PUBLISHED

MAY 18, 1943.

BY A. P. C.

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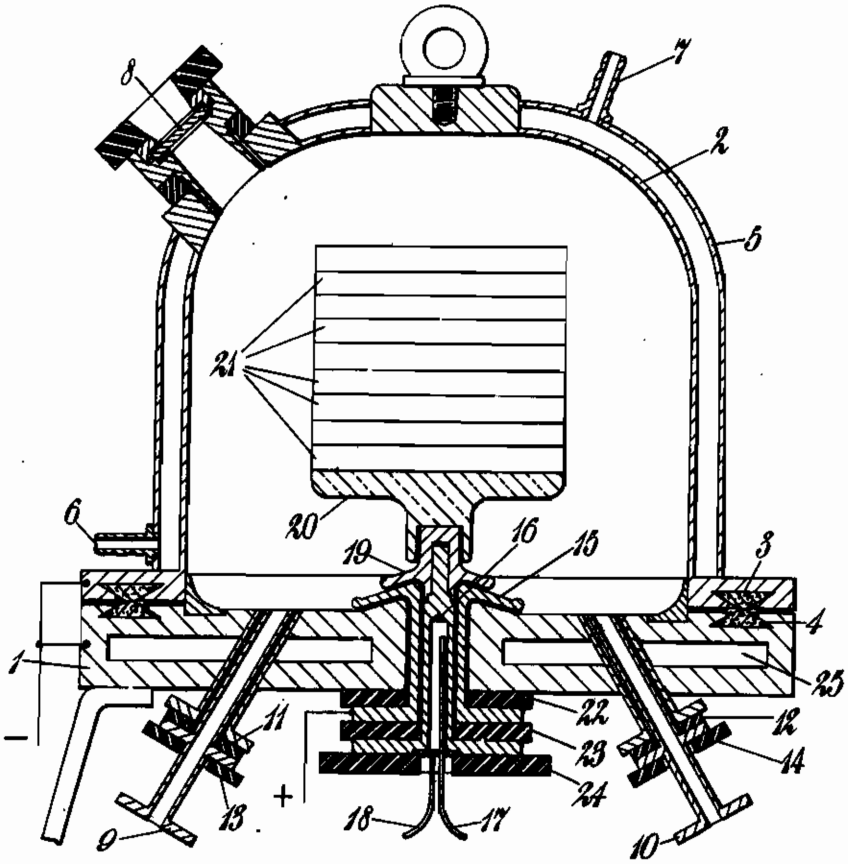
Filed Oct. 3, 1938

Serial No. 233,139



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Published May 18, 1943

Serial No. 233,139

ALIEN PROPERTY CUSTODIAN

METHOD OF METALLISING ARTICLES BY MEANS OF CATHODE DISINTEGRATION

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Application filed October 3, 1938

This invention relates to a method of metallising articles by means of cathode disintegration which is distinguished by the fact that the whole discharge energy which is applied to the cathode to be disintegrated amounts to at least 5 kw. at a minimum current of 5 amp. In order to be able to stand up to the high output the cathode is constructed so that it can be cooled; advantageously the cathode forms the vessel wall of the disintegrating chamber, which is surrounded by a coolable jacket through which can be led a cooling agent such as water, oil or air. The disintegration is effected at a pressure of 40 to 0.01 mm., and preferably at 5 to 0.1 mm., of mercury.

