

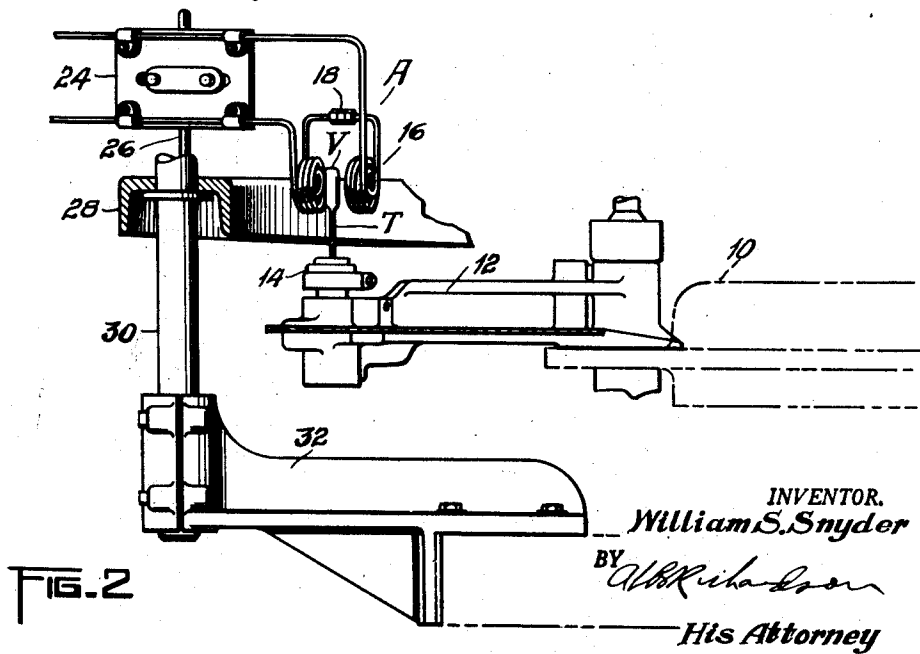
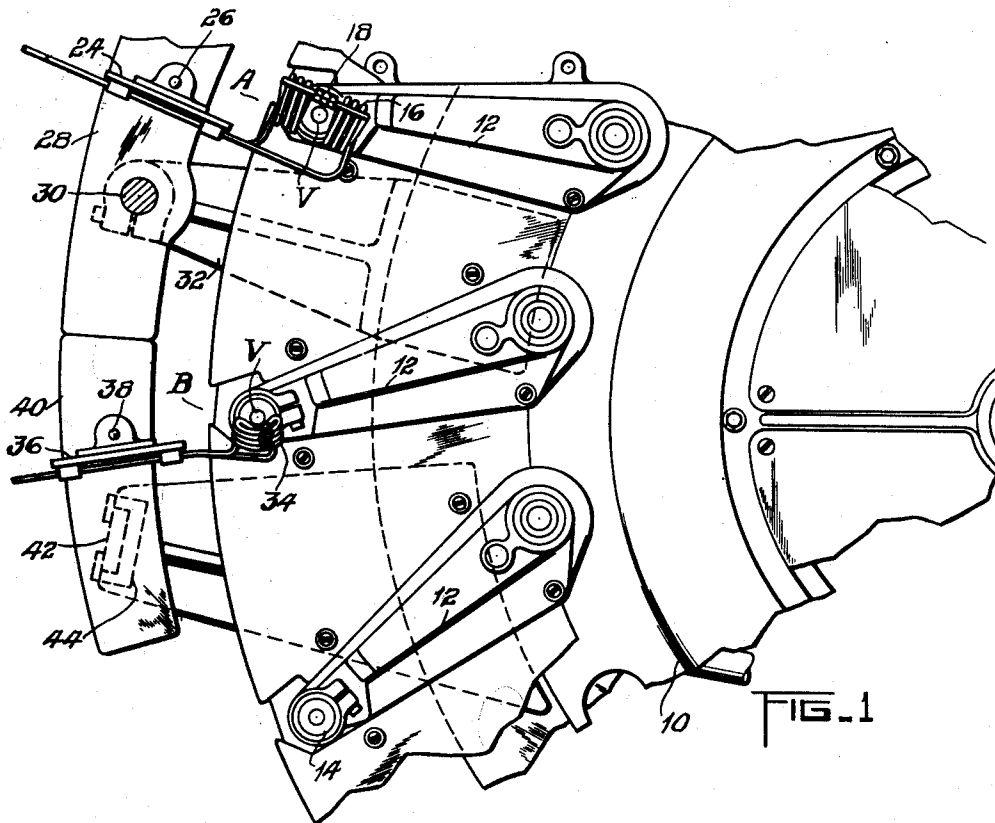
March 30, 1954

