Feb. 2, 1932. M. U. SCHOOP 1,843,842

METHOD AND DEVICE FOR PRODUCING METALLIC COATINGS AND PARTICULARLY LEAD COATINGS

Filed Jan. 4, 1929

FIG. 1

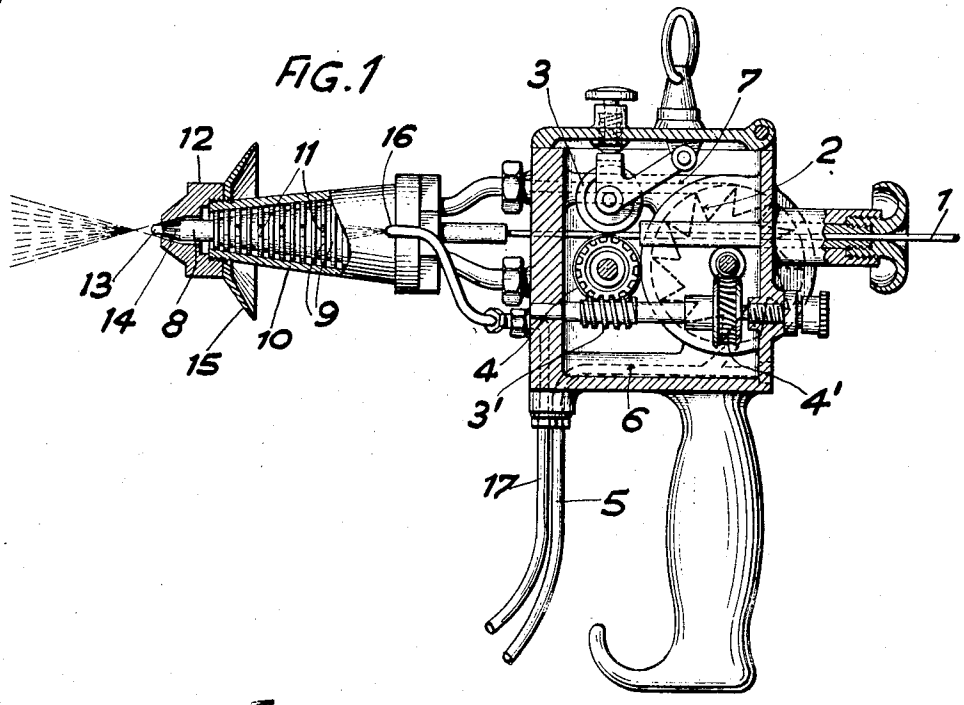


FIG. 2

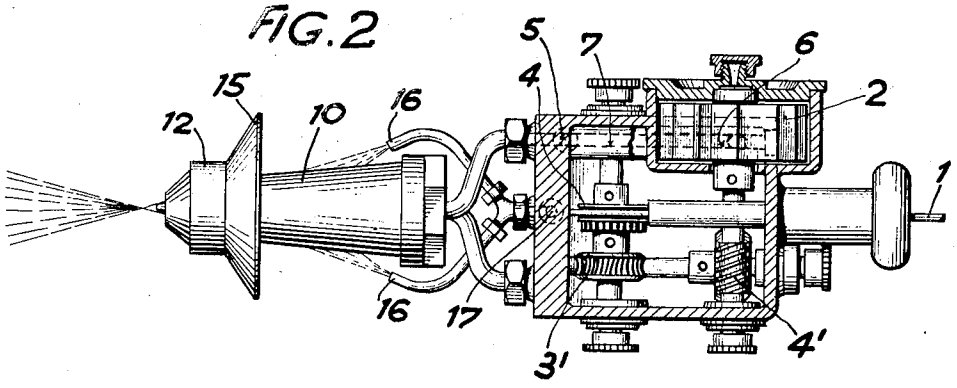


FIG. 3

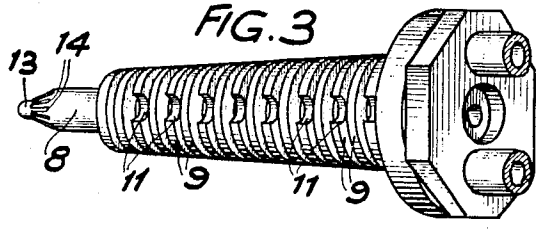
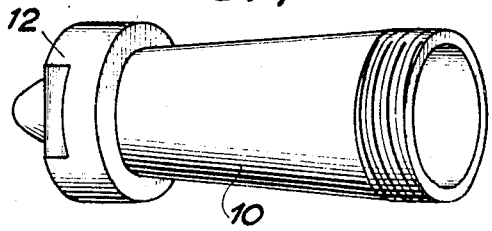


FIG. 4



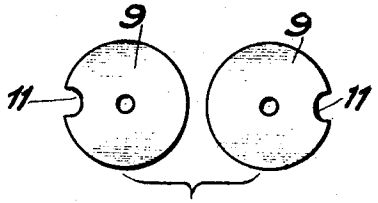


FIG. 5

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UNITED STATES PATENT OFFICE

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METHOD AND DEVICE FOR PRODUCING METALLIC COATINGS AND PARTICULARLY LEAD COATINGS

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In producing coatings according to my known metallizing process the metal to be deposited passes through a flame by which it is melted and is then projected on to the object to be coated either by the action of the blow flame or of a stream of compressed air.

