March 15, 1949. G. N. MEYERS 2,464,764

SPRAY GUN APPARATUS

Filed Feb. 19, 1945 2 Sheets-Sheet 1

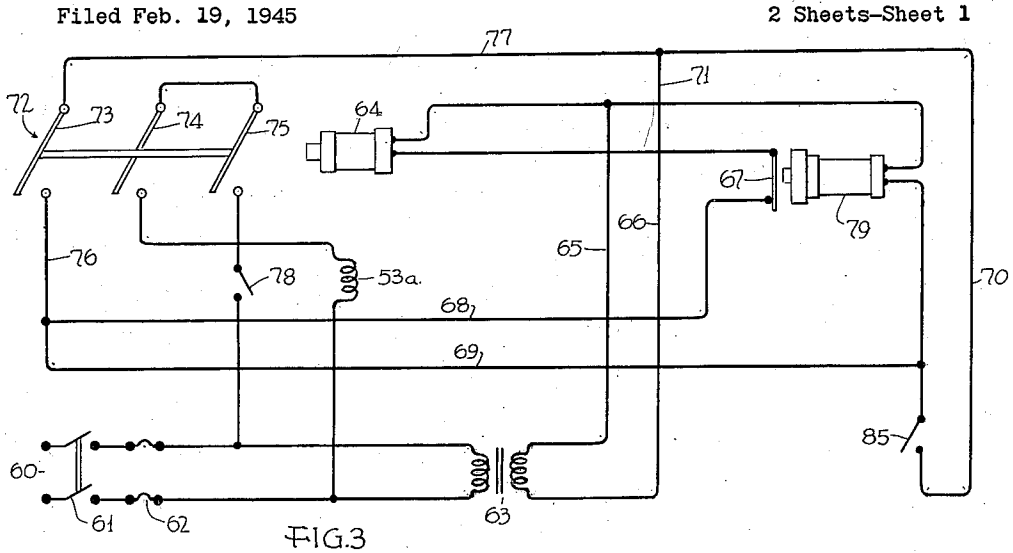


FIG. 3

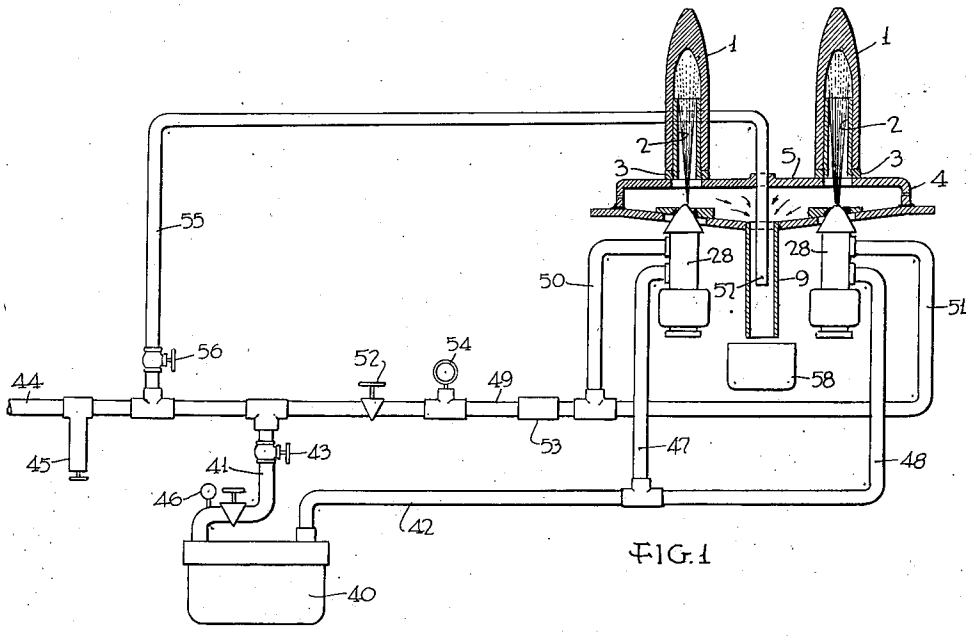


FIG. 1

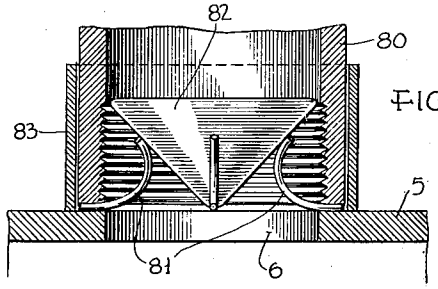


FIG. 4

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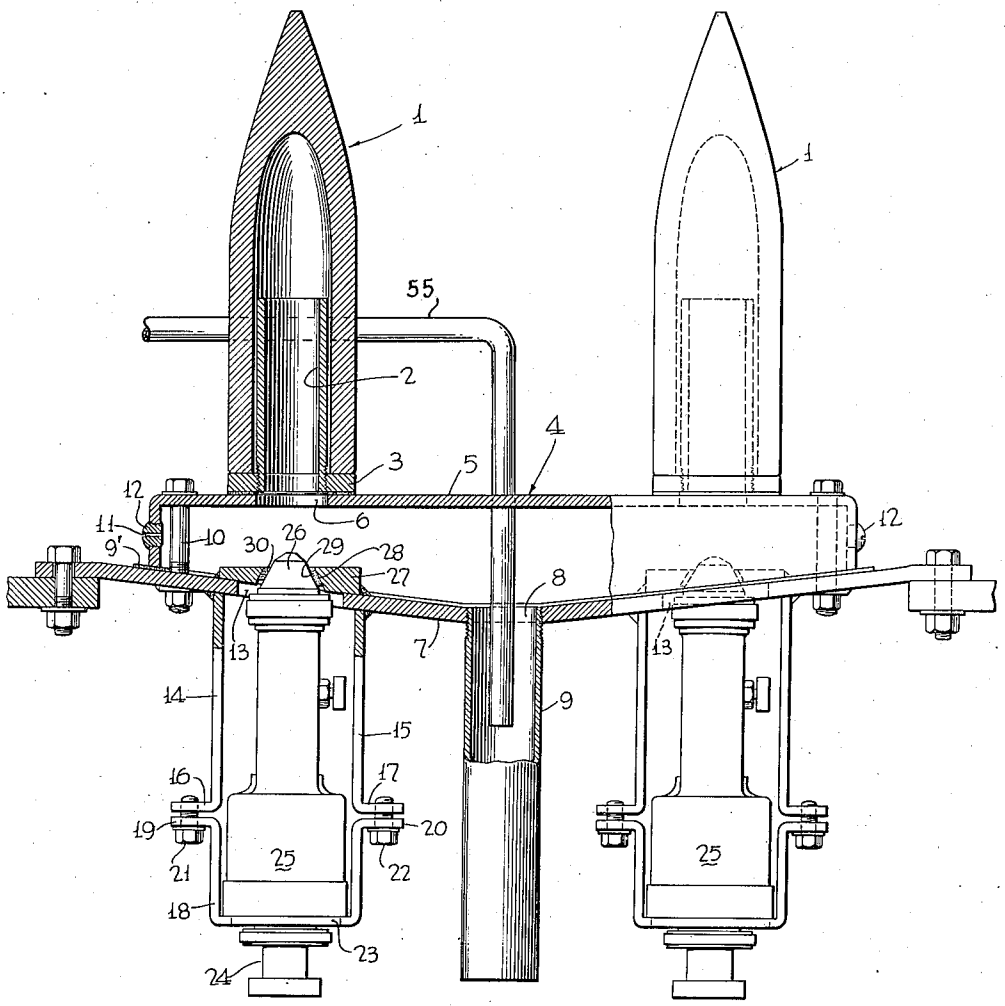
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FIG. 2



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SPRAY GUN APPARATUS

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4 Claims. (Cl. 91—45)

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This invention relates to spray gun apparatus for the application of paint, rust preventives and the like, to either external or internal surfaces.

