Aug. 19, 1941. C. E. BOWES ET AL 2,253,225

SPARK PLUG CLEANER

Filed Oct. 4, 1939 3 Sheets-Sheet 1

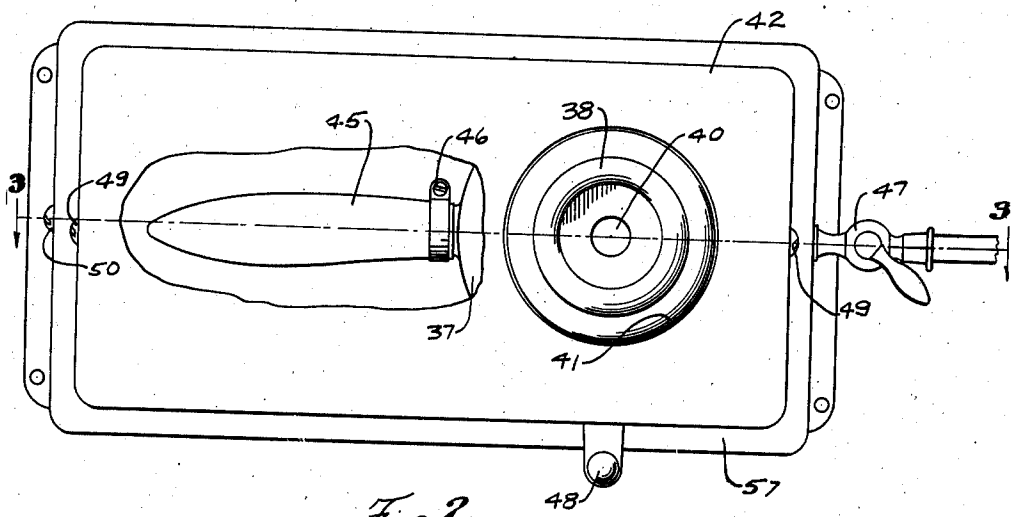


Fig. 2

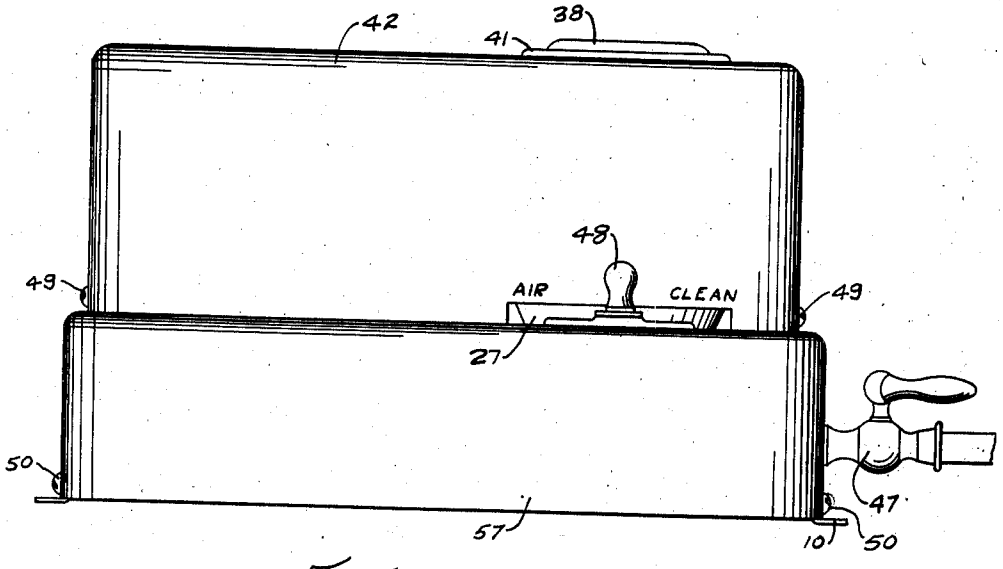


Fig. 1

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Filed Oct. 4, 1939 3 Sheets-Sheet 2

