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(54) **Improvements in and relating to torches**

(57) A portable gas hand torch igniter and burner assembly of the piezoelectric type to be assembled onto a portable gas cylinder includes a handgrip housing body 11 having an internal gas conduit 11*a* to 11*b* and an elongate burn tube 17 having a venturi portion 16 at its inlet end and an end-tapered orifice cylinder 13 removably mounted in the venturi portion. A regulator valve 31*a* maintains a substantially constant gas pressure at the inlet portion 11*d* of the gas conduit and a control valve 31 associated with a push button 34 normally closes the conduit against passage of gas to the burn tube 17. A piezoelectric igniter 33 in the body 11 is actuated by depression of the push button 34 to open the control valve 31 to admit gas to the burn tube and generate a spark-producing voltage a predetermined short interval after opening of the control valve to produce a spark within the burn tube 17.

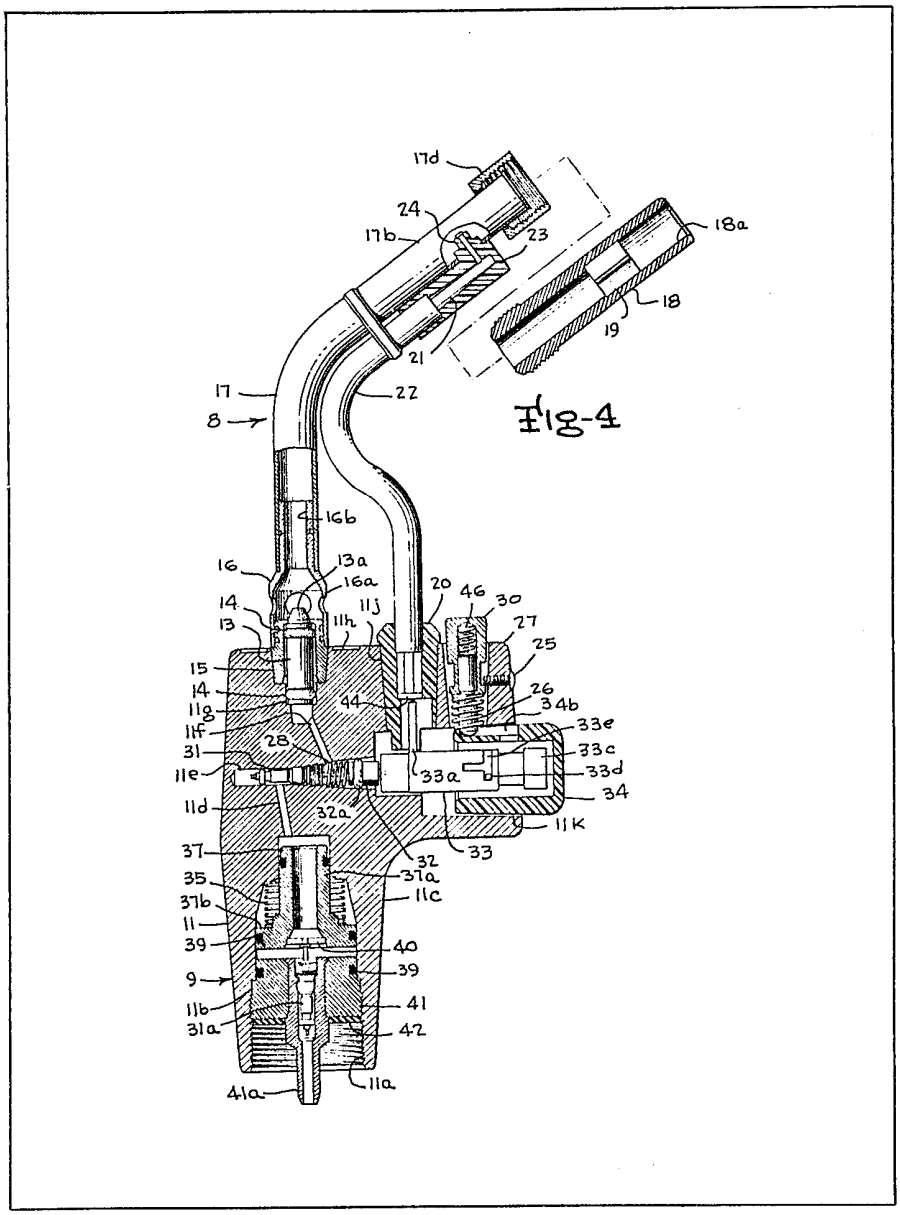

Fig-4

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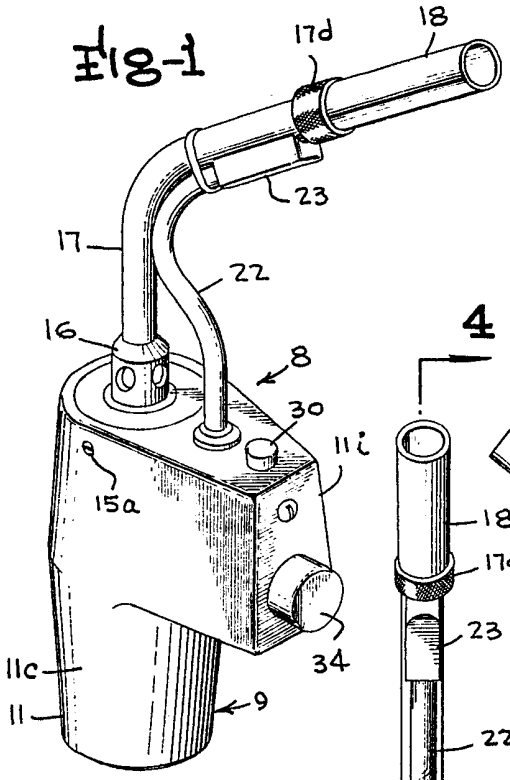
Fig-1