Among the objects of the invention, are to provide a spray gun apparatus which is particularly useful and efficient in conjunction with the spraying of internal areas such as a metal tube. Another object is the provision of spray gun apparatus which eliminates permanent disposition of solidified spray material in areas adjacent the spray nozzle and external to the surfaces being treated. Still another object is the provision of an effective seal between the spray nozzle and the connections to the workpiece. An object also is the provision of a spray gun connection which is susceptible to easy pivotal movement without developing breakdown of the connections. Additional objects of the invention relate to the utilization of efficient recovery means for unused spray material, to electric circuit means for controlling the time of spray, to spray shield means for the workpiece and to other details of the assembly and arrangement which will appear on consideration of the following detailed description and accompanying drawings. In the drawings, which illustrate preferred embodiments and physical arrangements of the invention,

Figure 1 is a view, partly in section, showing the apparatus in association with workpieces being treated;

Figure 2 is a detail of the spray gun units as related to the vacuum chamber and workpiece;

Figure 3 is a diagrammatic showing of the electric circuit; and

Figure 4 is a detail showing of a modification of the spray shield apparatus.

The apparatus as shown in Figure 1 is intended for the spraying of the internal surfaces of a bomb shell, although applicable to any closed interior surface. As shown, the shells 1 are mounted on shield tubes 2 provided with base supports 3 on which the lower edges of the shells loosely rest. The dimensions of the shield tubes 2 are such as to provide a relatively close fit to the workpieces, different tubes being usable for different workpieces, as required. The base supports 3 are fixed to the upper surface of a vacuum chamber or box 4 formed of an upper flat plate 5 containing apertures 6 in the area aligning with the tubes 2, and a lower plate 7 having sections converging from the box edge to the center where an opening 8 is formed. An outlet pipe 9 is screw threaded to the edge of this opening. As shown, the edge of the box 4 is continuous

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with the upper plate 5 and forms with the lower plate 7, an air sealed chamber by means of the edge strip 9' of rubber or rubber-like composition against which the box edge is held by means of bolts 10 passing through both plates. A pin hole aperture 11 is provided through a screw 12 placed at intervals around the edge periphery, these screws being replaceable by others of different leakage capacity, as desired.

The lower plate 7 of the vacuum box is provided with openings 13 which are positioned diametrically across from the openings 6. External to the openings 13 are secured two depending straps 14 and 15 having outwardly offset ends or lugs 16 and 17. A third and U-shaped strap 18 having end lugs 19 and 20 is adapted for attachment in extension of the pair of straps 14 and 15, connection being made by machine bolts 21 and 22 passing through apertures formed in the end extensions of the adjacent straps. The cross piece 23 of the end strap 18 is bifurcated so as to receive the adjusting terminal 24 of the spray gun 25, when this gun is positioned between the straps 14 and 15, and the nozzle 26 thereof extends through the opening 13 formed in the base plate 7 of the vacuum box 4. A taper washer 27 is fixed by welding or other means to the inner surface of base plate 7 directly over the aperture 13. The inner edge 28 of the washer is tapered to correspond approximately to the tapered surface 29 formed on the spray end of the gun nozzle 26 and intermediate the nozzle and washer, a gasket 30 of yieldable and airproof material, such as rubber or the like, is interposed so as to form an effective seal for liquid, air or other gases.

It is pointed out that the lug pairs 16—17 and 19—20 are, when the spray gun is placed in position with the nozzle in contact with the gasket 30, spaced from each other so that a degree of adjustment by means of the bolts 21 and 22 may be obtained as desired. Also the openings formed in the lugs 19 and 20 of the lower strap 18 have a diameter in excess of that of the bolts so that the strap may be shifted laterally to cause a virtual pivoting of the gun. This may take place inasmuch as the gasket 30 at the gun nozzle yields to permit a shifting in the lateral position of the gun.