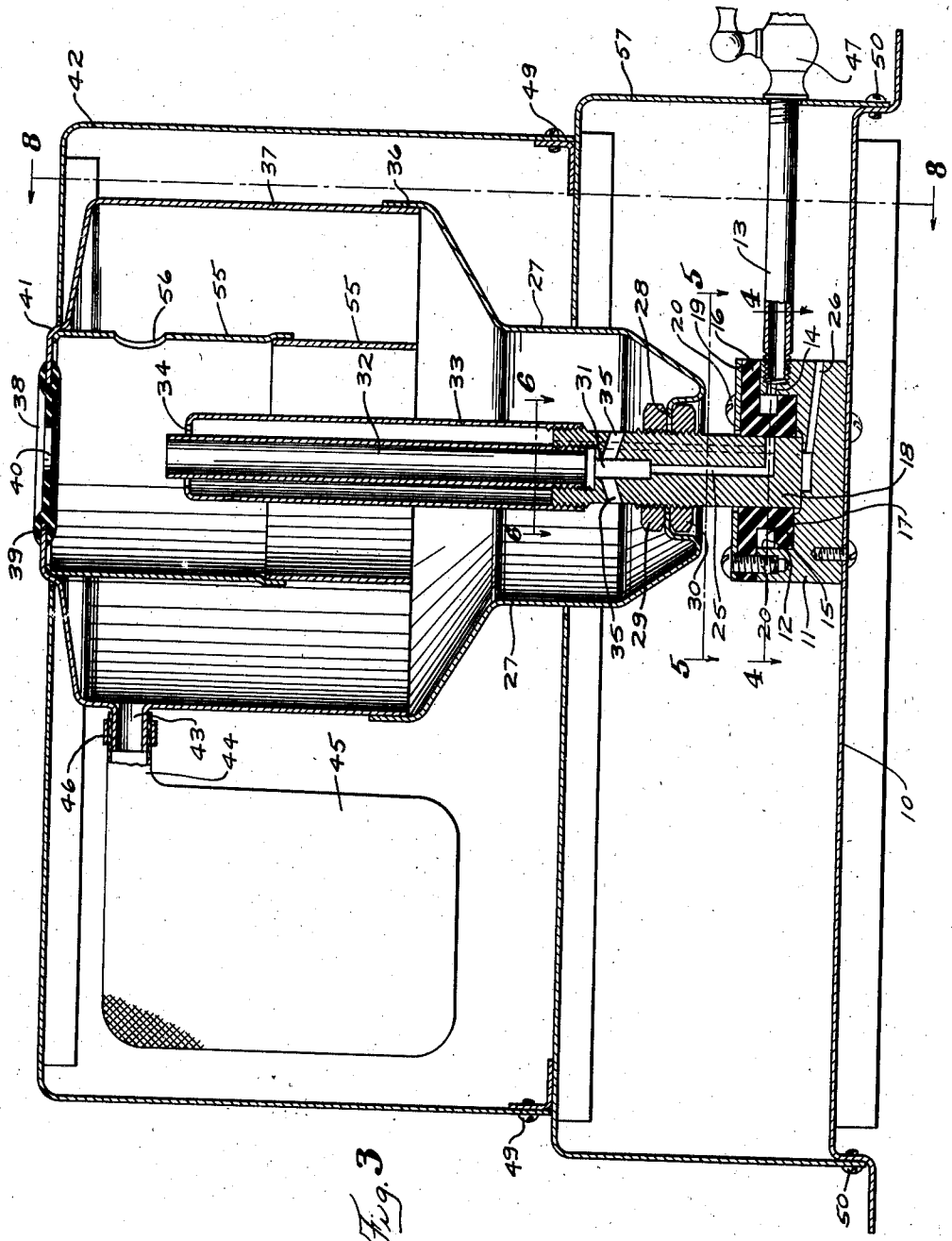


Fig. 3

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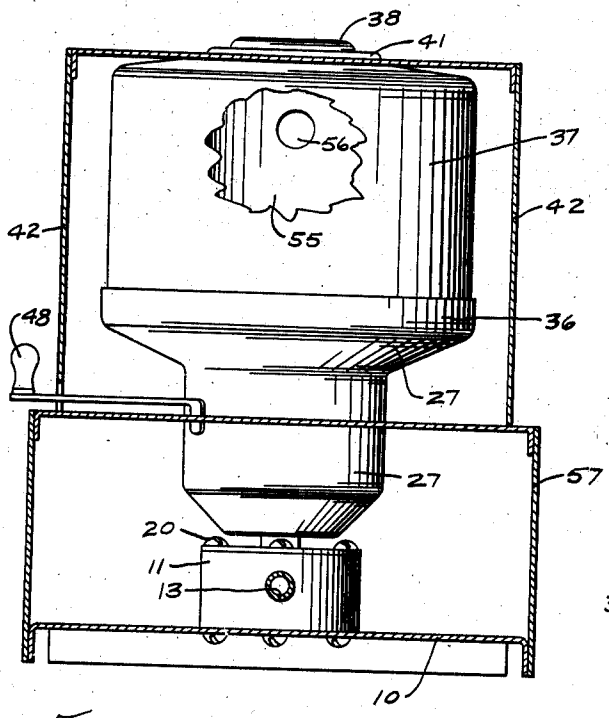


Fig. 8

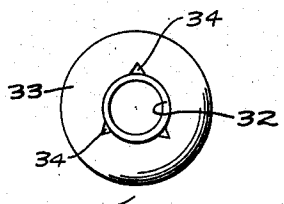


Fig. 7

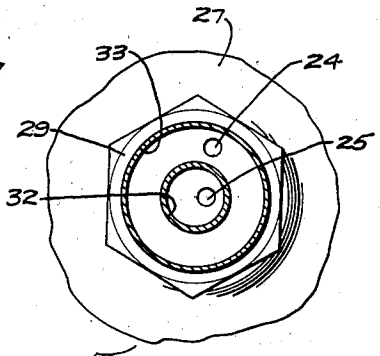


Fig. 6

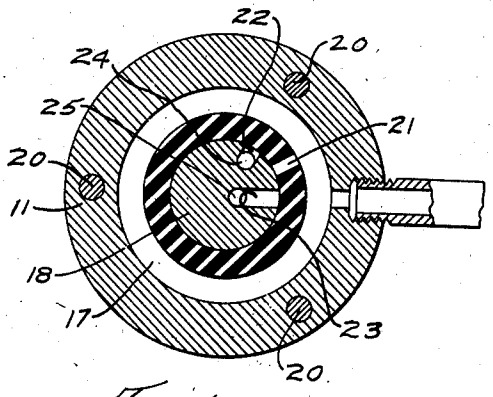


Fig. 4

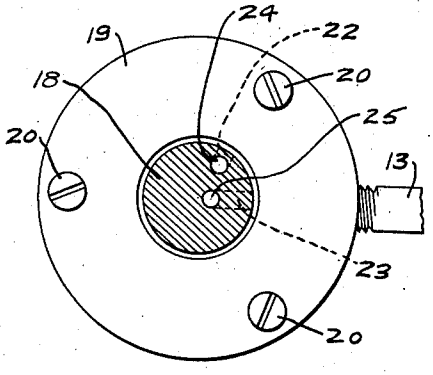


Fig. 5

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UNITED STATES PATENT OFFICE

2,253,225

SPARK PLUG CLEANER

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Application October 4, 1939, Serial No. 297,804

8 Claims. (Cl. 51—8)

This invention relates to means for cleaning spark plugs of the type commonly employed upon internal combustion engines and has for a primary object the provision of a very simple and yet effective structure wherein the plug may be applied thereto for cleaning and the abrasive cleaning material may be applied under air pressure and recovered, all without having to employ screens or the like to separate dust from the cleaning material.

