion of constituents which are loosened only partially from the mass, thereafter tending to melt and adhere to the mass being worked. When an attempt is made to pierce a hole in such a mineral material by ordinary thermal methods, fused particles of partially loosened material may accumulate in the hole and eventually form a plug of slag preventing the advance of the blowtorch to deepen the hole. Examples of mineral materials exhibiting this phenomenon are granite, dolomite, and some sand stones having a small proportion of iron impurities.

In application Serial No. 389,116, filed April 18, 1941, by Charles J. Burch, there is disclosed and claimed a novel method of piercing holes in semi-spallable material by mechanically scraping the partially loosened particles from the forward face of the hole, while an oxy-acetylene flame is played against the forward face and the blowtorch is advanced to deepen the hole. The blowtorches disclosed in that application for performing the method require manipulation by an operator for scraping free the partially loosened particles.

The principal object of the present invention is to provide a blowtorch adapted to be automatically operated for piercing holes in semi-spallable rock. Another object is the provision of a rock piercing blowtorch having means for scraping the forward face of a hole, which means may be actuated automatically without materially interfering with the flame. Still another object is the provision of a blowtorch having a scraper member which may be rotated relatively to a flame-providing member. Still other objects are the provision of a blowtorch having a rotatable scraper for scraping the forward face of a hole, and means for introducing a cooling fluid into heat-transfer relation with the scraper, and for discharging the fluid into the hole for the ejection of detritus.

The above and other objects, and the novel features of the invention, will become apparent from the following description, having reference to the annexed drawing, wherein:

Fig. 1 is a view in longitudinal mid-section of a blowtorch embodying the invention;

Fig. 2 is a front end elevational view, partly broken away, of the blowtorch of Fig. 1;

Fig. 3 is a sectional view taken along the line 3-3 of Fig. 1; and

Fig. 4 is a view looking at the front end of a modified blowtorch embodying the invention.

Generally, the blowtorch of the invention comprises an elongated tubular member T, having front and rear ends, which is adapted to provide a flame in advance of its front end for heating and disintegrating rock. A rotatable scraper member S, for scraping the forward face of a hole as piercing progresses, is associated with the tubular member T for rotation relatively thereto, and extends ahead of the front end of the latter. Preferably the scraper member S extends diametrically across the front end of the member T in longitudinally spaced relation thereto, for the least interference with the flame during rotation.

The terms "oxygen" and "acetylene" will be used hereinafter, for simplicity, to denote any suitable combustion supporting gas and any suitable fuel gas, respectively.

More specifically, the tubular heat-producing member T comprises a cylindrical tip 11 at the forward end of the blowtorch, composed of copper or other heat-resistant metal, and a rear body 12 connected to the tip 11 by a plurality of conduits. A conduit 13, which conducts fluid for cooling the blowtorch and for ejecting detritus from a hole, for example water or air, is threaded at its forward end into a counter-bore 14 in the tip 11. At its rear end the conduit 13 passes through a counterbore 15 in the front block 16 of the rear body 12 and is threaded into a bore 17. Fluid is supplied to the bore 17 and thence to the conduit 13 through a radial inlet passage 18 in the block 16, in which a hose connection nipple 19 is threaded.

A second conduit 21, arranged concentrically within the conduit 13, is soldered or otherwise secured at its rear end to a small tubular header block 22 threaded into the rear end of the bore 17. The conduit 21 fits at its front end gas-tightly into a counterbore 23 in the tip 11. Gaseous oxygen is supplied to the conduit 21 from a hose-connection nipple 24 threaded into a radial inlet passage opening into the bore 25 in the header block 22.

A third tube 26, for acetylene gas, is arranged concentrically within the conduit 21 and is soldered or otherwise secured at its rear end to a hose connection nipple 27 threaded into the rear end of the bore 25. At its front end, the tube 26

fits gas-tightly into a central bore 28 in the tip 11.

The acetylene gas entering through the nipple 27 passes by way of the central conduit 26 into the bore 28, and is then discharged from the tip 11 through two ducts 29 and 30 diverging forwardly from the longitudinal axis of the tubular member T and from one another. The ducts 29 and 30 have outlets in the front face of the tip 11 at diametrically opposite localities offset from the center of the tip.

Gaseous oxygen from the header block 22 passes forwardly through the conduit 21 into the counterbore 23, from which it is then discharged from the tip 11 through two diametrically opposite oxygen ducts 31 and 32 diverging forwardly from the longitudinal axis of the tubular member T and converging slightly each toward a different one of the passages 29 and 30. The oxygen ducts 31 and 32 have outlets in the front end of the tip 11 close to the outlets of the ducts 29 and 30, but spaced a greater distance from the center of the tip. Each separately discharged stream of acetylene intermixes externally of the tip 11 with the corresponding stream of oxygen to provide a combustible gas mixture which, on ignition, forms a flame of the diffusion type offset from the center of the tip.

