

[54] PORTABLE DESOLDERING TOOL

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[58] Field of Search 15/341, 344; 228/20

[56] References Cited

UNITED STATES PATENTS

3,263,889	8/1966	Fortune	228/20
3,604,610	9/1971	Fortune	15/344 X

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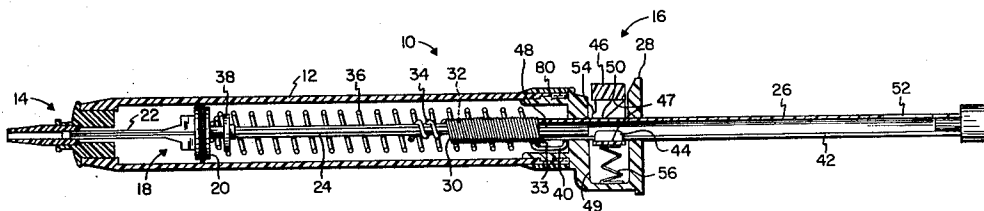
[57] ABSTRACT

A portable, hand operated vacuum stroke implement is disclosed which includes a hollow cylindrical pump body and a low inertia, spring loaded, trigger actuated

piston assembly contained therewithin.

A cocking plunger is carried by a journal fixture disposed at the rear of the pump body. The plunger may be axially forced into the pump body to urge the piston assembly to a forward, "loaded" disposition where it is retained by a trigger mechanism. Once the tool is thusly cocked, the plunger is returned by a separate return spring to its axially extended configuration whereby when the trigger is actuated and the piston flies back, there is no external manifestation thereof, thusly eliminating any danger to the user and minimizing the recoil during the flyback, vacuum stroke. The trigger mechanism also is of the character to retain, when desired for storage or shipping, the cocking plunger within the pump body. A nozzle element is frictionally fitted to the forward end of the pump body and may be removed, for cleaning or replacement, by inserting further, in cooperation with the trigger mechanism the cocking plunger into the pump body. A reading of the complete specification is recommended for a full understanding of the principles and features of the tool.