A further primary object of the invention is to provide an unique structure permitting continuous use and reuse of the finely divided abrasive material without escape therefrom even though air pressure is applied in the step of carrying it against the spark plug. In order to permit effective use of air pressure as a means of feeding the abrasive material against the spark plug, a flow of air must be had. In other words, where the end of the plug is presented within a closed vessel, there must be some means provided for escape of air from that vessel in order to permit the existence of the current of air as required. In the structures heretofore known, the discharge of air from the closed vessel has been such that the finely divided dust particles resulting from the abrasion of the spark plug and its cleaning escape into the atmosphere, resulting in inconvenience and also being detrimental to the health of the operator. Our invention prevents this escape of dust and yet permits the escape of air, at the same time separately collecting the dust for removal so that the main body of abrasive material is retained in a condition free from this dust and foreign matter.

These and many other objects and advantages of the invention will become apparent to those versed in the art in the following description which is illustrated in the accompanying drawings, in which

Fig. 1 is a front elevation of a structure embodying the invention;

Fig. 2, a top plan view;

Fig. 3, a central longitudinal, vertical section in part on the line 3—3 in Fig. 2;

Fig. 4, a horizontal transverse section on the line 4—4 in Fig. 3;

Fig. 5, a similar section at a higher elevation on the line 5—5 in Fig. 3;

Fig. 6, a detail in horizontal transverse section on the line 6—6 in Fig. 3;

Fig. 7, a top plan view of the air directing nozzle; and

Fig. 8, a vertical transverse section on the line 8—8 in Fig. 3.

Like characters of reference indicate like parts throughout the various views in the drawings.

Upon a suitable base 10, herein shown as made of sheet metal, is mounted a valve body 11 consisting essentially of a cylindrical length of metal having a bore 12 entering from its top side. An air line 13 is connected to the body 11 in communication with a passageway 14 discharging laterally through a side of the bore 12.

In the bore 12 is inserted a cylindrical projection 15 from a disc 16 which has a sufficiently large diameter to rest over the top side of the body 11. The projection 15 carries a circumferential groove 17 therearound immediately under the disc part 16. The disc 16 and its projection 15 are made out of a resilient material such as rubber or preferably a synthetic rubber which will not deteriorate in the presence of oil and air. Axially through the disc 16 and its projection 15 extends a bore in which is revolvably carried a stem 18. A plate 19 fits over the top of the disc 16 and has a plurality of screws 20 passing downwardly therethrough to engage in the body 11 as a means of retaining the projection 15 within the bore 12.

The projection 15 has a transverse bore 21, Fig. 4, entirely through the neck portion whereby a passageway is provided from the annular groove 17 to discharge into the axial bore through the disc 16 and projection 15 and in which the stem 18 is positioned. The stem 18 is provided with a pair of spaced apart passageways 22 and 23 respectively leading inwardly from its cylindrical face to communicate with corresponding upwardly directed passageways 24 and 25 respectively. The lower end of the stem 18 rests in direct contact with a metallic face presented by the body 11 at the lower end of the bore through the projection 15. A passageway 26 is provided through the member 11 from the central portion thereof immediately under the stem 18 to discharge externally of the member.

Secured to the stem 18 above the plate 19 is a metallic receptacle 27. In the form herein shown, this receptacle 27 has a lower cylindrical portion, the under side of which is conically formed to terminate with an inturned flange 28 gripped between a pair of lock nuts 29 and 30 screw-threadedly engaging about the stem 18. A major bore 31 is provided in the upper end of the stem 18 and a tube 32 is engaged therein by any suitable means, such as by screw-threads. A shell 33 in the nature of a tube of greater diameter than that of the tube 32 is engaged over the upper end of the stem 18 by any suit-

able means, such as by screw-threads, to extend upwardly in telescoping relation spaced from and along the tube 32. The upper end of the shell 33 is closed over against the inner tube 32 a short distance below the upper end of the tube 32. A plurality of openings 34, herein shown as three in number, Fig. 7, are provided in the upper closed end of the shell 33 immediately adjacent the tube 32. Transversely through the stem 18 are a number of upwardly inclined transverse passageways 35, herein shown as two in number, discharging into the central bore 31 to communicate with the bore through the tube 32.