Further it has already been proposed in the production of coatings, particularly of metal, to melt the coating material (preferably in the form of dust or powder) and project it on to the object to be coated by means of a highly heated compressed gas and preferably by means of compressed air.

To both processes drawbacks of a fundamental nature are inherent; the coating material gets into contact with atmospheric air as well as with the combustion gases of the flame and this is a considerable disadvantage and renders impossible the production of a faultless coating as the metal oxidizes. The temperature of the blow flame cannot be regulated and is so high that an excessive overheating of the metal must occur at the melting place which enhances an oxidation of the atomized metal (large reaction surface). These disadvantages are overcome with the method according to the present invention in that the melting of the respective metal is caused in the interior of the nozzle head, i. e. under total exclusion of atmospheric air and a suitably heated pressure gas is used which has no oxidizing effect. It is particularly pointed out that the comparatively low temperature of the melting process is one of the characterizing features of the present invention. It may be mentioned that it took not less than 20 years to arrive at this cognition; my first experiments have been made in summer 1908 and from these experiments the present technics of atomizing metals has crystallized. The novel process is particularly adapted for producing coatings of lead and tin; in the following for sake of simplicity the coating material will be called a lead wire. The feed of the lead wire will be caused by means of the same current of compressed gas, for instance of carbonic acid, which has to effect the melting, atomizing and projecting of the material and by these measures the material does not get into contact with atmospheric air until after the coating has been produced.

The heating of the compressed gas is effected in the most convenient manner by the aid of a heating device or glow head through which the compressed gas is conducted for being heated. This device comprises an inner core, on which disks acting as baffle plates are provided in order to reduce the velocity of the flow of the gas, and an outer cover having a conical bore and fitting exactly on the suitably shaped circumferences of the disks.

A constructional example of a device for carrying into effect the process according to the present invention is illustrated on the accompanying drawings, in which:

Fig. 1 shows the apparatus diagrammatically and for the greatest part in a vertical section,

Fig. 2 is a horizontal section of the apparatus,

Fig. 3 shows the core of the heating device,

Fig. 4 shows the cover of the heating device, and

Fig. 5 shows two adjacent disks.

The apparatus is constructed in the manner of the metallizing pistols and the coating material, for instance, the lead wire 1 is fed into the heating device at a regulable speed by means of the feed rollers 3, 4 driven by a turbine wheel 2 by the aid of two worm gearings 3′ and 4′ for speed reduction purposes. The turbine is actuated by the compressed gas, which is supplied by the hose 5 and led to impinge on the turbine wheel by the channel 6, so that the feed of the piece of coating material is effected by this gas. The gas leaving the turbine wheel flows through the channel 7 to the heating device.

The heating device comprises an inner core 8, on which a plurality of disks 9 arranged one behind the other at a small distance from each other are seated, and an outer cover 10. The inner core 8 and the disks 9 may also be made in one. The cover 10 has a conical bore and is exactly fitted (by grinding) to the correspondingly shaped circumferences of the disks. The compressed gas must pass between the core and the cover of the heating

device and in order to reduce the velocity of the flow of the gas and to provide a path in the heating device that is as long as possible the disks 9 act as baffles in as much as notches 11 which permit the passage of the gas, are angularly displaced through 180° (Fig. 5) in adjacent disks.

On the front end of the cover 10 a nozzle head 12 is screwed the bore of which together with the conical end 13 of the core 8 forms a nozzle. The conical end 13 is provided with grooves 14 uniformly spaced around the circumference of the cone and axially directed; the gas flows through said grooves and a uniform conical jet is formed thereby. At the rear of the nozzle head 12 a protecting disk 15 is arranged.

The heating of the heating device and thereby the indirect heating of the gas is effected by means of two combustible gas-oxygen flames sweeping the cover 10, and produced by the burner nozzle 16 as illustrated in Fig. 2. By means of the hose 17 the combustible gas mixture is supplied to the nozzle 16.

In utilizing oxygen-hydrogen flames local temperatures of appr. 3000° C. will be reached. The selection of a suitable material for the heating device which is heat resisting for a comparatively long time presented considerable difficulties as the usual materials for such purpose such as chromium steel, alloys of nickel and others have high melting points, which, however, are much below 3000° C. I have succeeded to solve this task completely by making use of the following novel cementation process: The parts 8, 10 and eventually 12 of the heating device are made of mild steel, they are then cleaned and coated with a layer of aluminium. The parts treated in this manner are thereupon embedded in a mixture of pulverized charcoal and bauxite and heated in a cementing box to a temperature of appr. 800° C. during four hours under exclusion of atmospheric air. This thermical treatment causes on account of the diffusion of aduminium into the mild steel the formation of an interesting and surprisingly heat resisting alloy of the composition Fe-Al_2O_3. The converted surface layer has as a rule a thickness of 1, 5 mm. and is so hard that the grinding of the parts for fitting them into the conical cover 10 can only be made with carborundum disks.

