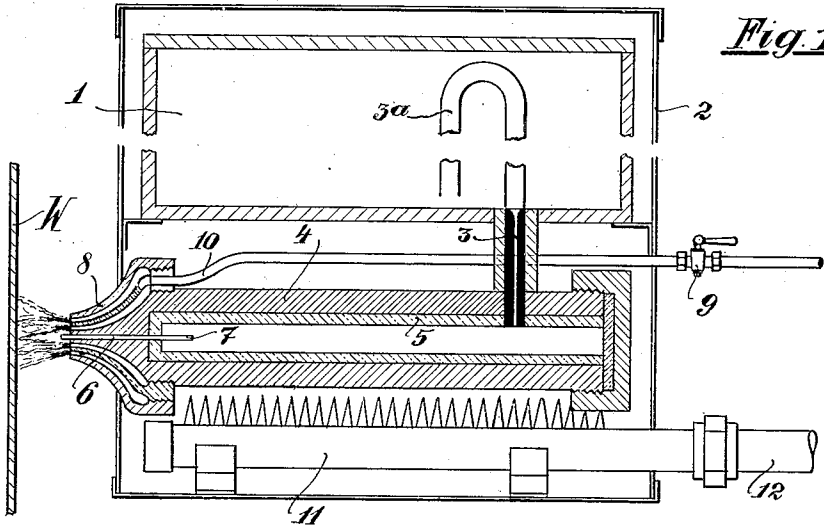


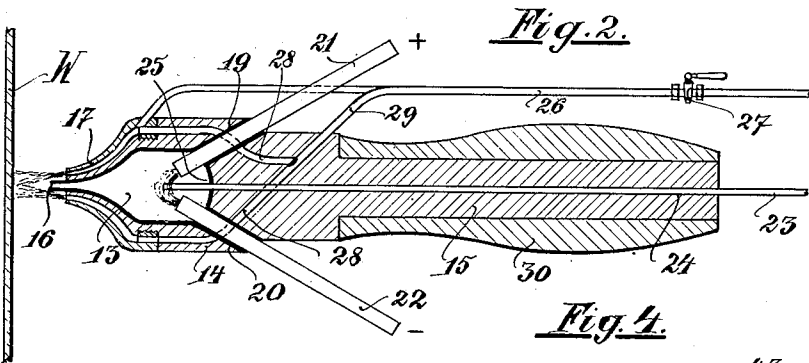
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 APPARATUS FOR MAKING METALLIC COATINGS.  
 APPLICATION FILED JUNE 2, 1914.

1,262,134.

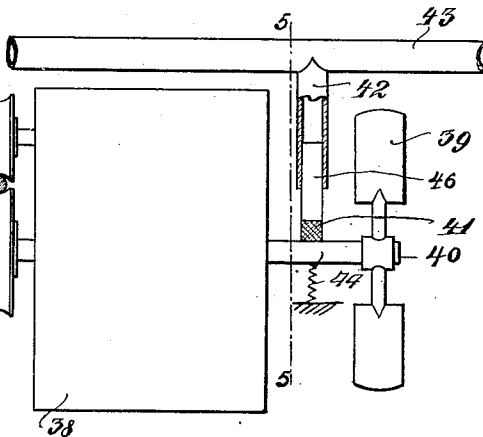
Patented Apr. 9, 1918.



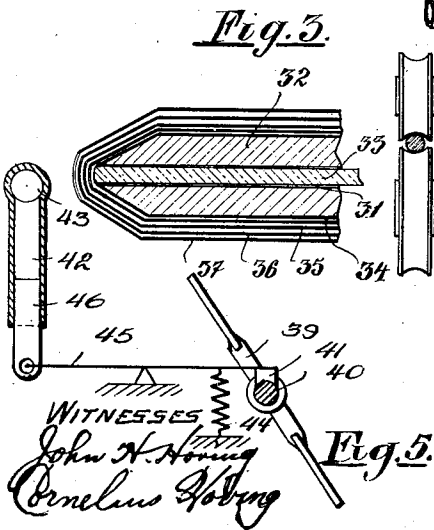
*Fig. 1.*



*Fig. 2.*



*Fig. 4.*



*Fig. 5.*

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# UNITED STATES PATENT OFFICE.

GEORG STÖLLE, OF KIEL, GERMANY.

## APPARATUS FOR MAKING METALLIC COATINGS.

1,262,134.

Specification of Letters Patent.

Patented Apr. 9, 1918.

Application filed June 2, 1914. Serial No. 842,410.