The upper end of the receptacle 27 flares outwardly into a turned up flange 36. An inverted cup 37 is frictionally engaged within the flange 36 and has its upper end spaced a distance above the discharge end of the tube 32 sufficient to permit clearance of the lower end of the spark plug (not shown) when inserted through the flexible throat 38 centrally positioned in the upper end of the cup. This throat 38 consists essentially of an elastic material, such as rubber but preferably synthetic rubber, formed in the nature of a grommet to have an annular groove about its periphery receiving the edge 39 of an opening in the top of the cup 37. The central part of the member 38 is provided with a hole 40 therethrough smaller in diameter than the threaded portion of the spark plug to be tested. This central portion is in the nature of a diaphragm, being much thinner in cross section than the external peripheral portion which carries the groove therearound.

It is to be noted that the upper end of the cup 37 is provided with a central circular boss 41 extending upwardly. This boss 41 serves as a pilot by extending with a running fit through a hole provided in a cover 42 which is supported by the base 10, here shown as indirectly by an intermediate base portion 57, the exact means of support and connection between the base 10 and the cover 42 being immaterial to the present invention.

The cup 37 has a side outlet 43 passing through a nipple around which is clamped a hose 44 integrally extending from a bag 45. The bag 45 is detachably secured to the nipple by means of the clamp 46 so that it may be removed for emptying.

A cylindrical metal sleeve 55 is carried within the cup 37 suspended from the top thereof. In the present form, the sleeve 55 fits within the upwardly extending cup boss 41 and is welded thereto. The sleeve 55 is axially aligned with the cup 37 and extends downwardly in spaced relation around the tube 33 to terminate well down therealong, terminating in the present illustration on a level with the underside of the cup 37. While the sleeve 55 may be made of two parts to achieve the desired length, it may be made in one length, the number of pieces depending upon mechanical expediency in forming.

On the side of the sleeve 55 diametrically opposite the outlet 43 in the cup 37, is provided a discharge hole 56 at an elevation above the top of the tubes 32 and 33.

In operation, air is supplied under pressure from any suitable source, such as from the usual tire pump supply. This supply is controlled through a valve 47 to flow through the pipe 13 and around the groove 17. The pressure thus applied serves to press the projection 15 inwardly to form an air-tight fit about the lower end of the stem 18, and also serves to press downwardly to seal the lower face of the projection 15 against the end of the bore in the member 11. Any air that might escape around and under the projection 15 discharges under the stem 18 and is immediately conducted outwardly through the passageway 26 without being permitted to build up pressure under the stem 18. Therefore, no pressure can be exerted even if leakage exists that would tend to lift the stem 18 upwardly. A lever 48 is fixed to the receptacle 27 and extends outwardly through a slot in the cover 42. The passageways 22 and 23 are arranged in relation to the transverse passageway 21 in the rubber projection 15 and to the position of the lever 48 to have the passageway 21 intermediate of the passageways 22 and 23 when the handle 48 is in the central position as indicated in Figs. 1 and 2, this being the position where no air is admitted to either passageway 22 or 23 from the groove 17. The lever 48 is then shifted to the right, Figs. 1 and 2, to shift the stem 18 to bring the passageway 23 into register with the passageway 21 and thereby permit air to be discharged through the tube 32. As the air travels up this tube 32 under suitable pressure (generally between 75 and 125 pounds) abrasive material (not shown) carried in the receptacle 27 is drawn inwardly through the passageways 35 and carried upwardly in this current of air to be directed against the lower end of the spark plug which is positioned through the hole 40 in the grommet 38, the idea being to shoot this abrasive material against the insulating member and within the bore of the plug shell around the insulating member so as to clean out all of the carbon and foreign matter and leave the porcelain in a clean condition. This abrasive material is of the usual type in fine granular form so it will flow freely through the passageways 35 under the ejector action of the blast of air through the tube 32.