6 Claims, 4 Drawing Figures



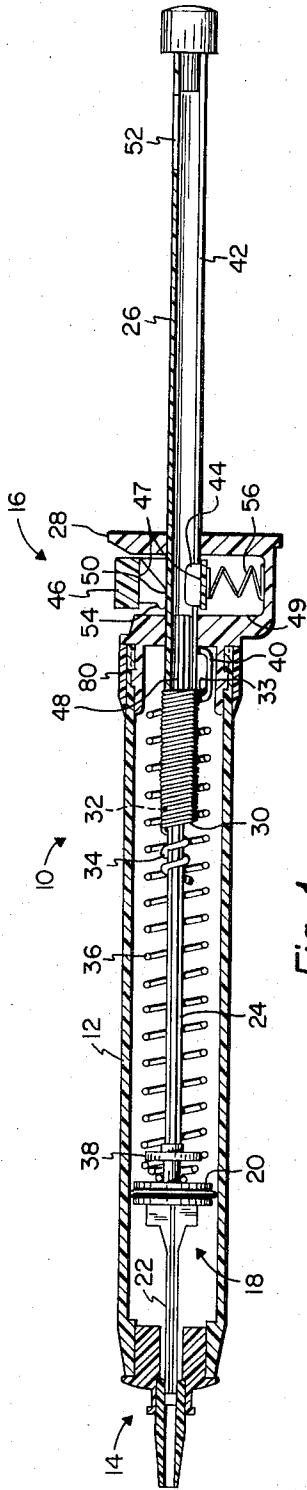


Fig. 1

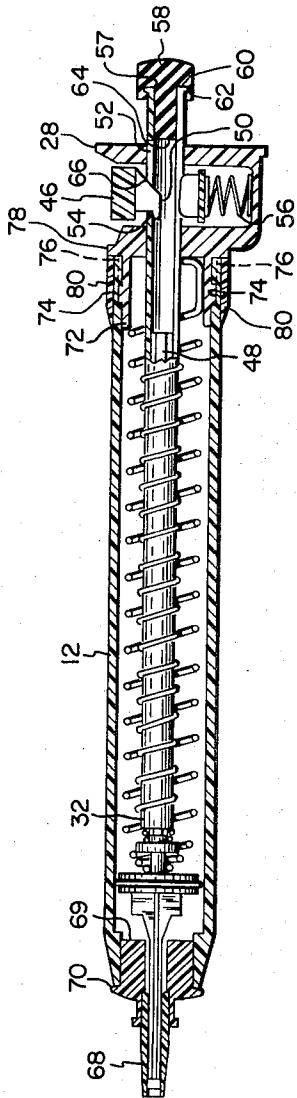


Fig. 2

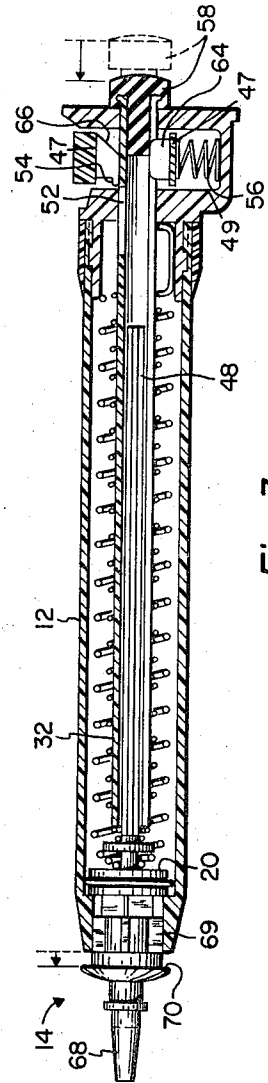


Fig. 3

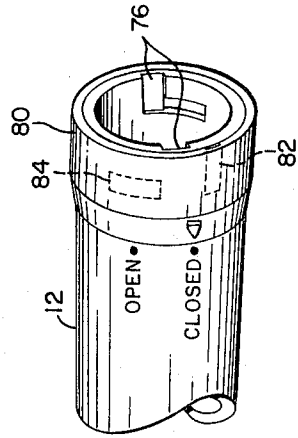


Fig. 4

PORTABLE DESOLDERING TOOL

BACKGROUND OF INVENTION

1. Field of the Invention

The invention relates generally to removing or lifting or drawing away, by air suction technique, small quantities of particulate, liquid, or molten matter and particularly to apparatus improvements in hand held, hand operated vacuum stroke cleaning devices. The present invention finds particularly useful application in the field of soldering, desoldering, and rewiring in electronic laboratories, maintenance shops, factories, or hobbyists' benches; and although, in the cause of clarity and brevity, much of the following discussion and description of examples of the invention are directed theretoward, it is expressly to be understood that the advantages of the invention are equally well manifest in other fields wherever and whenever substances are to be removed or cleaned from an object such, for further example, in medical or dental fields as in removal of foreign objects or unwanted substances from portions of the body including the eye, ear, nose, throat, or open wound or the like.

2. Background of the Invention

In the electrical arts as mentioned, it is often desired to desolder an electrical connection such as, for example, a wire wrapped terminal, a wire to circuit board eyelet, or the like. The removal from the connection, of the molten solder without dropping or spattering it onto other portions of the equipment is generally essential. Blowing or shaking the molten metal away is therefore not an acceptable practice; and, in combination with its high mass density, the high surface tension associated with the solder makes its removal particularly difficult. Furthermore, the problem is aggravated by the requirement that the solder be removed quickly and without application of cooling means before the mechanical connection such as a wire-wrapped terminal may be taken apart.

Various non-portable central vacuum systems and high portable and efficient hand held vacuum stroke tools have advanced the state of the art and have solved certain aspects of the desoldering problems outlined; however, the former suffer from disadvantages of cost, complexity, lack of versatility, and nonportability while the latter suffer from some disadvantages, to a lesser extent, of cost and complexity, and, in some applications, undesirable recoil due to the flyback action of the piston cocking shaft-knob assembly during the vacuum stroke. Typically, in these prior art devices the cocking shaft which functions as a connecting rod between the piston and the cocking knob must be relatively massive to be strong enough to cock the piston against a relatively strong loading spring. Also the cocking knob is typically large and soft, and therefore massive, for comfortable repeated cocking cycles by the hand of the operator. These criteria cause the flyback mass to be relatively large compared to the thin-walled cylindrical housing body; consequently, the outer housing suffers a recoil causing a deflection of the solder inlet tip away from the location of the molten solder.

This recoil caused displacement is particularly intolerable in medical applications such as in removing foreign matter from a child's eye.

Another disadvantage of the abrupt flyback of the shaft and knob is that the eye of the operator during the vacuum stroke is typically disposed near thereto in a position causing risk of eye injury.