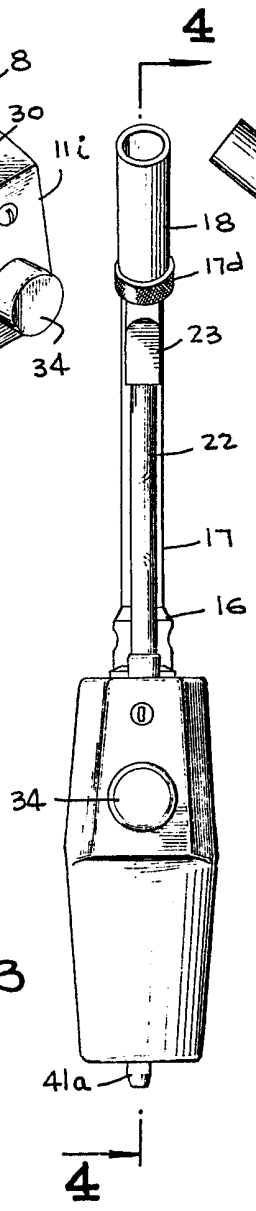


Fig-3

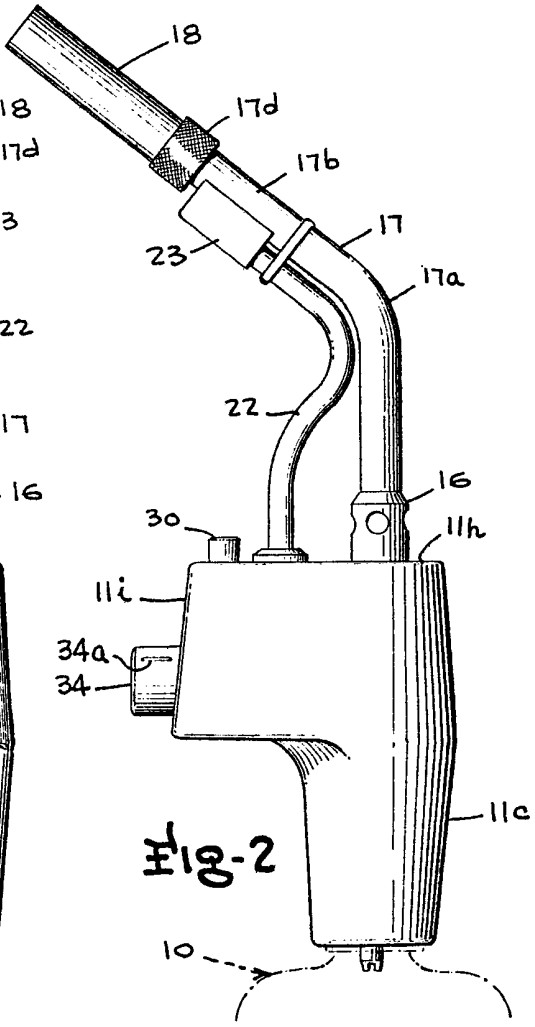


Fig-2

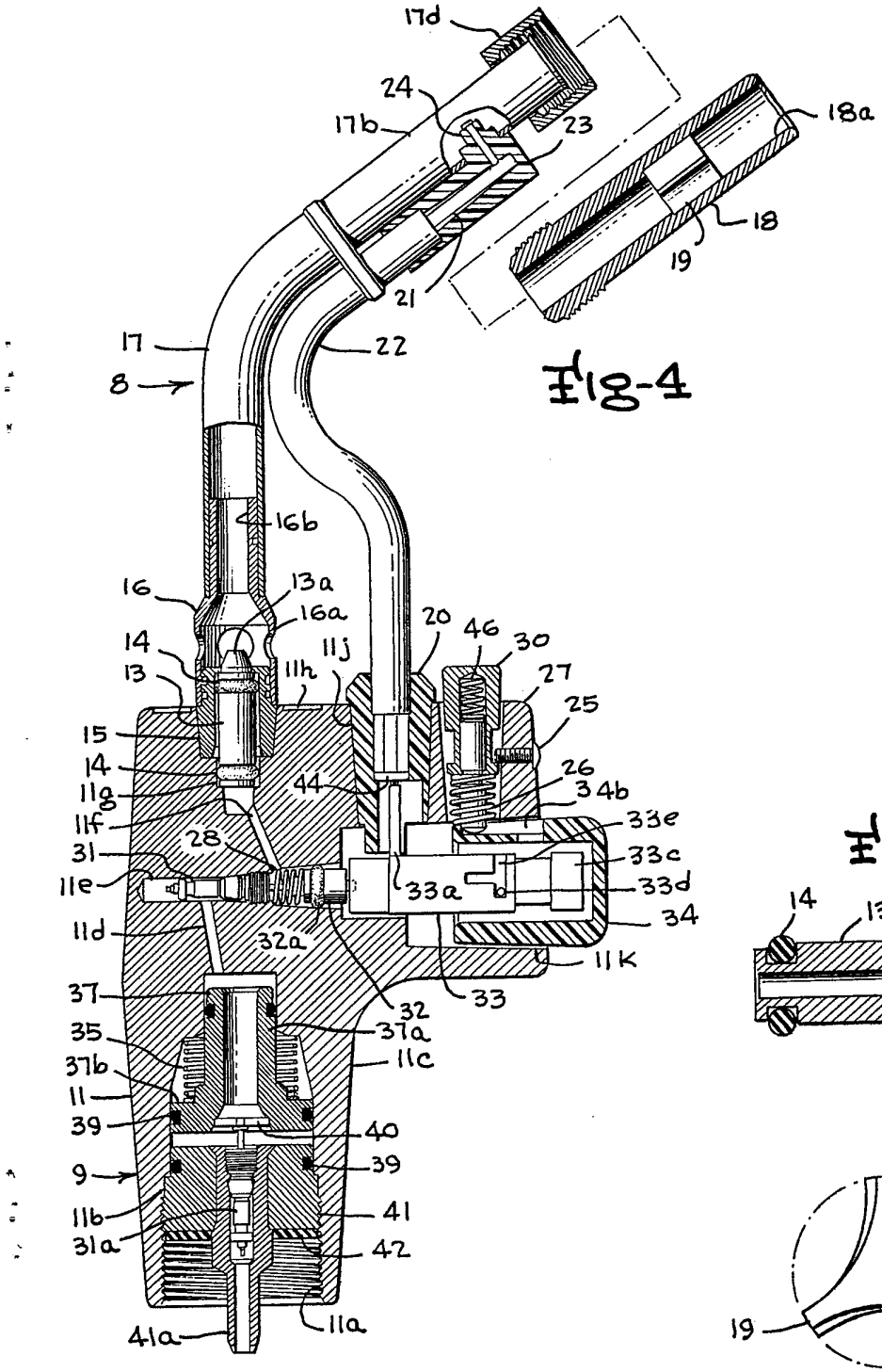


Fig-4

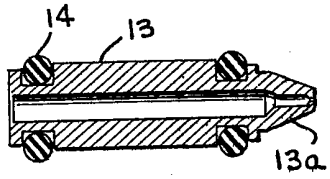
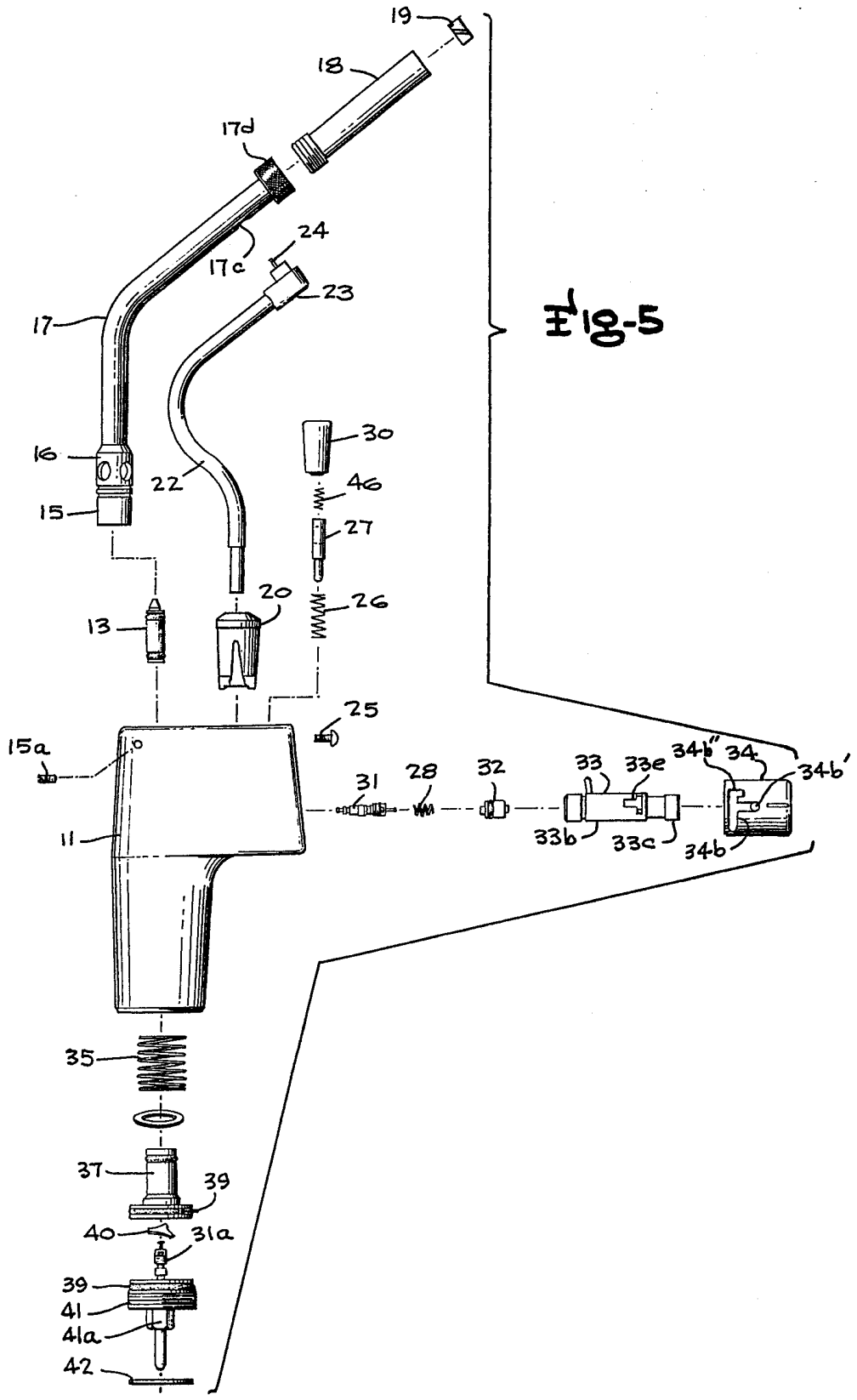


Fig-6

Fig-7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17d
17c
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13
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15a
11
31
28
32
33
33e
34b"
34
34b'
33b
33c
34b
35
37
39
40
31a
39
41
41a
42

Fig-5

SPECIFICATION

Improvements in and relating to torches

The present invention relates to portable gas hand toches comprising piezoelectric igniters.

Piezoelectric spark-producing devices for use in igniting combustible fuels such as propane gas and similar fuels which can be stored in portable containers have been known for a number of years. Such devices typically have a hammer which in operation is driven into impact with an anvil structure of a piezoelectric crystal assembly forming part of an electrical circuit having a spark gap. When the crystal is deformed by the hammer blow, a voltage is generated in the circuit of sufficient magnitude to create a spark across the spark gap in the circuit. Typical of such piezoelectric spark-producing devices are those shown in United States Patents No. 3,509,388 and No. 4,139,792 both assigned to Matsushita Electric Industrial Co., Ltd. In those devices, the hammer is actuated by moving a slidably finger-piece or plunger slidably supported in telescoping relation projecting into the outer housing, which during an initial portion of its inward stroke arms a spring while restraining the hammer against movement towards the crystal, and then suddenly releases the hammer to be driven by the spring into spark-generating impact with the crystal stack. Other mechanical arrangements have also been devised in piezoelectric-type spark-producing devices for driving the hammer into spark-generating impact with the crystal structure.