W. S. SNYDER
EXHAUST MACHINE

2,673,784

Filed Jan. 23, 1947

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

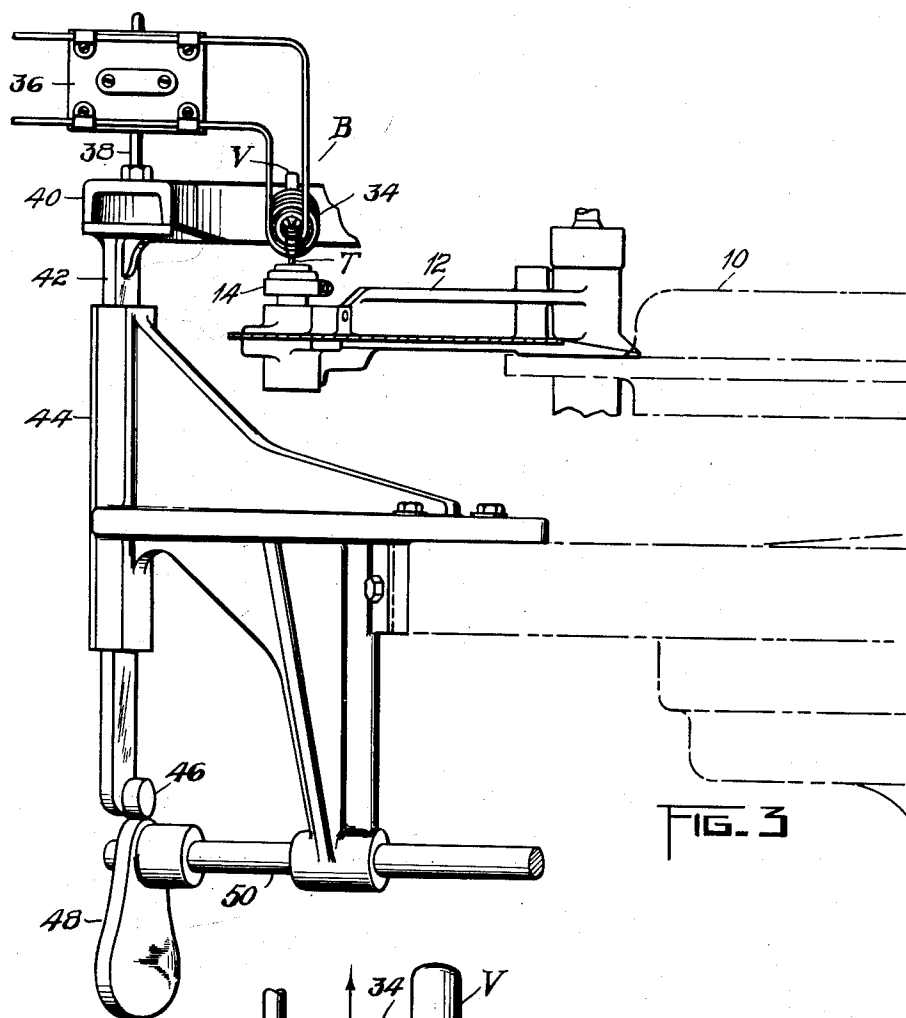


FIG. 3

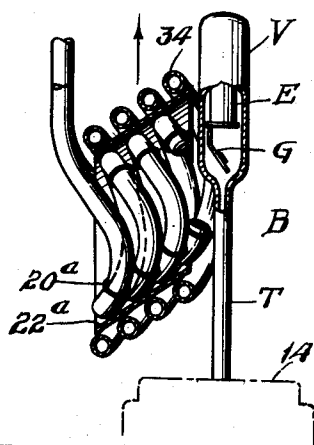


FIG. 4

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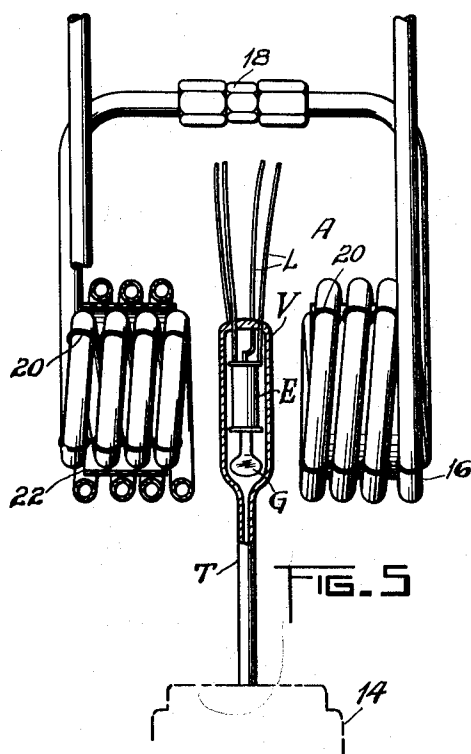


FIG. 5

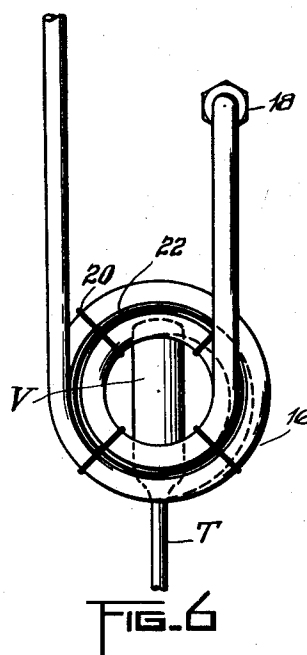


FIG. 6

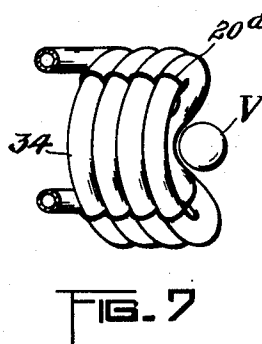


FIG. 7

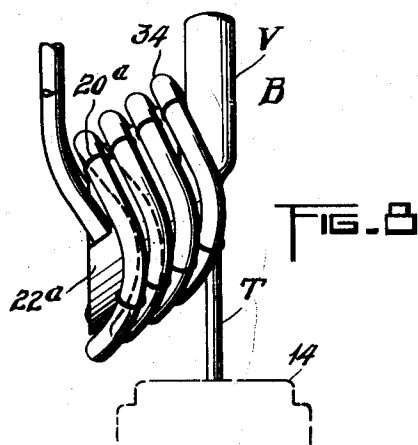


FIG. 8

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EXHAUST MACHINE

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6 Claims. (Cl. 316—30)

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This invention relates to exhaust machines for electron discharge devices and the like and to the electron bombardment and the gettering of such devices, customarily effected during their evacuation and prior to their tipping-off. The invention relates to the machine, and is not necessarily restricted to electron discharge devices as such, but extends also to other devices which may be enclosed in evacuated vessels, such as relays, and thermal switches, which may be in a vacuum or in a vessel initially evacuated and later charged with a special gas.

Vacuum tubes, gaseous tubes, and other devices which have metal parts enclosed in a vessel or envelope that is evacuated at some part of the manufacturing process, commonly have a gettering tab arranged critically in relation to the remainder of the metal parts. Those metal parts can be inductively heated by radio frequency current to drive off the gases included within or on the surface of the metal, and, after final evacuation of gases, the gettering tab may independently be inductively heated for flashing. As is well known, the flashing vaporizes the gettering metal which adsorbs minute quantities of gas remaining. An object of the present invention is to provide new and effective bombardment and getter-flashing devices for exhaust machines.

In one line of tiny radio tubes, including vacuum types and grid-controlled gas types, the gettering tab is positioned adjacent the junction of the exhaust tubulation with the remainder of the envelope, and at an angle to the common axis of the exhaust tubulation and the envelope. It is a further object of this invention to provide electron bombardment coils for heating the metal parts of such devices without flashing the getter, and for independently flashing the getter without unduly heating the metal parts. A further object is to improve the construction of induction-heating coils for getter-flashing and like purposes.

The embodiment of the invention for accomplishing these objects includes a carrier for moving the unevacuated vessels or envelopes, containing the metal parts and the gettering tab, successively past the bombardment coil and the getter-flashing coil which are usual in exhaust machines. In the present machine the bombardment coils are located adjacent the path of the vessel, while the getter-flashing coil is reciprocable into and out of the path of the vessel as it is carried through the exhaust cycle. The getter-flashing coil should develop a field in-

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tense enough to flash the getter, while at the same time it should be directed so that no intense part of it will unduly reheat the previously bombarded metal parts enclosed in the vessel.