It is, accordingly, an object of the present invention to provide improved vacuum stroke, cleaning apparatus which is not subject to these and other disadvantages and limitations of the prior art.

It is another object to provide such apparatus which, while providing consistently a high amplitude of impulse air flow, has no exposed flyback portion and a very low inertia associated with the flyback portions thereof causing a negligible deflection of the tool during its vacuum stroke.

It is another object to provide such apparatus which has a conveniently lockable and unlockable, compact, space saving configuration for shipping and storage.

It is another object to provide such apparatus which is low in cost and simple, rugged, and reliable in its structure and performance.

It is another object to provide such apparatus which is automatically self-cleaning with each cocking cycle.

It is another object to provide such apparatus having readily removable and replaceable tip means.

SUMMARY OF INVENTION

Briefly, these and other objects are achieved in accordance with the structural aspects of an example of the invention in which a hand held, hand operated vacuum stroke cleaning implement is provided which includes a hollow, essentially cylindrical pump body which holds a cooperating piston assembly axially reciprocally movable therewithin. The piston assembly is biased by a mainspring in a direction, hereinafter denoted rearwardly, away from the nozzle or vacuum tip end of the cylindrical pump body.

The piston assembly includes a forwardly extending cleaning rod which enters and cleans the bore of the forward tip nozzle with each cocking stroke. A rearwardly extending aligning shaft is also carried by the piston assembly. The rear end of the alignment shaft is engaged by a trigger mechanism whenever the piston assembly is urged fully forwardly during the cocking stroke. When the trigger mechanism is actuated, the rear end of the alignment shaft is released and the entire piston assembly flies abruptly rearwardly to create the vacuum stroke of air flow into the pump body through the nozzle portion of the forward tip element.

A cocking plunger tube is carried by a rear, trigger assembly housing and extends into the pump body and over the alignment shaft of the piston assembly. Thus the cocking plunger tube slides axially freely through the trigger housing, while the piston assembly may slide axially along the length of the pump body. In the latter motion, the forwardly extending cleaning rod moves axially in and out of the bore of the tip element; and the rearwardly extending alignment rod slides axially within the cocking plunger tube. When the cocking tube is urged forwardly, its forward end engages the piston and drives it forwardly to its cocked position. The cocking tube is slotted to provide access to the alignment rod whereby the trigger mechanism engages the rear end thereof and thereby holds the piston assembly in its forward, cocked disposition. The cocking tube then returns to its rearwardly extended position. When desired, the cocking tube may be retained forwardly by the trigger mechanism; and when desired to

eject the tip and nozzle element, the plunger tube is released by the trigger and pushed fully forwardly causing the piston to engage the rear of the tip assembly and force it forwardly.

In a presently preferred embodiment, a rotating slide valve is provided to control the release of air trapped behind the piston during its flyback stroke. This permits the operator to control the profile of the vacuum pulse from a slow, long pulse to a very sharp, abrupt impulse.

Further details of these and other novel features and their operation and cooperation as well as additional objects and advantages of the invention will become apparent and be best understood from a consideration of the following description taken in connection with the accompanying drawing which is provided by way of illustrative example only.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a longitudinal sectional view of a portable vacuum stroke cleaning or desoldering implement constructed in accordance with the principles of the present invention, the tool being illustrated in its cocked configuration;

FIG. 2 is a similar view illustrating the implement in its storage or shipping configuration;

FIG. 3 is a sectional view as above in which the tip ejection operation is illustrated; and

FIG. 4 is a perspective view of a portion of the structure of the above figures illustrating the details of a rotary slide exhaust control valve.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With specific reference now to the figures in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and structural concepts of the invention. In this regard, no attempt is made to show or discuss structural details of the apparatus in more detail than is necessary for a fundamental understanding of the invention. The description taken with the drawing will make it apparent to those skilled in the mechanical arts how the several forms of the invention may be embodied in practice. Specifically, the detailed showing is not to be taken as a limitation upon the scope of the invention which is defined by the appended claims forming, along with the drawing, a part of this specification.

In FIG. 1, the portable, hand operated vacuum pump 10 illustrated includes a pump body 12 with a removable, frictionally held, forward tip assembly 14 and a removable rearward trigger and bushing housing assembly 16. A piston assembly 18 is shown axially slidably disposed within the pump body 10 and includes a piston 20, a forwardly extending cleaning rod 22, and a rearwardly extending alignment shaft 24, all formed, in this example, as an integrally molded unit.