Water or compressed air, for cooling the blowtorch and for ejecting detritus from a hole being pierced, is conducted through the conduit 13 to the counterbore 14 in the tip 11. The fluid is then distributed to four circumferentially spaced longitudinally extending ducts 33 in the tip 11. This fluid then may be conducted to the scraper members, to be described more in detail hereinafter, through radial ducts 34 extending from near the forward ends of the ducts 33 to outlets in the outside cylindrical surface of the tip 11.

The scraper member S comprises a multipiece sleeve mounted concentrically over the tubular member T for rotation relatively thereto, and a scraper carried by the sleeve near its forward end. A first sleeve member 36, which is journalled at its rear end for rotation in the bore 15 in the block 16, is urged at its front end into contact with the rear face of the tip 11 by a coil spring 37 in the bore 15 bearing on a flanged thrust washer 38, which in turn bears against the rear end of the sleeve member 36. An annular gland nut 39, mounted on the sleeve member 36, is threaded over the front end of the block 16 and retains packing material in contact with the sleeve member 36 and the block 16. The gland nut 39 may be locked in position by a lock nut 42.

A second sleeve member 43 is threaded over the front end of the sleeve member 36, and is sleeved over the outside surface of the tip 11 with just enough clearance for free rotation of the sleeve with respect to the tip.

The second sleeve member 43 carries near its forward end two diametrically opposite welded-on metal blocks 44 and 46 for the support of a scraper. The scraper 47 is an arcuate piece of steel, or other suitable strong and heat-resistant metal, which is arranged with its convex edge to the front and is welded at its opposite ends to the blocks 44 and 46. The scraper 47 thus extends diametrically across, and bridges with its concave edge, the front end of the tip 11 in longitudinally spaced relation thereto. It is advantageous for the scraper 47 to be no wider than the space between the two diametrically opposite flames formed by ignition of the gases discharged from the two sets of ducts 29, 31 and 30, 32. It is thus

assured that the flames for heating the rock will avoid impingement against the scraper 47 during rotation of the latter, except during the brief interval during which the scraper is directly in front of the outlets of the gas discharge ducts.

The scraper 47 is provided with two V-shaped passages 48 and 49, for cooling and detritus-ejection fluid such as air or water, having outlets in the sides of the scraper. The second sleeve member 43 has an annular internal recess 51 which registers with the radial passages or ducts 34 in the tip 11 for distributing fluid to two radial passages 52 and 53 in the sleeve member connecting the annular recess 51 with two corresponding radial passages 54 and 55 in the blocks 44 and 46, respectively. The block 44 has a longitudinally extending duct 56 for conducting fluid from the radial passage 54 to the forwardly and inwardly extending leg of the V-shaped passage 48. The fluid thus is conducted for some distance into the scraper 47 to the apex of the V, before it is discharged from the scraper through the rearwardly inclined other leg in a rearwardly directed stream. Similarly, the forwardly and inwardly extending leg of the V-shaped passage 49 is supplied with fluid from the radial passage 55 through a longitudinal passage 57 in the block 46. Fluid then flows to the rearwardly inclined other leg of the V-shaped passage 49 and is discharged from the side wall of the scraper in a generally rearwardly directed stream.

In the operation of the blowtorch which has been described above, the two diffusion type flames from the front of the tubular heat-producing member T of the blowtorch impinge against the forward face of a hole H being pierced in a mass M of mineral material and cause the material to spall off and be ejected from the hole under the action of the gaseous products of combustion, and of the fluid streams discharged from the sides of the scraper 47. The scraper member S is concurrently and continuously rotated, so that the scraper 47 wipes over the forward face of the hole and scrapes free any clinging particles of material which might fuse and prevent the advance of the blowtorch. The scraper 47 interferes only slightly with the action of the flames because its arcuate shape permits it to bridge the front end of the blowtorch. Moreover, the scraper 47 is sufficiently narrow that the flames impinge against the scraper only when it is directly in front of the outlets of the acetylene and oxygen discharge ducts. Excessive wear of the scraper 47 in such abrasive service may be prevented if the convex front face of the scraper comprises a fusion-deposited layer 58 of a hard and abrasion-resisting material, such as the cobalt-chromium-tungsten alloy known as "Haynes Stellite" alloy.

Automatic operation of the blowtorch of the invention is obtainable when it is employed with a motor-operated rotating and advancing mechanism of the type shown in application Serial No. 368,283 filed December 3, 1940, by Charles J. Burch. The mechanism shown therein is constructed to grip the sleeve member 36 of the rotating scraper member S and cause it to rotate on the tubular member T while the blowtorch is advanced progressively into the mineral material.