To this end the getter-flashing coil is so shaped as to partly embrace the vessel and allow relative reciprocation parallel to the envelope which is in getter-flashing position, portions of each of the turns of the coil being in planes parallel to each other and to the plane of the getter tab, while the remainder of each turn is bent out of the respective plane. The invention will be better understood from the following detailed description of the preferred embodiment thereof, from which further objects and features of novelty will become apparent. In the drawings:

Fig. 1 is a fragmentary plan view of an exhaust machine embodying the present invention, showing one of a series of bombardment stations and the getter-flashing station;

Fig. 2 is an elevation, partly in section, of a bombardment station;

Fig. 3 is an elevation, partly in section, of the getter-flashing station;

Fig. 4 is an enlarged view, partly in section, of the getter-flashing coil in relation to the getter, the enclosing vessel being partly broken away to show the gettering tab;

Fig. 5 is an enlarged partly sectional view of the bombardment coil in its relationship to an electron discharge device the internal elements of which are disclosed by a broken-away section of its envelope;

Fig. 6 is an end view of the coils in Fig. 5; and

Figs. 7 and 8 are a plan view and a lateral elevation, respectively, of the getter-flashing coil in Figs. 1, 3, and 4.

Referring now to the drawings, there will be described a preferred arrangement for bombarding the metal electrodes E (Fig. 5) supported within glass vessel V on leads L which are sealed through the glass. An exhaust tubulation T is attached to vessel V, by means of which the vessel is supported while being exhausted, bombarded, while the getter is being flashed, and until the time that the junction of tubulation T and vessel V is heat-softened to seal off the vessel. Exhaust tubulation T also serves as the connection between vessel V and the exhaust system in the machine for evacuating the vessel before and during the bombardment, and to supply any necessary gas to the vessel. As shown in Figs. 4 and 5, a getter element G is supported on the assembly of electrodes E and is located near the junction of vessel V with tubu-

lation T and at an angle to the common axis of the vessel and the tubulation.

Each tubulation T is supported vertically on a bracket 12 carried by turret 10, being gripped within the end 14 of a line (not shown) through bracket 12 to an exhaust pump. The turret is intermittently indexed to carry the vessels being evacuated in a horizontal circular path successively past a series of exhaust stations, the last of which is shown at A in Fig. 1, and then past getter-flashing station B and ultimately to a tipping-off station where the junction of vessel V with exhaust tubulation T is fused and the vessel is removed from the machine. In the present instance the long dimension of the electrodes is along the axis of the vessel.

A two-part bombarder coil 16 of metal tubing is supported adjustably at station A with its axis at right angles to the path of vessels V and to their axes. With the coil axis arranged thus radially of the turret, it is possible to develop a uniform high-frequency field for heating electrodes T and thus driving off the occluded and the surface gases. This induction heater is best shown in Fig. 5 wherein the two parts of the coil are shown joined by metal coupling 18. Multiple cords 20 of glass fiber hold the several turns of each layer of turns close to each other but insulated apart, and a flexible sheet 22 of insulation separates the layer of the coil. A high frequency generator (not shown) energizes the coils which are conventionally cooled by circulating liquid within the tubing. Coil 16 is carried adjustably by insulating block 24 clamped to rod 26 upstanding from segmental rim 28, carried in turn on rod 30 projecting from stationary bracket 32 on the machine base. The axis of coil 16 is at a level midway along the length of electrode assembly E, and is radial of carrier 10.

At station B the getter-flashing coil 34 is shown. This coil is similarly of metal tubing for circulation of cooling fluid and is also energized from a high frequency source (not shown). When coil 34 is in position for flashing the getter (Fig. 4) it is in the path of vessel V, but the turret is stationary at this time. Coil 34 is supported on insulating block 36 carried by rod 38 on segmental support 40. Unlike support 28, segmental support 40 is vertically movable, being carried by slide 42 in stationary guide 44 on the machine base. At the lower end of slide 42, cam follower 46 is in engagement with cam 48 on shaft 50 which rotates once for each operation of the turret indexing mechanism (not shown), so as to lower the coil after carrier 10 comes to rest and raise it before renewed indexing has commenced.