Other similar devices have been proposed, for example, in United States Patent No. 3,802,828, wherein the hammer is driven by a piston which responds to fluid pressure from the combustible fuel source, in a manner which ensures that the gaseous fuel has reached the combustion chamber portion of the burner by the time the hammer is allowed to strike the crystal and produce the spark for igniting the fuel in the burner.

The invention provides a portable gas hand torch igniter and burner assembly suitable for use mounted on a portable pressurised gas fuel cylinder, comprising a handgrip housing body having first and second cavities opening through opposite wall portions of the housing body and a gas conduit connecting the cavities, the first cavity forming an internally threaded gas inlet suitable for mounting on the neck of a fuel cylinder to mount the housing body rigidly thereon, an elongate burn tube having a venturi portion at its inlet end and an orifice cylinder with a tapered end removably mounted in the venturi portion, the venturi portion and orifice cylinder being removably supported in the second cavity to mount the burn tube rigidly on the housing body, a gas pressure regulator valve mechanism adjustably supported in the first cavity for maintaining a substantially constant predetermined gas supply pressure in an inlet portion of the gas conduit, a valve chamber intercepting the gas conduit having a control valve therein normally closing the conduit against passage of gas to the burn tube, a push button on the housing body supported for rectilinear inward movement along an axis intercepting the control valve from a normal outward position projecting from the housing body to open the control valve, piezoelectric igniter means in the housing body having a case portion movable along the said axis in response to inward depression of the push button and having a plunger portion movable relative to its case portion in response to such push button depression to activate the igniter to generate a spark-producing voltage a predetermined short interval after the opening of the control valve and electrode means extending from the igniter to a location within the burn tube near its exit end forming a spark gap with the burn tube for igniting the gas admitted thereto upon opening of said control valve.

Advantageously, there is provided a novel portable finger-activated gas hand torch with a piezoelectric igniter, wherein the igniter is associated with a finger-operated control knob in a novel manner facilitating manufacture and reliable operation of the torch, and which provides improved safety features ensuring igniting of the gaseous fuel from the attached container and operation only while safely in the hands of the user maintaining the control knob in depressed condition by finger-pressure, thus ensuring automatic extinguishing of the torch if it is dropped or finger-pressure is released from the control knob for any reason.

Preferably, the action of the igniter and the valve controlling release of gaseous fuel to the combustion chamber of the burner tube reliably operate in a manner such that gaseous fuel reaches the combustion zone of the burner tube immediately prior to spark generation.

Advantageously, the torch is constructed in such manner that the torch may be used upside down or in any position without flare-out of flame or significant changes in flame pattern and wherein the control knob which in its ON position must be maintained depressed to continue the burning condition is spring biased in a direction to cause shutting off of the gas fuel supply so that the torch will not be accidentally maintained in burning condition when accidentally overturned or rolling on surfaces onto which it may be dropped.

One form of portable hand-held propane gas torch constructed in accordance with the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the torch;

Figure 2 is a side elevation view of the torch;

Figure 3 is a front elevation view of the torch;

Figure 4 is a side elevation view, largely in section along the line 4—4 of Figure 3, to a larger scale than Figure 3;

Figure 5 is an exploded elevation view of the torch;

Figure 6 is a longitudinal section view of an orifice member of the torch; and

Figure 7 is an end elevation view of a helix member of the torch.