A hollow cocking plunger tube 26 is slidably carried by the trigger housing bushing member 28 and extends, at all times, over at least the rear portion of the alignment shaft 24. The cocking tube is normally returned rearwardly to its disposition, as shown in FIG. 1, by its tension return spring 30 extending between the forward tip end 32 of the cocking tube 26 and a spring end re-

taining slot 33 formed in the molded bushing housing member 28. It may be noted that the forward few turns 34 of the return spring 30 are of a reduced diameter thereby to retain the tip end of the cocking tube and to provide an impact cushion both when the piston is pushed forwardly by the cocking tube and when the piston flies back against the cocking tube at the end of the high velocity vacuum stroke.

The mainspring 36, for creating the vacuum, flyback stroke is a tension spring disposed between a retaining disc 38 on the piston assembly 18 and a second spring end retaining slot 40 formed in the bushing housing member 28.

The cocking tube is provided with a trigger access slot 42 along a major portion of its length whereby the boss portion 44 of the trigger body 46 may project into the slot 42 and engage the rear tip end 48 of the alignment shaft 24 and retain it forwardly in a cocked position against the mainspring 36 all as shown in the configuration of FIG. 1. Thus it may be noted that, in this cocked configuration, the cocking tube 26 is free to slide axially in and out of the bushing housing member 26 for essentially the full length of the access slot 42; of course, inward motion is resisted by the force of the return spring 30 and, when released, it is returned to its fully rearwardly extended position, as shown, by the return spring 30.

The structure of the trigger mechanism includes the trigger body 46 having a transverse opening 47 therethrough to permit passage of the cocking tube 26 which, when in place, retains the trigger body within the main trigger housing bore 49. A trigger spring 56 retained in compression between the bottom of the bore 49 and the bottom of the trigger body 46 tends to urge the trigger body upwardly against the lower edge of the cocking tube 26 at all times.

Referring to FIG. 2, when it is desired to retain the cocking tube within the pump body as for shipping or tool box storage or the like, the cocking tube may be urged further forwardly by, at the same time, depressing the trigger body 46 so that its latch prong 50 enters the shorter, latching slot 52 in the cocking tube. Once the latch prong 50 is so inserted, the cocking tube may be released whereby the forward edge of slot 52 is engaged by the forward edge of the prong 50. A small, friction nub 54 retains the latch prong 50 in engagement with the latching slot edge against the force of the compressed trigger spring 56.

The rear, tip end 57 of the cocking tube 26 is terminated in this example by a molded, rubber-like bumper element 58 which is formed with an annular receiving channel 60 into which the tube end 57 may be pressed. An annular retaining barb-like shoulder 62 formed about the outer extremity of the tube end 57 locks the bumper element 58 in place. When it is desired deliberately to push the piston assembly further forwardly for purposes of fully inserting the cleaning rod 22 into the nozzle bore of the tip assembly 14 or of ejecting the tip assembly 14, the trigger body must, at the same time, be depressed to remove the boss portion 44 from its interfering position with respect to the forward portion 64 of the bumper element 58. The cocking tube 26 may then be pushed forwardly, with the rear edge of the latching slot 52 pushing the trigger body 46 upwardly by its lifting engagement with the ramp portion 66 of the trigger body 46. When this action is complete, as shown in FIG. 3, the bumper element 58 is displaced

fully forwardly against the bushing housing member 28; and the forward tip end 32 of the cocking tube 26 has forcefully ejected the tip assembly 14 from the front end of the pump body 12. It should be noted that inadvertent tip ejection is precluded by this cooperation of the trigger and cocking tube.

The purpose of thusly ejecting the tip may be to clean and oil the pump body cylinder and the piston parts or to repair or replace the tip assembly. To such ends, alternative nozzle element inserts 68, usually of teflon or the like, may be provided for access to different desoldering and other vacuum stroke applications. The remainder of the tip assembly may be molded in one piece to provide a rear, reduced diameter portion 69 for a snug frictional fit within the forward end of the pump body and an enlarged diameter portion forming a stopping shoulder 70.

With reference again to FIG. 2 as well as now to FIG. 4, the bayonet-locked, insertable fit of the reduced diameter forward portion 72 of the bushing housing body 28 into the rear of the pump body 12 is illustrated. The bayonet style ridges 74 on the outer cylindrical surface of the reduced diameter portion 72 of the bushing housing body 28 are of the character to mate in an interlocking relation with the bayonet style grooves and channels 76 formed in the inner cylindrical surface of the rear portion of the pump body 12. An annular retaining shoulder 78 completes the fitting of the pump body to the bushing housing body.