### *To all whom it may concern:*

Be it known that I, GEORG STÖLLE, a citizen of the German Empire, residing at Kiel, in the Kingdom of Prussia, Germany, have  
5 invented certain new and useful Improvements in Apparatus for Making Metallic Coatings; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable  
10 others skilled in the art to which it appertains to make and use the same.

In British Patent No. 23289/1913 a process for making metal coatings by means of a compressed gaseous medium is described,  
15 in which the metals in a wholly or partially volatilized condition are blown against the article to be coated. The object of the volatilization is to obtain such a fine distribution of the metal as cannot be obtained by  
20 the spraying method with any other means, and also to utilize the kinetic energy of the vapor in order to produce a brazing or welding of the metal particles with one another and with the foundation.

Now this invention has for its object an apparatus for practising a further development of this process with the object of substantially lowering the point at which the molten metal volatilizes, and enabling coatings  
30 to be made on easily inflammable articles or articles which suffer by the action of heat.

The improved process is firstly based on the discovery that the volatilization point of the metal is substantially lowered if the volatilization of the metal is done in a vacuum chamber; and further in the improved process, use is made of the discovery that volatilized metals which are blown through a jet  
40 of gas at ordinary temperature, which may be chemically inert or neutral, and thereby cooled, when cooling down to metal dust lose nothing of their fine distribution and therefore when blown simultaneously  
45 against a foundation or article give a coating of such fineness as can never be attained with sprayed molten metals.

In carrying out the process, the metal vapor from the volatilizing chamber is  
50 drawn through a suction nozzle which acts as an injector and is operated with a compressed gaseous medium, whereby a vacuum is formed in the volatilizing chamber and the current of gas also produces a cooling of the  
55 volatilized metal particles and the resultant

metal dust is thrown on to the body which is to be coated or metalized.

Examples of construction of the necessary apparatus for carrying out the improved process are shown in the accompanying  
60 drawings, in which:—

Figure 1 is a section of an apparatus in which the metal is introduced in a molten condition into the volatilizing chamber;

Fig. 2, a form of construction of the apparatus in which the metal reaches the volatilizing chamber in a bar form, and is melted in an electric arc;

Fig. 3 shows another melting device for this form of construction in which the metal,  
70 in rod form, is melted, vaporized and whirled about by a plurality of oxyhydrogen flames or the like.

Fig. 4 shows an apparatus for pushing forward the metal bar in the apparatus illustrated in Fig. 2.

Fig. 5 is a fragmental sectional view taken on the line 5—5 of Fig. 4.

In the form of construction of the apparatus according to Fig. 1, 1 is a molten  
80 metal holder filled with the molten metal; this container and the other parts of the apparatus are disposed within a casing 2. A capillary tube 3 lined with fireclay or the like leads from the vessel 1 to a  
85 volatilizer 4 which is also provided with a lining 5 of fireproof material, and is conically formed at the end 6, which when in operation faces the work W. The volatilizing nozzle 7 is inserted in this end in such  
90 manner that it projects somewhat beyond the front end of the cone 6. A conical suction nozzle 8 is arranged at the same end to which the compressed gas is supplied through a pipe 10 provided with a cock 9.  
95 Beneath the volatilizer 4, are provided heating means 11 consisting of any known arrangement to which the combustible flows through a pipe 12.

When working with the apparatus, the  
100 heater 11 is first set in operation, and the gases therefrom keep the metal in a molten condition in the container 1. A thin jet of molten material is forced through the capillary tube 3 into the vaporizer 4 where the  
105 metal, under the action of the heating apparatus, is heated so far that vapor is formed. When compressed gas is admitted through the pipe 10 into the suction nozzle 8, a vacuum is formed, by reason of the escape  
110

of gas, in front of the mouth of the volatilizer nozzle 7, which vacuum draws the metal vapor from the volatilizer 4, and also lowers the volatilization point of the molten metal. The escaping metal vapor is cooled by the action of the compressed gas and can be condensed to metal dust, and simultaneously thrown against the work W on which it consequently forms a dense coating of permanent permanency.

The capillary pipe 3 has a continuation which is shown in Fig. 1 and indicated by 3<sup>a</sup>. This pipe acts as a siphon, and the molten metal is drawn into the volatilizer by the vacuum formed in front of the volatilizer nozzle 7.