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, a portable propane gas hand torch is indicated generally by the reference numeral 8, and is generally made up of a handgrip control head and burner tube assembly forming the upper portion thereof as seen in Figure 2, indicated generally by the reference numeral 9, assembled onto a conventional liquefied propane tank or cylinder indicated generally by the reference numeral 10 in Figure 2. The control head and burner tube assembly 9 comprises a handgrip-shaped main body 11 having an internally threaded entrance portion 11*a* to a cavity 11*b* opening downwardly (as seen in Figure 4) through a lower handgrip shaped portion 11*c* of the body 11, to be threaded onto the conventional neck of the propane gas container or tank 10 to form a changeable tank assembly therewith. The body 11 is preferably a moulded metal body, and includes a plurality of interconnected passages and cavities, formed generally by a gas passage 11*d* communicating with the cavity 11*b* and with a manually activated control valve cavity 11*e*, which in turn communicates with a gaseous fuel passage 11*f* which extends to a main orifice housing cavity 11*g* opening through a surface 11*h* of an enlarged upper portion 11*i* of the body 11. The cavity 11*g* houses an orifice member 13 defining the exit orifice for the fuel from the container or tank 10, having, for example, the cross-sectional shape shown in Figure 6, providing a pair of external circumferential grooves concentric with the axis of the passage through the orifice member 13 in which are seated a pair of O-rings 14 to form seals about the exterior of the orifice member 13 in a smaller diameter lower portion of the cavity 11*g* and against the walls of a central bore of an orifice adapter member 15 which is releasably held by a screw 15*a* in the enlarged upper portion of the cavity 11*g* in the body 11. Mounted over the orifice adapter 15 is a shaped tubular venturi member 16 having a large diameter portion 16*a* encircling a truncated conical upper nozzle portion 13*a* of the orifice member 13 and with laterally facing openings therein as shown, and having a smaller diameter upper, substantially cylindrical portion 16*b* tightly fitted in the lower end portion of a burn tube 17 having a bend 17*a* near its mid-region and providing a straight exit end section 17*b* as shown apertured at 17*c* near the uppermost end thereof.

Removably held on the upper end portion 17*b* of the burn tube 17 by a threaded collar 17*d* is a tubular cylindrical burn tip 18 positioned with its downstream or inlet end tightly against the outlet end of the burn tube 17 and having a helix or flame divider structure 19 near the mid-region of its internal bore 18*a* of the cross-sectional configuration shown in Figure 7, to impart some helical swirl to the flame passing through the burn tip 18.

The enlarged upper portion 11*i* of the body 11 includes another upwardly opening, frusto-conical cavity 11*j*, communicating with an enlarged cavity portion 11*k* for a control knob, later described, joining with the valve chamber 11*e*, in which is tightly fitted an insulator 20. The insulator 20 houses and supports the lower end portion of a conduit 22 for an igniter wire 21. The wire 21 at the upper end of the curved conduit 22 extends into an electrode housing 23 of insulating material having an electrode 24 therein connected to and projecting at right angles from the upper end portion of the wire 21 and extending into an exposed position in the burner tube 17 near its outlet end as shown. The lower end of the wire 21 below the lower end of the conduit 22 within the bore of the insulator 20 is in electrical contact with a contact cap 44 which engages and is in electrical communication with an ignition electrode 33*a* of a piezoelectric igniter 33, which is advantageously an igniter having the construction shown in previously mentioned U.S. Patent No. 3,509,388 or No. 4,129,792.

Such a piezoelectric spark generating device or igniter 33 includes a stationary housing portion indicated at 33*b* (the left-hand portion of the igniter as shown in Figure 4) which houses a piezoelectric crystal stack and in which a finger-actuated slide plunger member 33c slides. A transverse pin 33*d* in a hammer portion rides in what appears as a substantially T-shaped slot 33*e* in Figure 4, projecting laterally from the hammer through a cam slot in one or both sides of the plunger 33*c*. The lower portion of the T-shaped slot 33*e* as seen in Figure 4, in which the pin is initially located, restrains the pin and thus the hammer against inward movement during initial inward movement of the plunger (to the left as seen in Figure 4) while a spring within the plunger is compressed. At a predetermined position during the inward or leftward stroke of the plunger, inclined surfaces of the cam slot in the side wall of the plunger drive the pin 33*d* upwardly to the horizontal portion of the T-slot 33*e*, releasing the hammer to strike against the crystal and produce a momentary high voltage which is conducted through the electrode 33*a* and the wire 21 to the electrode tip 24 within and near the discharge end of the burn tube 17. The inmost end, or left end portion as seen in Figure 4, of the piezoelectric spark igniter devices bears against an actuator 32 surrounded by an O-ring 32*a* to form a seal against the surrounding wall of the cavity in which the actuator resides, and the actuator bears against a spring 28 whose other end engages the plunger pin of a valve core 31 controlling the emission of gaseous fuel from the passage 11*d* to the passage 11*f* and into the region of the venturi formed at the outlet of the orifice device 13.