The pipe circuit employed to supply the spray nozzle with air under pressure and spray liquid is illustrated in Figure 1. The supply tank 40 has two pipe connections 41 and 42. Pipe connection 41 admits under control of valve 43, air under pressure from inlet pipe 44. A filter 45

and gage 46 are provided in this inlet connection. Pipe connection 42 leads directly to the spray guns 28 through branch pipes 47 and 48. From the air inlet 44 connection is also made to the guns through the pipe 49 and branch pipes 50 and 51, air pressure control in this airline is obtained through the manually adjusted automatic air pressure regulator 52, the period during which air flows being automatically controlled by solenoid valve 53. An air pressure gage 54 is also provided. Additionally, pipe 55 extends from the source pipe 44 controlled by manual valve 56 to the vacuum box 4, the connection passing through an opening in the top plate 5 or any other convenient opening as desired, and into the outlet tube 9, where it terminates at a point short of the end of this tube. Directly beneath the end of outlet tube 9 is placed a waste receptacle 58.

From the description of the apparatus to this point, the general functioning of the same may be apparent. When air under pressure is introduced to pipe 41, paint or other coating material is forced through pipe 42 and branches 47 and 48 to the air guns 28, the pressure being adjusted to lift the liquid to a point short of the nozzle end. Impetus and effective spray formation is supplied to this air-paint stream by the air supply through pipe 49 and branch pipes 50 and 51, sending the mixture in a rapid stream through the vacuum box 4 and shield tubes 2 into the area of the shells 1 above the tubes.

If no other apparatus were supplied, the spray operation would be a failure from the practical viewpoint inasmuch as the spray stream is received in a closed space and dead air regions prevent the desired disposition of the spray material to the surfaces being treated. To overcome this difficulty, the vacuum box 4 with the associated air pressure line 55 is provided. When valve 56 is opened and air current flows from pipe 55 through outlet pipe 9, the moving air stream draws air from the interior of the sealed box 4 as indicated by the arrows. If this air stream flows continuously, therefore, the pressure within the box 4 will be continuously sub-atmospheric. Also by reason of the pin hole openings 11 a continuous trend of air is developed from the box edges toward the outlet pipe 9. The effect of this reduced pressure in the box is to produce an air movement from the loose junction between the base nut 3 and shell 1, between the shell and tube 2 and down through the interior of tubes 2 toward the outlet pipe 9. Thus the pressure within the shell spaces is sub-atmospheric and as a consequence the spray stream readily passes upwardly through the tubes 3 and into the shell space where it deposits the spray material over the entire surface above the tube ends.

By reason of the pin hole opening 11 and the consequent continuous movement of air toward the outlet pipe 9, any condensation of spray on the base plate of box 7 is drawn toward the outlet pipe. This movement is accentuated by the inclination of the base plate toward the outlet pipe. Thus any tendency of the spray material to accumulate and solidify, requiring more or less frequent removal, is obviated.

In order to secure efficient handling of the spray material, given the apparatus as described, it is important that the spray be applied for a predetermined limited time period. In Figure 3 is shown a time control circuit for the solenoid valve 53 indicated in the pipe line 49 of Figure 1. In this diagram a source of alternating current is

indicated by the numeral 60. From this source through the manual switch 61 and fuses 62, current is led to the transformer 63. From the secondary of this transformer connection is made to the relay coil 64 by way of conductors 65 and 66, dependent upon the closure of initiating switch 85. On closure of switch 85 current passes through conductor 65, relay coil 64, time delay switch 67, conductors 68 and 69, switch 85 and conductors 70 and 71. This energizes relay 64 and operates its switch 72, having contact arms 73, 74 and 75, closing the same. Closure of contact 73 establishes a holding circuit from conductor 68 through conductor 76, 77 and 71 to the transformer 63, by-passing initiating switch 85 which may then be opened. Closures of contacts 74 and 75, with manual switch 78 closed, energizes solenoid coil 53*a*, causing the beginning of the spray cycle in the apparatus.