Following the initial blasting action as just indicated, the lever 48 is then shifted to the left-hand position. In this position, the passageway 23 is then closed off and the passageway 22 is registered with the passageway 21 to have the air flow then through the space within the shell 33 outside of the tube 32. Air discharges from this space through the orifices 34 to blow away any remaining particles of the abrasive material that may be adhering to the spark plug and also to remove any of the dust and lighter foreign particles therefrom.

In order that both the blasting and cleaning operations may be successfully performed, it is necessary to permit escape of air from the enclosing cup 37. It is to be noted that the diameter of this cup 37 is considerable in relation to the diameters of the tube 32 and the shell 33. This relatively large volume of the cup 37 is purposely employed to permit a quick reduction in pressure of the air within the cup so that the heavy particles carried upwardly in the blast from the tube 32 will tend to drop downwardly within the receptacle 37, at least following paths that would be below the level of the discharge opening 43. The pressure within the cup 37 is relieved by escape of air through the opening 43.

It is to be noted that direct discharge of the air from the tubes 32 and 33 is not into the cup 37 but immediately into the sleeve 55 which is open at the lower end to permit a quick reduction in pressure within the sleeve. The air blast from the tube 32 is within the sleeve 55 and the abrasive particles strike the sleeve wall in part upon dropping downwardly from the air current, and

such particles return by gravity to the supply in the receptacle 27. The dust particles, however, of such fineness as not to be immediately affected by the pull of gravity within the sleeve 55 tend to be carried out through the upper discharge hole 56 in the current of air escaping therefrom.

As indicated by the above description of the structure, the air discharging through the hole 56 is directed toward the wall of the cup 37 to a side opposite the cup outlet 43. This means that the air current is reduced in velocity by reason of expansion of the air into the larger cup 37. Also, the air current is given a swirling action upon being reversed in direction and turned around by the cup wall and directed thereby toward the outlet 43 to escape into the filter bag 45. During this reduction in velocity and change in direction of flow, the heavier abrasive particles carried along by the current through the sleeve hole 56, are dropped from the air current under the constant downward pull of gravity, the change in flow direction particularly aiding in throwing the particles out of the air stream.

Hence by the time the air reaches the cup outlet 43, the heavier usable particles of the abrasive are separated from the air and returned to the receptacle 27 for re-use, and at the same time, the fine dust is carried out of the cleaner to the bag 45, and the bag is kept free of the heavy particles. This dust-laden air passes into the fabric bag 45 where is is retained as the air escapes through the fabric in the same manner as the dust is separated in the usual collecting bag on a vacuum carpet sweeper. It is understood that the bag 45 is of sufficient close mesh that the dust will be retained but air will be permitted to escape therefrom.

Thus it is to be seen that the invention provides a structure that is exceedingly simple to manufacture and yet very effective in its operation and action. By providing the boss 41 to serve as a top pilot bearing, the stem 18 may be oscillated in its valve-like structure at the lower end without having to provide any other type of bearing, particularly since the disc 16 and its projection 15 are resilient in nature and maintained in sealing contact with the stem 18 by the pressure of the air itself. The cover 42 prevents any accidental lifting of the stem 18 and its carried parts. It is to be noted that the cover 42 is secured in its seated position by screws 49, the under member 57 being likewise secured by the screws 50 to the base 10.

While we have herein shown and described our invention in the one best form as now known to us, it is obvious that structural changes may be made without departing from the spirit of the invention and we, therefore, do not desire to be limited to that precise form beyond the limitations as may be imposed by the following claims.