The plunger end portion of the igniter device 33 is surrounded by a rotatably adjustable and axially movable control knob 34 which projects from the right-hand end of the enlarged portion 11*i* of the body 11. The control knob 34 has an index mark 34*a* on its surface as seen in Figure 2 and is

rotatably adjustable about its axis between an OFF position, and ON position and a CLEAN position. In the ON position, a slot 34*b*, paralleling the central axis of the control knob and located in its periphery in upwardly facing position when the knob is in its ON position, aligns with the lower end portion of a lock button assembly formed of a vertically movable lock button 30 in a suitably shaped cavity in the body 11 projecting from the top of the body 11, and having a bore in which are seated a lock button spring 46 and a shaft 27 surrounded by a spring 26 compressed between the lower end of the lock button 30 and the top of the control knob 34. The lock button is normally restrained within its cavity with the lower end portion of the shaft 27 extending into the slot 34*b* by a lock button screw 25 threaded into the body 11.

A regulator valve and piston assembly is housed in the downwardly opening bottom cavity 11*b* of the body 11 and, as illustrated, comprises a regulator piston 37 having a substantially cylindrical smaller diameter upper portion which is movable axially within the uppermost portion of the cavity 11*b* substantially conforming in diameter to the smaller diameter piston portion, while the lower portion 37*b* of the regulator piston is of larger diameter and corresponds substantially to the diameter of the portion of cavity 11*b* in which it moves. O-rings 39 are provided in grooves in the regulator pistons 37*a* and 37*b* as shown to seal against the confronting wall portions of the cavity 11*b*. A central bore passes axially through the regulator piston 37, and is shaped at the lower end portion of the central bore to receive a spider-like contact plate 40 having, for example, three outwardly extending legs to engage in the shaped portions of the central passage through the regulator piston 37 in which it is seated, while its centre portion engages the plunger pin of a regulator valve core 31*a*. For example, a valve core such as the 5344 valve core made by Schrader Automotive Products Division of Scovill Manufacturing CO., of the type used with refrigerants such as R—12 and R—22, having an internal spring biasing the plunger pin to maintain the valve core resiliently in a closed condition, may be used for both valves 31 and 31*a*.

The regulator valve core 31*a* is threaded into and carried by a regulator valve body insert 41*a* carried within a regulator valve body member 41 as shown, and having a gasket 42 against the lower face thereof. The regulator valve body 41 has external threads for threading it into the internally threaded portion 11*a* of the cavity 11*b* and also has an O-ring 39 to form a seal near the upper end of regulator valve body member 41. After positioning of the regulator valve body member 41 and its associated valve body insert 41*a* within the cavity 11*b*, the lower end portion of the body 11 can then be assembled onto the threaded neck of the conventional propane container or tank with a gasket 42 forming a seal against the rim of the container neck and the regulator valve body insert 41*a* engaging and depressing the customary control valve pin internally incorporated in the container neck to open the internal propane container valve and allow the propane gas to flow through slot passages in the lower end portion of the valve body insert 41*a* communicating with the central bore of the insert to admit the propane gas to the regulator core 41. The pressure regulator assembly in the cavity 11*b* including the regulator core 41*a* with its plunger pin bearing against the centre portion of the contact plate 40 in the piston 37 which is spring-biased by the piston spring 35, is constructed so as to change the higher pressure in the propane cylinder or container to a lower pressure of approximately 36 ± 3 p.s.i. (2.5 ± 0.2 kg/cm^2) for operation of the torch.

When the control knob 34 is in the OFF position, the lower end portion of the spring-biased shaft 27 assembled with the lock button 30 lies in a portion of the control knob groove 34*b* which restrains the control knob in its outermost position, illustrated in Figure 4. When the control knob 34 is rotated to the ON position, the portion 34*b*′ of the control knob slot which extends parallel to the central axis of the control knob aligns with the lock button shaft 27, permitting the control knob to be depressed inwardly against the spring bias of the internal spring in the igniter 33 and against the bias of the actuator spring 28. Inward axial movement of the control knob 34 in the ON position moves the igniter 33, the actuator 32 and the plunger pin of the control valve core 31 just enough to release the propane gas for travel through the orifice 13*a* and burn tube 17 to the location of the electrode 24 before the piezo-crystal igniter 33 is depressed enough to produce the electric current for generating the spark. When the hammer of the piezoelectric igniter 33 is released by its pin 33*d* coming into alignment with its release slot, the impact of the hammer against the piezoelectric crystal portion produces an electric current that travels up through the wire 21 in the conduit 22 to the electrode 24 and jumps from the end of the electrode to the inside of the burn tube 17, causing a spark that ignites the gas.