Heating devices treated in this manner have a life of 7–8 months according to the experiments made up till now, after that period the outer cover 10, which is subjected to the narrow flames, has to be replaced. The conical form permits an easy assembling and taking to pieces of the heating device.

The compressed gas which is led through the heating device should show a temperature of 300–350° C. at the discharge end, in order to prevent an excessive heating of the lead; only under these conditions an optimal effect is obtained, i. e. a homogenous coating of lead which is free of pores and has the physical and chemical properties inherent to lead.

Any contact of the lead with the atmospheric air or with the flame after the lead has been introduced into the heating device is totally excluded. The protecting cover 15 prevents the flames and the combustion products to get into contact with the cone of the atomized material and to unfavorably influence the latter. Therefore no oxidation can possibly occur and this accounts for the fact that according to the present invention sound, ductile and dense lead or tin coatings may be produced, which coatings are of considerable importance for the chemical and food-stuff industries.

The adhesive properties of the lead coatings, which may be produced in any thickness, on iron and steel are very good and in contradistinction to the hitherto known methods the novel method permits to coat cast iron objects. Obviously the object to be coated, previous to the coating process has to be carefully cleaned and heated. In certain cases a preliminary coating with tin is advisable as is usual in the typical homogeneous lead covering art. Whether the preliminary coating has to be made or not depends on the nature of the object to be coated as well as on the service to which the coating is subjected. If the coating is highly strained in service the resisting properties of the coating against chemical influences may be essentially improved by applying a coating of pulverized Al_2O_3, bauxite, porcelain or the like on the lead coating or by applying water glass, that is to say metallic coatings and non-metallic coatings are alternately deposited on the object.

In order to produce these non-metallic coatings preferably the same apparatus may be used as above described for the metallic coatings with certain alterations. The latter consist in inserting a small tube into the channel serving for taking up the metallic wire in order to feed the pulverized material throug this tube to the mouth of the nozzle. The material is heated as it passes through the heating device; if necessary an increased melting heat may be produced by removing the cover 10 or by increasing the flames.

It may further be mentioned that during the working no vapours of lead and no lead dust are generated so that the operators are able to work without using any protection device such as face masks and the like.

I claim:

1. A device of the type described, comprising a device for heating a compressed gas and having an inner core, disks acting as baffles provided on said core, an outer cover having a conical bore and fitting ex-

actly on the correspondingly shaped circumference of said disks, means producing a flame impinging on said outer cover, means to supply gas to the intermediate space between said inner core and said cover, a nozzle head at the outer end of said core for discharging said gas for atomizing purposes, and means to feed the coating metal through said heating device in which it is melted by said heated gas, atomized and projected against the surface to be coated.

2. A device of the type described, comprising a device for heating a compressed gas and having an inner core, disks acting as baffles provided on said core, an outer cover having a conical bore and fitting exactly on the correspondingly shaped circumference of said disks, means producing a flame impinging on said outer cover, means to supply gas to the intermediate space between said inner core and said cover, a nozzle head at the outer end of said core for discharging said gas for atomizing purposes, and means to feed the coating metal through said heating device in which it is melted by said heated gas, atomized and projected against the surface to be coated, the outer end of said core being provided with axial grooves.

3. A device of the type described, comprising a device for heating a compressed gas and having an inner core, disks acting as baffles provided on said core, an outer cover having a conical bore and fitting exactly on the correspondingly shaped circumference of said disks, means producing a flame impinging on said outer cover, means to supply gas to the intermediate space between said inner core and said cover, a nozzle head at the outer end of said core for discharging said gas for atomizing purposes, means to feed the coating metal through said heating device in which it is melted by said heated gas, atomized and projected against the surface to be coated, and a protecting disk arranged on the rear end of said nozzle head.

4. A device of the type described, comprising a device for heating a compressed gas and having an inner core, disks acting as baffles provided on said core, an outer cover having a conical bore and fitting exactly on the correspondingly shaped circumference of said disks, means producing a flame impinging on said outer cover, means to supply gas to the intermediate space between said inner core and said cover, a nozzle head at the outer end of said core for discharging said gas for atomizing purposes, means to feed the coating metal through said heating device in which it is melted by said heated gas, atomized and projected against the surface to be coated.

5. A device of the type described, comprising in combination, means to feed the coating metal operated by a turbine driven by a compressed indifferent gas, a device for heating a compressed gas and having an inner core, disks acting as baffles provided on said core, an outer cover having a conical bore and fitting exactly on the correspondingly shaped circumference of said disks, means to supply a compressed indifferent gas to the intermediate space between said inner core and said cover, means to produce a flame impinging on said outer cover for heating said compressed gas on its passage through said intermediate space, a nozzle head at the outer end of said core for discharging said gas in jet form, and means for feeding the coating metal through said heating device in which it is melted by said heated gas, atomized and projected against the surface to be coated.

In testimony whereof I have signed my name to this specification.

MAX ULRICH SCHOOP.