We claim:

1. In a spark plug cleaning device, a stem, an abrasive carrying receptacle carried by the stem, an abrasive ejector nozzle in the receptacle extending from said stem, valve means associated with said stem for controlling flow of air through said nozzle, an expansion chamber into which said nozzle discharges and having a pressure discharge opening, a dust filter bag fixed over said opening, and a spark plug carrying flexible throat carried by said chamber in substantial axial alignment with said nozzle, said stem being rockably connected with said valve means, and means for rocking said stem to effect said air control, said stem having a peripheral orifice communicating with a passageway through the stem from said nozzle to said orifice, and said valve means comprising a resilient, stem encircling thimble mounted within a cup and sealed thereover, and air conducting means through said cup, said thimble having an annular, external passageway therearound into which said air means discharges to press said thimble around said stem, and a passageway through said thimble selectively registrable with said stem orifice upon said rocking of the stem.

2. In a spark plug cleaning device, a stem, an abrasive carrying receptacle carried by the stem, an abrasive ejector nozzle in the receptacle extending from said stem, valve means associated with said stem for controlling flow of air through said nozzle, an expansion chamber into which said nozzle discharges and having a pressure discharge opening, a dust filter bag fixed over said opening, and a spark plug carrying flexible throat carried by said chamber in substantial axial alignment with said nozzle, said receptacle being substantially funnel shaped, said chamber comprising an inverted cap telescopically fitting with said receptacle, and said nozzle being axially aligned with the receptacle axis extending upwardly from the base thereof and having a plurality of abrasive inlet holes near the junction of the nozzle and the receptacle, and a tubular envelope surrounding said nozzle sealed off from flow of abrasive therein and having at least one air discharge orifice at its upper end, and air passage means from said valve means through said stem into said envelope.

3. In a spark plug cleaning device, a stem, an abrasive carrying receptacle carried by the stem, an abrasive ejector nozzle in the receptacle extending from said stem, valve means associated with said stem for controlling flow of air through said nozzle, an expansion chamber into which said nozzle discharges and having a pressure discharge opening, a dust filter bag fixed over said opening, and a spark plug carrying flexible throat carried by said chamber in substantial axial alignment with said nozzle, said stem being rockably connected with and forming a part of said valve means, and means for rocking said stem to effect said air control, said chamber being carried by said receptacle and shiftable therewith upon rocking of said stem.

4. In a spark plug cleaning device, a valve having a central vertical bore, a stem entered in said bore and bearing by one end against an end of the bore, an abrasive carrying receptacle fixed on the stem above said valve, said stem having air passageways with inlet orifices selectively registrable with an orifice in said valve within said bore, a nozzle tube extending upwardly from said stem in said receptacle and having one of said stem passageways discharging therein, said tube having at least one inlet passageway near its base from said receptacle into the tube, a closure over said receptacle forming an expansion chamber with top and side walls spaced from said nozzle, said closure having a discharge opening in its side wall near its top, said chamber being of sufficient diameter to permit nozzle ejected abrasive particles to fall by gravity between the nozzle and the chamber side wall to cause separation of those particles from an air flow through said discharge opening, a dust filter receptacle connecting with said discharge opening, a resilient spark plug holder in a wall of said closure toward which holder said nozzle is directed, an air conductor leading from the other of said stem passageways

also discharging toward said holder, and means for shifting said stem in said valve.

5. In a spark plug cleaning device, a valve having a central vertical bore, a stem entered in said bore and bearing by one end against an end of the bore, an abrasive carrying receptacle fixed on the stem above said valve, said stem having air passageways with inlet orifices selectively registrable with an orifice in said valve within said bore, a nozzle tube extending upwardly from said stem in said receptacle and having one of said stem passageways discharging therein, said tube having at least one inlet passageway near its base from said receptacle into the tube, a closure over said receptacle forming an expansion chamber with top and side walls spaced from said nozzle, said closure having a discharge opening in its side wall near its top, said chamber being of sufficient diameter to permit nozzle ejected abrasive particles to fall by gravity between the nozzle and the chamber side wall to cause separation of those particles from an air flow through said discharge opening, a dust filter receptacle connecting with said discharge opening, a resilient spark plug holder in a wall of said closure toward which holder said nozzle is directed, an air conductor leading from the other of said stem passageways also discharging toward said holder, and means for shifting said stem in said valve, said shifting means consisting of a lever extending from said receptacle, and a housing stationary in respect to said stem and the receptacle and closure carried thereon, said housing having guide means cooperating with said closure for maintaining said stem in alignment with said valve.