A rotary exhaust control valve is provided by a sleeve member 80 fitting snugly but rotatably over and lineally co-extensively with the rear end portion of the pump body 12. The rotatable sleeve is provided with an exhaust channel 82 which may be selectively rotatably aligned with an exhaust port 84 in the wall of the barrel of the pump body 12. When so aligned, minimum impedance to the exhaust of air trapped behind the piston 20 during the flyback stroke is exerted. When, on the other hand, and as shown in the figure, the port 84 is totally displaced from any alignment with the exhaust channel 82, maximum impedance is exerted thusly significantly slowing or retarding the flyback velocity and consequently providing a longer, less intense "vacuum" draw. When the port and channel are fully aligned, the vacuum draw creates a maximally abrupt impulse of air flow through the bore of the nozzle element 68 and into the interior volume of the pump body.

There has thus been disclosed and described a portable vacuum stroke cleaning implement which exhibits the advantages and achieves the objects set forth hereinabove.

What is claimed is:

1. A portable desoldering tool of the character to be hand cocked and triggered when desired to produce a vacuum stroke comprising:

a cylindrical pump body having forward and rear ends;

a forward tip assembly of the character to be frictionally fitted and retained within and selectively ejected from said forward end of said body;

a rear bushing housing member of the character to be retained by fitting with said rear end of said body and having an axial bushing opening therethrough;

a piston assembly including a forwardly extending tip bore cleaning rod, an air pump piston element, and a rearwardly extending alignment shaft, said rod and shaft being disposed substantially concentri-

cally within said pump body, said alignment shaft having a rear, trigger engaging end portion: main-spring means within said pump body against which work is done in cocking said piston assembly and which upon triggering causes a rapid flyback of said piston element to create a vacuum stroke of air flow through said forward tip element;

a cocking tube retained by said axial bushing opening and being disposed over at least a portion of said alignment shaft, said cocking tube extending rearwardly from said pump body and being axially slidable with respect to said bushing opening and said alignment shaft,

said cocking tube having a forward, piston assembly engaging end portion for pushing said piston assembly forwardly; and

trigger means carried by said rear bushing housing for engaging said rear end of said alignment shaft and being of the character to release said alignment shaft for said rapid flyback selectively upon actuation of said trigger means,

said cocking tube including access means comprising an elongate slot disposed along a major portion of the length of said tube for providing trigger engagement communication between said trigger means and said alignment shaft disposed therewithin,

said trigger means including a boss portion and trigger spring means for urging it through said elongate slot in holding engagement with said rear end of said alignment shaft disposed therewithin; and

cocking tube return spring means connected to said cocking tube and said bushing housing member for urging said cocking tube rearwardly from said pump body; and

cocking tube rear end termination means disposed to abut said boss portion of said trigger means to limit normally the forward displacement of said tube into said pump body, said boss portion being removable from said access slot to permit further forward, tip ejection displacement of said cocking tube when said trigger means is displaced against said trigger spring means.

2. The invention according to claim 1 in which said trigger means includes cocking tube engagement means and in which said cocking tube includes latching means for said cocking tube engagement means for selectively holding said cocking tube forwardly and substantially within said pump body for shipping or storage of said tool.

3. The invention according to claim 2 in which said cocking tube latching means comprises a second slot in said cocking tube near its rear end portion.

4. The invention according to claim 3 in which said trigger means includes:

a trigger body retaining guideway formed in said bushing housing member transversely to said axial bushing opening; and

a trigger body disposed in said guideway and movable therein against said trigger spring means,

said trigger body being formed to include a cocking tube passageway substantially in alignment with said axial bushing opening and through which is disposed said cocking tube in a trigger body retaining relationship for said trigger body with respect to said trigger body retaining guideway,

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said trigger body means projecting into said cocking tube passageway in the direction of urging of said trigger spring means.

5. The invention according to claim 4 in which said trigger means cocking tube engagement means includes a latching prong projecting into said cocking tube passageway in the direction opposite to that of said urging of said trigger spring means.

6. The invention according to claim 5 in which the

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separation of said boss means and said latching prong in said cocking tube passageway is of a magnitude to permit the further forward displacement of said cocking tube to eject said forward tip element when said trigger body is displaced against said trigger spring means and said cocking tube is pushed fully forwardly coincidentally therewith.

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