The torch is designed to facilitate cleaning to remove any clogging of the orifice in a novel manner. If the orifice becomes blocked due to contamination, the burner tube 17 and the venturi structure 16 and the orifice adapter 15 can be removed by loosening the orifice adapter screw shown at 15*a*; the orifice member 13 can then be removed and reversed, and the burner tube, venturi and orifice adapter reassembled. The control knob 34 may then be shifted to the CLEAN position, wherein a short axial portion 34*b*″ of the slot 34*b* aligns with the lock button shaft 27 which will permit a slight amount of inward movement of the control knob 34, igniter 33 and actuator 32 sufficient to depress the plunger pin of valve core 31 and admit some gas pressure to the passage 11*f*, but the control knob stroke is insufficient to activate the igniter to produce a

spark. When the control knob is pressed to the extent allowed by the slot 34*b*" at the CLEAN position, gas pressure is admitted through the orifice member in the reverse direction to achieve cleaning of the orifice by the pressurised gas. The components can then be reassembled to the original positions to resume normal operation.

CLAIMS

1. A portable gas hand torch igniter and burner assembly suitable for use mounted on a portable pressurised gas fuel cylinder, comprising a handgrip housing body having first and second cavities opening through opposite wall portions of the housing body and a gas conduit connecting the cavities, the first cavity forming an internally threaded gas inlet suitable for mounting on the neck of a fuel cylinder to mount the housing body rigidly thereon, an elongate burn tube having a venturi portion at its inlet end and an orifice cylinder with a tapered end removably mounted in the venturi portion, the venturi portion and orifice cylinder being removably supported in the second cavity to mount the burn tube rigidly on the housing body, a gas pressure regulator valve mechanism adjustably supported in the first cavity for maintaining a substantially constant predetermined gas supply pressure in an inlet portion of the gas conduit, a valve chamber intercepting the gas conduit having a control valve therein normally closing the conduit against passage of gas to the burn tube, a push button on the housing body supported for rectilinear inward movement along an axis intercepting the control valve from a normal outward position projecting from the housing body to open the control valve, piezoelectric igniter means in the housing body having a case portion moveable along the said axis in response to inward depression of the push button and having a plunger portion movable relative to its case portion in response to such push button depression to activate the igniter to generate a spark-producing voltage a predetermined short interval after the opening of the control valve, and electrode means extending from the igniter to a location within the burn tube near its exit end forming a spark gap with the burn tube for igniting the gas admitted thereto upon opening of said control valve.

2. A portable gas hand torch assembly as claimed in claim 1, wherein the control valve and valve chamber are interposed between inlet and outlet conduit portions of the said conduit and include a valve member and a plunger pin movable along the movement axis of the push button and the igniter plunger portion to close and open gas communication between the two said conduit portions.

3. A portable gas hand torch assembly as claimed in claim 2, wherein the said movement axis of the push button and the plunger portion and the plunger pin intersects perpendicularly an axis through the said upper and lower cavities.

4. A portable gas hand torch assembly as claimed in any one of claims 1 to 3, wherein the push button is of hollow cup-shaped configuration open inward and receiving the plunger portion nested therein, the movable case portion of the igniter having a control valve actuator in abutment therewith for moving the control valve to the open position upon depression of the push button through a distance insufficient to activate the igniter to generate a spark.

5. A portable gas hand torch assembly as claimed in claim 4, comprising spring means between the control valve and the actuator biasing the actuator and the igniter and the push button toward the normal outward position of the push button.

6. A portable gas hand torch assembly as claimed in any one of claims 1 to 5, wherein the push button has a first axially elongate slot in a side thereof for receiving a limit pin formation therein in a first angular position of the push button permitting the push button to travel axially a sufficient distance from its normal position to open the control valve and activate the igniter to produce a spark, the push button having a second slot for shorter axial length paralleling the first slot for receiving the limit pin at a second angular position allowing the push button to travel axially a sufficient distance axially to open the control valve but not a sufficient distance to activate the igniter, and wherein the orifice cylinder is reversibly housed in the venturi portion of the burn tube enabling the orifice assembly to be removed and reinstalled in a reversal orientation, and wherein depression of the push button in the second angular position admits pressurised gas to the reversed orifice cylinder to dislodge debris without the igniter being activated.

7. A portable gas hand torch assembly as claimed in any one of claims 1 to 6, wherein the pressure regulator valve mechanism includes a spring biased piston member in the uppermost portion of the first cavity having a central through passage and an abutment therein and an externally threaded valve carrier threaded into the first cavity adjustable in angular position to vary force on a valve member actuator of the regulator valve by the abutment and to maintain selected source pressure levels in the inlet portion of the conduit.

8. A portable gas hand torch assembly substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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