6. In a spark plug cleaning device, a valve having a central vertical bore, a stem entered in said bore and bearing by one end against an end of the bore, an abrasive carrying receptacle fixed on the stem above said valve, said stem having air passageways with inlet orifices selectively registrable with an orifice in said valve within said bore, a nozzle tube extending upwardly from said stem in said receptacle and having one of said stem passageways discharging therein, said tube having at least one inlet passageway near its base from said receptacle into the tube, a closure over said receptacle forming an expansion chamber with top and side walls spaced from said nozzle, said closure having a discharge opening in its side wall near its top, said chamber being of sufficient diameter to permit nozzle ejected abrasive particles to fall by gravity between the nozzle and the chamber side wall to cause separation of those particles from an air flow through said discharge opening, a dust filter receptacle connecting with said discharge opening, a resilient spark plug holder in a wall of said closure toward which holder said nozzle is directed, an air conductor leading from the other of said stem passageways also discharging toward said holder, and means for shifting said stem in said valve, said shifting means consisting of a lever extending from said receptacle, and a housing stationary in respect to said stem and the receptacle and closure carried thereon, said housing having guide means cooperating with said closure for maintaining said stem in alignment with said valve, said guide means consisting of a hole through the housing and a part at least of said closure revolvably entering the housing hole.

7. In a spark plug cleaning device, a valve having a central vertical bore, a stem entered in said bore and bearing by one end against an end of the bore, an abrasive carrying receptacle fixed on the stem above said valve, said stem having air passageways with inlet orifices selectively registrable with an orifice in said valve within said bore, a nozzle tube extending upwardly from said stem in said receptacle and having one of said stem passageways discharging therein, said tube having at least one inlet passageway near its base from said receptacle into the tube, a closure over said receptacle forming an expansion chamber with top and side walls spaced from said nozzle, said closure having a discharge opening in its side wall near its top, said chamber being of sufficient diameter to permit nozzle ejected abrasive particles to fall by gravity between the nozzle and the chamber side wall to cause separation of those particles from an air flow through said discharge opening, a dust filter receptacle connecting with said discharge opening, a resilient spark plug holder in a wall of said closure toward which holder said nozzle is directed, an air conductor leading from the other of said stem passageways also discharging toward said holder, and means for shifting said stem in said valve, said shifting means consisting of a lever extending from said receptacle, and a housing stationary in respect to said stem and the receptacle and closure carried thereon, said housing having guide means cooperating with said closure for maintaining said stem in alignment with said valve, said guide means consisting of a hole through the housing and a part at least of said closure revolvably entering the housing hole, said housing hole being smaller in diameter than the diameter of said closure, and said closure part consisting of a boss entering said housing hole.

8. In a spark plug cleaning device, a vertically directed stem, an abrasive carrying receptacle carried by the stem, an abrasive ejector nozzle in the receptacle extending vertically from said stem, valve means associated with said stem for controlling flow of air through said nozzle, an expansion chamber into which said nozzle discharges and having a pressure laterally discharging opening, a dust collecting filter bag fixed over said opening and extending therebelow, and a spark plug carrying flexible throat carried by said chamber in substantial axial alignment with said nozzle, and a cylindrical wall surrounding said nozzle spaced both from the nozzle and the wall of said chamber and opening across its lower end into said chamber, said cylindrical wall having a lateral discharge opening directed oppositely from said chamber opening.

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