In the modification shown in Fig. 4, three discharge ducts for the acetylene and three corresponding ducts for the oxygen are provided in the tip 60, the outlets of the several ducts being arranged at the apices of triangles, preferably equilateral triangles. With this arrangement, the scraper 61 cannot interfere with more than

two of the three flames at any one moment, a third flame always avoiding impingement against the scraper and assuring continuity of heating of the rock. Even when only two flames are projected from a blowtorch tip, if one of the flames is offset from that diameter of the front end of the tip which passes through the other flame, there will always be one flame avoiding impingement against the scraper. This is contingent, of course, upon the spacing of the two flames from one another by a distance greater than the width of the scraper.

What is claimed is:

1. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame in advance of said front end; and means associated with said tubular member and extending ahead of said front end for scraping the forward face of such hole as piercing progresses, said means being rotatable with respect to said tubular member.

2. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame in advance of said front end; and means associated with said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means comprising a scraper extending across the front end of said tubular member in spaced relation thereto.

3. A blowtorch comprising, an elongated tubular member having front and rear ends, said member being adapted to provide a flame in advance of said front end; a sleeve sleeved over said tubular member and rotatable relatively thereto; and a scraper carried by said sleeve and rotatable therewith, said scraper bridging the front end of said tubular member.

4. A blowtorch comprising an elongated tubular member having front and rear ends, said member being adapted to provide one or more flames at localities ahead of said front end and offset from the center thereof; a sleeve sleeved over said tubular member and rotatable relatively thereto; and a narrow scraper carried by said sleeve and rotatable therewith, said scraper extending diametrically across the front end of said tubular member and bridging said front end.

5. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame ahead of said front end; means associated with said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means comprising a scraper extending diametrically across the front end of said tubular member and bridging said front end; said scraper having passage means for conducting cooling fluid and for discharging fluid into such hole; and means for supplying fluid to said passage means.

6. A blowtorch comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame ahead of said front end; a sleeve member sleeved over said tubular member and rotatable relatively thereto; a narrow scraper carried by said sleeve member and rotatable therewith, said scraper extending diametrically across the front end of said sleeve and bridging said front end of said

tubular member; said scraper having a passage for the circulation and discharge of fluid; said sleeve member having a passage connected to the passage in said scraper; said tubular member having a passage for supplying fluid to the passage in said sleeve member; and one of said members having an annular recess forming with the other of said members an annular distributing chamber connecting together the passage in said tubular member and the passage in said sleeve member.

7. A blowtorch comprising an elongated tubular member having front and rear ends; said tubular member having a plurality of passages therein having openings in said front end offset from the center thereof for discharging fuel gas; said tubular member having a plurality of passages therein having openings in said front end adjacent to said first-named openings for separately discharging combustion-supporting gas to mix with said fuel gas externally of said tubular member and form a combustible gas mixture providing on ignition flames of the diffusion type; a sleeve sleeved over said tubular member and rotatable relatively thereto; and a narrow scraper carried by said sleeve and rotatable therewith, said scraper having an arcuate front face, and said scraper extending diametrically across the front end of said sleeve and bridging said front end of said tubular member.

8. A blowtorch comprising a tip having passage means for the discharge of gas to provide a flame ahead of said tip; a rear body; conduit means connecting together said tip and said rear body for conducting gas to said passage means; said rear body having inlet means for supplying gas to said conduit means; a sleeve sleeved over said conduit means and supported by said tip for rotation relatively thereto, said sleeve being journaled at its rear end in said rear body; and a scraper carried by said sleeve and extending across the front of said tip in spaced relation thereto.

9. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide at least two flames in advance of said front end, one of said flames being offset from that diameter of said front end passing through the other flame; and means associated with said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means comprising a scraper extending diametrically across the front end of said tubular member, the width of said scraper being less than the distance between said flames.

10. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame in advance of said front end; and means associated with said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means comprising a scraper extending across the front end of said tubular member in spaced relation thereto, said scraper having a front face comprising a fusion-deposited layer of a hard and abrasion-resistant material.

11. A blowpipe suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said member being adapted to provide a flame in advance of said front end; means associated with

said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means including a scraper extending diametrically across the front end of said tubular member and bridging said front end; said means having passage means for discharging fluid into such hole to remove detritus therefrom; and means for supplying fluid to said passage means.

12. A blowtorch suitable for piercing a hole in a rock or the like, comprising an elongated tubular member having front and rear ends, said

member being adapted to provide three flames in advance of said front end arranged at the apices of a triangle; and means associated with said tubular member and rotatable relatively thereto for scraping the forward face of such hole as piercing progresses, said means comprising a scraper extending diametrically across the front end of said tubular member, the width of said scraper being less than the distance between
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10 said flames.

JAMES R. CRAIG.