Experiments have shown that the quantity disintegrated off increases with the discharge intensity. In the case of disintegration of small electrodes the disintegration intensity may be produced in the main only by voltage increase, discharge current strengths above 2 amps. not being produced. The opinion generally prevails that electric outputs in cathode disintegration in the case of a total current of above 2 to 3 amps. are no longer possible since in consequence of the great cathode drop and the resulting great force on the cathode, arc formation takes place, that is to say a striking over into the so-called glow arc. Furthermore, there is also the opinion that the cathodes of large surface are uneconomical for the disintegration owing to the back diffusion of the particles disintegrated off. Experiments have now shown that even at cathodes of large surface the same quantity is disintegrated off per square cm. if the applied intensity per surface unit is chosen suitably high. In order to be able to use cathodes of large surface with a corresponding special discharge intensity, such as is employed in the case of thin wires, all together large current strengths are necessary or else only very small surfaces can be disintegrated. With suitable formation of the current lead in (anode), contrary to this opinion current strengths up to 50 and 100 amps. can be forthwith applied to a large surfaced cathode, even the discharge intensity per square cm. of surface of the cathode amounting up to 20 watts. If as a result of cooling the cathode the heat loss cannot reveal itself as a harmful temperature rise of the same, the discharge intensity per square centimetre of surface may be increased to any desired height. The total current strength may therefore assume values which may lie even above 100 amps. without the operative certainty of the discharge being impaired. The quantities then disintegrated off are proportional to those quantities which thin wires have attained as most favourable values in the disintegration. The current lead in to the anode, which in the case of alternating current operation may for a brief time be cathode, is protected by the interpositioning of a vacuum gap between the wall of the vessel and it. Behind this vacuum gap, which may have a space distance of 5 to 0.1 mm., there is the electrical insulating material proper. The vacuum gap interposed before the insulating material prevents the metallisation of the said material and consequently the feared arc formation in the case of high total discharge currents. In the case of the cathode being disintegrated being constructed in the form of a vessel, the voltages with high current densities on the cathode were comparatively small. Thus for example even with an applied voltage of 1000 volts a specific load of 30 watts per square centimetre could be attained on the cooled cathode. The total current strength on the discharge then amounted to 50 amp. The surface of the cathode to be disintegrated amounted to 1700 per square centimetre.

In the accompanying drawing one constructional form of the invention is shown schematically in some detail by way of example, the drawing showing a sectional elevation through an apparatus for metallising articles by means of cathode disintegration.

The cathode disintegration apparatus consists of a lower part 1 and a removable upper part 2, which are connected in vacuum-tight fashion by means of the seals 3 and 4, and which individually or jointly form the cathode. The total discharge output in the cathode disintegrating chamber amounted according to the invention to at least 5 kilowatts and the current strength to at least 5 amps. The load per square centimetre of the cathode surface amounted to at least 1 watt, preferably 3 to 60 watts per square centimetre. The upper part 2, constructed for example in the form of a hood, is provided with a cooling jacket 5 to which a cooling medium may be supplied through the lead 6, which medium can be run off through the outlet 7. In the upper part an opening is also provided which is closed off by means of a viewing window 8. The insulated pipe connection 9 arranged in the lower part has connected to it a vacuum pump (not shown) by means of which preferably a pressure of 10.0 to 0.05 mm. of mercury can be adjusted. The lower part 1 also possesses a pipe connection 10, which likewise is insulated with respect to the cathode. The parts 11 and 12 are insulating rings and the parts 13 and 14 are insulating and pressing-on rings. A pressure indicating appliance may be attached to the pipe connection 10, and through the pipe connection 18 there may also be supplied a filling gas in regulated quantity by way of a regulating valve which is not shown. According to the material employed to be disintegrated there may be used as filling gas an inert gas, such as argon, krypton, xenon, helium, or a reducing gas, such as hydrogen, hydrocarbon or the like, the gas being employed stationarily or in flow. Nitrogen, ammonia or similar gases may also be employed if an action on the for example metallic material being annealed is intended before, during, or after the cathode disintegration. Gases or vapours may be supplied which have chemical actions on the material. In the lower part 1 the anode 15 is also arranged, insulated and screened off, as well as the lead-through element 16 which is constructed hollow and to which a cooling agent may be supplied through the lead 17, and led off through the lead 18. Between the anode 15 and the lower part 1 of the vessel there is a narrow gap of labyrinth form, which is so narrow that no glow discharge in the gap is possible. Also between the anode 15 and the lead-through element 16 there is a similar narrow gap of labyrinth form. The lead-through element 16 carries by means of an insulating screen pin 19 for example a quartz plate 20 on which the material 21 is disposed in insulated manner. The parts 22 and 23 are insulating rings and 24 is an insulating and pressing-on ring which is pressed on by a screw means which is not shown. The part 25 is a cooling duct which may be supplied with a cooling agent.

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