From Figs. 4, 7 and 8 it will be evident that coil 34 is free to reciprocate vertically while embracing vessel V, and that the upper half of each turn of the coil lies in a plane parallel to generally flat getter element G. The lower portions of the respective turns are bent out of the plane of the aforementioned parts of the several turns, in order that the coil may be raised freely. Were the entire coil merely made of oblique helical turns the field would be either too weak to flash the getter, or if strong enough, would harmfully reheat the electrodes E. The bent-away portions of each of the turns produces a field more or less transverse to exhaust tubulation T and while this is largely ineffectual, it is neither wasteful nor damaging.

Just as in the case of bombardment coil 16,

coil 34 is made in two layers separated by a sheet of insulation 22^a, and the several turns of the coil are held together but separated by cords 20^a of glass fiber.

The sequence of operations in this machine follows that in other well known exhaust machines, in that a series of bombardment stations is followed by a getter-flashing station. The orientation of the bombardment coils and the getter-flashing coil is such that the action of each is relatively independent of the other. However, the particular configuration of the getter-flashing coil which promotes efficient flashing, in relation to the small vessel described, requires a special positioning of the bombardment coils if reheating of the electrodes is to be avoided. It will be recognized that the various parts are subject to modifications by those skilled in the art, and that the novel construction may be used for other purposes. Therefore it should be understood that the specific disclosure is intended to be illustrative and not as a limitation.

What is claimed is:

1. In combination in an envelope exhausting machine, a carrier for moving said envelopes to be processed successively past induction heating and getter-flashing positions, an induction heating coil located laterally of the path of the envelopes for inductively heating the contents thereof, a getter-flashing coil mounted for movement into the path of the envelopes, said last mentioned coil being so warped so as to closely embrace a portion of each of the envelopes in succession, and means for alternately moving the coil into said path and removing it in timed relation with the movement of said carrier.

2. The combination according to claim 1 where'n said getter-flashing coil includes a plurality of turns most of each of which lies in respective parallel planes intersecting that envelope which is in getter-flashing position, the remainder of each of the turns being bent away from said planes and from the envelope.

3. The combination, in an exhaust machine for electron tubes having an enclosing envelope and a number of electrodes, of a carrier for moving said envelope stepwise past induction heating and getter-flashing positions, said envelope being generally cylindrical and enclosing said electrodes coaxially and a gettering element obliquely, a stationary induction heating coil adjacent the path of the envelope having an axis transverse to the path and axis of the envelope, and a getter-flashing coil reciprocable into and out of the path of the envelope having turns only part of each of which lies in a plane parallel to the gettering element when the envelope is in getter-flashing position whereby substantially only said getter element is heated by said getter flashing coil.

4. In an envelope exhausting machine, a carrier for moving said envelope successively past an induction heating station and a getter flashing station, induction coils at each of said stations, the coil at the first mentioned station being located laterally of the path of said envelopes for heating conductive material within said envelopes, the coil at the second of said stations being laterally movable into and out of the path of said envelopes in timed relation with the movement of said carrier, and said last mentioned coil being so curved as to partly embrace a portion of each envelope when in the path of said envelopes.

5. In an envelope exhausting machine, a car-

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rier for moving said envelope successively past an induction heating station and a getter flashing station, induction coils at each of said stations, the coil at the first mentioned station being located laterally of the path of said envelopes for heating conductive material within said envelopes, the coil at the second of said stations being laterally movable into and out of the path of said envelopes in timed relation with the movement of said carrier, and said last mentioned coil including a plurality of turns most of each of which lies in a plane parallel to an element within said envelope, the remainder of each of said turns being bent to lie in planes at an angle to said element whereby only said element is heated to a substantial extent, and being so curved as to partly embrace a portion of each envelope when in the path of said envelopes.

6. In an envelope exhaust machine, a carrier for moving said envelope successively past an induction heating station and a getter flashing station, induction coils at each of said stations, the coil at the first mentioned station being lo-

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cated laterally of the path of said envelopes for heating conductive material within said envelope, the coil at the second of said stations being laterally movable into and out of the path of said envelopes in timed relation with the movement of said carrier, and said last mentioned coil having a number of turns, an arc of each of which lies in a surface partly embracing said envelope when in the path of said envelopes, the remainder of each of said turns being bent to lie in a surface at an angle to the surface of said arc and away from the envelope.

WILLIAM S. SNYDER.

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