In the form of construction shown in Fig. 2, the volatilizer 13 is constructed in the front end 14 of a holder 15 provided with a handle 30. At the front end of the volatilizer 13 a volatilizing nozzle 16 is arranged which projects beyond the suction nozzle 17 in similar manner to what was the case in Fig. 1. In the arrangement shown in Fig. 2, arc-light carbons 21 and 22 serve for melting the metal and are carried by tubular parts 19 and 20 and project into the chamber 13 and between them is arranged the solid metal 23 in the form of a bar, which is carried in an axial perforation 24 of the holder 15 and passes through an aperture 25 in the rear part of the volatilizer 13.

A pipe 26 with a cock 27 is connected with the suction nozzle 17, from which pipe a branch pipe 29 with a second arm 28 can also be connected with the nozzle 17 for the purpose of cooling the front end 14.

In using the apparatus shown in Fig. 2, an arc is formed between the carbons 21 and 22, and the metal bar 23 is slowly pushed forward, when the metal is converted into the form of vapor which is then drawn through the suction nozzle 17, and blown against the work W.

In the form of construction according to Fig. 2, instead of electric melting, a device may also be employed for melting by means of a gas blast flame. This is shown more particularly in Fig. 3. Here, gas nozzles 34, 35 and 36, 37 are arranged concentrically one in another and are coaxial with the perforation 31 of the guide 32 of the metal bar 33, and the blast flames of the nozzles act successively on the metal; the inner nozzles 34, 35 serve for melting the metal and volatilizing the molten metal, while the outer nozzles 36, 37 produce a further increase in the heat of the molten metal dust particles which are blown against the work in a disintegrated condition corresponding to this heat with or without the assistance of a compressed gaseous medium.

This arrangement has for its object to convey the metal which is to be applied by

means of a separate apparatus through two sets of flames which inclose one another, and act successively, and thus first to melt and if desired to disintegrate the metal into the smallest units and then to bring it into the hottest zone of another gas blast flame in which it is subjected to a further increase of heat causing volatilization before it is blown against the work.

According to the invention the bar shaped body is fed by some outside means for instance a clock work 38 which is provided in the usual manner with a fly wing governor 39. In order to effect the feeding of the wire or metal rod 23 quicker or more slowly correspondingly with the pressure of the projecting gases, there is provided a brake stop 41 which presses upon the governor shaft 40 and is fixed to a lever 45 operating under the action of a spring 44 and which therefore is pressed constantly against the shaft 40 or a disk on that shaft by the action of the spring. At the other end of the lever there is provided a piston 46 which moves in a branch 42 of the pressure gas feed pipe 43 and is thus acted upon by the compressed gas. When the gas pressure increases there will be, by an overcoming of pressure of the spring, a release of the pressure on the governor shaft and the feeding of the wire will take place quicker than when the gas pressure is low. The current of compressed gas may of course also operate a resistance governor in an electromotor, if such be employed instead of a clock-work, and thus regulate the speed at which the bar is pushed forward. By employing an outside operating means to which any desired strength may be given, the arrangement is made entirely independent of the strength of the compressed gas. This is preferably only utilized for producing a regulation of the outside operating means.

The process which may be carried out by this apparatus is described and claimed in my U. S. Letters Patent 1,221,104, Apr. 3, 1917, and an analogous process in my application Serial Number 855,691, filed Aug. 7, 1914.

I declare that what I claim is:

1. Apparatus for making metal coatings comprising a volatilizer, means to supply metal thereto, a nozzle, means to supply compressed inert gas to said nozzle, and means to supply gaseous metal to the low pressure zone of the nozzle.

2. Apparatus for making metal coatings comprising a vaporizer, a container for molten metal, a pipe leading from the container to the vaporizer, a nozzle, means to supply compressed gas to the nozzle, and means to supply metallic vapor to the low pressure zone of the nozzle.

3. Apparatus for making metal coatings comprising a vaporizer, a container for

molten metal, a capillary pipe leading from  
the container to the vaporizer, a nozzle,  
means to supply compressed gas to the nozzle,  
and means to supply metallic vapor to  
5 the low pressure zone of the nozzle.

4. Apparatus for making metal coatings  
comprising a vaporizer, a container for  
molten metal, a capillary pipe adapted to  
act as a siphon leading from the container  
10 to the vaporizer, a nozzle, means to supply

compressed gas to the nozzle, and means to  
supply metallic vapor to the low pressure  
zone of the nozzle.

In testimony whereof I affix my signature  
in presence of two witnesses.

GEORG STÖLLE.

Witnesses:

JULIUS RÖPKE,

KARL FRIEDRICK FRENZEL.