Closure of initiating switch 85 also energizes the time delay relay coil 79 which, after a predetermined time period operates to open the time delay relay switch 67. As in the case of relay 64, relay switch 72 functions to hold the energizing circuit through relay 79 after switch 85 is opened. On opening of time delay switch 67, relay switches 74, 75 are opened, breaking the circuit through solenoid coil 53*a* and stopping the spray cycle. Hence, the entire cycle is accomplished merely by closing the initiating switch 85 and opening it again at will, the spray cycle being controlled by the time delay relay 79 and the automatic relay switch, connections for the solenoid coil 53*a* being controlled by relay coil 64.

As previously indicated, the shield 2 as employed for interior spraying, may be changed as to length, to vary the extent of spray surface within the workpiece. In some cases it may be desirable to spray the whole interior surface with paint, with the exception of a threaded section adjacent the open end of the shield. This threaded section preferably should be sprayed with rust resisting composition and this may be accomplished by use of the shield and supporting unit shown in Figure 4. In this unit the workpiece 80 is mounted directly on the upper plate 5 of the vacuum box 4, or upon the ends of support rods 81 which are fastened by an appropriate means to the plate 5. The other ends of the support rods 81 are fixed to an inverted conical shield 82 the apex of the shield being centrally positioned at the plate aperture 6 and the skirt edge of the cone lying adjacent the approximate inner surface of the workpiece when in position. A guide and retaining ring 83 is also fixed to the plate 5 surrounding the shield 82 for supporting the workpiece in proper relationship to the shield.

In the action of this particular type of shield, the spray from the nozzle gun impinges on the conical surface of the shield and is deflected toward the threaded section of the workpiece to coat the same. The down coming draft of air around the edges of the shield tend to prevent penetration into the upper space of the workpiece interior above the shield. This draft is due to the sub-atmospheric pressure maintained in the vacuum chamber as herein above described.

While emphasis has been made on spraying of interior surfaces the apparatus may be also employed for exterior coating. This may be accomplished by placing the guns at edge apertures of the vacuum box and extending the workpiece through the top plate of the box within range of the gun spray.

Modifications of the invention, other than as

herein referred to, may be made and hence no limitations arising from the specific disclosure are intended other than may be required by the claims hereto appended.

What is claimed is:

1. In spray gun apparatus, a work receiving support, a spray gun having a nozzle, a sub-atmospheric pressure chamber between said support and nozzle, and connection means between the nozzle and chamber permitting pivotal shifting of said gun, said connection means comprising a yieldable annular plate surrounding an opening in the chamber wall and forming a sealing contact with said nozzle through which the outlet portion of the nozzle projects.

2. In spray gun apparatus, a work receiving support, a spray gun having a conical nozzle, a sub-atmospheric pressure chamber between said support and nozzle, and connection means between the nozzle and chamber, said connection means comprising an annular yieldable plate having inclined inner edges corresponding to the conical nozzle surface, said plate being positioned around an opening in the chamber and forming a sealing contact with the plate through which the outlet portion of the nozzle projects.

3. In spray gun apparatus, a work receiving support, a spray gun having a nozzle, a sub-atmospheric pressure chamber between said support and nozzle, and connection means between the nozzle and chamber permitting pivotal shifting of said gun, said connection means comprising a yieldable annular plate inside said chamber and surrounding an opening in the chamber wall through which the outlet portion of the nozzle extends into sealing contact with said plate.

4. Spray gun apparatus comprising an enclosed chamber, a spray gun mounted to project the spray toward and through an opening in one wall of the chamber and having a substantially air-tight joint with said wall, a work holder positioned to hold the work to receive spray through an opening in an opposite wall of the chamber, said work holder, with a workpiece in place, forming a substantially air-tight closure over said opening in said opposite wall, means for withdrawing air from the chamber to create a sub-atmospheric pressure therein, and a restricted opening in a wall of said chamber for admitting a limited amount of air, said opening being located in such position that air entering the chamber therefrom passes over and across the inner end of the spray gun.

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