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R. J. COWAN ET AL

1,905,810

LOW TEMPERATURE BRIGHT ANNEALING

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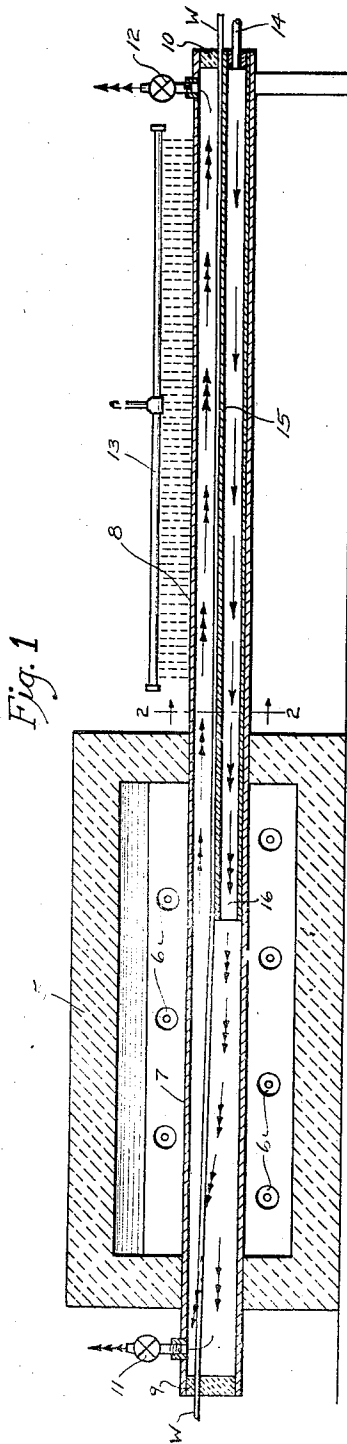
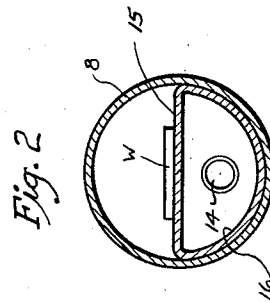


Fig. 3

RAW GAS
PARTIAL DISSOCIATION
COMPLETE DISSOCIATION

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LOW-TEMPERATURE BRIGHT-ANNEALING

Application filed December 29, 1930. Serial No. 505,240.

This invention relates to the art of bright-annealing metals and has for its object to provide a process wherein hydrogen or a hydrogen-bearing gas may be used as the cleaning agent. More particularly it is an object of the invention to provide a process for the bright-annealing of metals that must be heat-treated at relatively low temperatures, for example at temperatures between 800 and 1200° F.

Conspicuous among the metals which must be annealed between the temperatures indicated is brass. So-called bright-annealing of this metal has at the best produced no more than a lack-lustre finish irrespective of the cleaning gas employed.

We have discovered that brass and other metals which must be annealed at relatively low temperature can be given a lustrous finish during the annealing operation by subjecting the metal to the action of hydrogen or a hydrogen-bearing gas provided the hydrogen or said gas is heated above a certain minimum critical temperature of 1200° F. With an iron (steel) or a chromium-nickel reaction chamber, the minimum temperature is 1200° F., but in practical operation a minimum temperature of 1300° F. is found most suitable. Hydrogen or a hydrogen-bearing gas heated above said minimum temperature we term "activated" hydrogen. For convenience of description, hydrogen and hydrogen-bearing gas before such heating will be called "raw" gas.

The manner of activating the raw gas as said and at the same time preventing the metal from being over-heated is substantially as follows: The reaction chamber is maintained at a temperature above 1200° F. preferably above 1300° F. The raw gas is admitted into this reaction chamber, the gas being preferably first preheated. The metal is then passed through the reaction chamber at such a speed that the desired annealing temperature will be attained but not exceeded.

It is of course important that after being brought to annealing temperature the metal be cooled before being brought into contact with the open air. To this end, the metal is passed through a cooling chamber wherein

an atmosphere consisting of spent activated gas may be maintained. In practical operation, the reaction chamber and cooling chamber form one continuous tube the reaction chamber being contained within a furnace the temperature of which may be readily controlled.

Preheating of the raw gas is preferably effected by abstraction of heat from the cooling chamber. To this end, the raw gas is passed through a conduit contained within the cooling chamber, this conduit terminating within the reaction chamber.

We have referred to a hydrogen-bearing gas as well as hydrogen as such. Among the hydrogen-bearing gases which have been successfully used are ethane, methane, propane, butane, ethylene and ammonia. The hydrogen liberated by these gases at the said minimum temperature will give the desired result. Of the various hydrogen-bearing gases mentioned, propane is preferred since it is a relatively cheap substance.

For a more complete understanding of the invention, reference is made to the detailed description taken in connection with the accompanying drawing, wherein the preferred form of heat-treating apparatus is shown.

Referring to the drawing,—

Fig. 1 is a longitudinal section through said apparatus;

Fig. 2 is a section on line 2—2 of Fig. 1, and

Fig. 3 is explanatory of certain legends used in connection with Fig. 1.

In the drawing, 5 indicates any suitable heating furnace, the same being shown as provided with upper and lower tiers of gas burners 6. Extending through the furnace is a muffle 7. Formed as a continuation of the muffle is a cooling chamber 8. The muffle and cooling chamber therefore constitute an elongated tube through which the work is to be passed. The work is indicated at W and as shown is in strand form, which is to be understood as being representative of wire and strip, the invention being particularly well adapted for bright annealing strand material. Said tube is closed at both ends 9 and 10 except for an inlet and outlet

for the work as will be readily understood. At each end of the tube is a valve controlled vent indicated at 11 and 12. As a means for assisting in cooling the cooling chamber 8 there is indicated a water spray 13.

14 indicates a pipe leading from a supply of hydrogen or hydrogen-bearing gas. It is preferred that the raw gas be preheated before being introduced into the muffle or reaction chamber 7 and to this end there is placed within the cooling chamber a partition 15 which divides the cooling chamber into upper and lower sections or passages, the raw gas being introduced into the lower passage for flow into the muffle. Since it is essential that none of the raw gas enters the cooling chamber it is preferred to employ a D-tube 16 the flat side of which constitutes the partition 15. It will be noted that the D-tube extends into the muffle. The point where this tube terminates is the point of highest temperature within the muffle. If it be preferred to provide a continuous support for the work, the tube 16 may be continued to the inlet end of the muffle but in such event the extended partition should be perforated to permit free escape of the heated gas.

The work is passed through the heat-treating tube (muffle 7 and cooling chamber 8) by any preferred reeling and unreeling mechanism, not shown. The muffle is preferably made of a substance which has a catalytic effect on the hydrogen. Iron and steel, chromium-nickel alloys have such effect the latter material being preferred because of its heat resisting properties. While the minimum temperature for activating the hydrogen may be as low as 1200° F. it is preferred to employ a higher temperature in order to more quickly heat the work. In order to prevent overheating of the work, it is passed through the heat-treating tube at such a rate that the desired annealing temperature will not be exceeded. Practically speaking, there is no upper critical temperature beyond which the hydrogen must not be heated. There is, however, a lower critical temperature below which the hydrogen will not be activated for the purpose in view, and that lower critical temperature is 1200° F., as already stated. For bright-annealing brass, the preferred temperature within the muffle is 1300° F.

Before the work is passed through the heat-treating tube, the latter must be thoroughly purged of air. This is effected by allowing the heated gas to flow from both ends of the tube through the vents at either end thereof. In normal operation, the vent 12 at the discharge end of the cooling chamber will be so restricted that but little gas from the muffle will flow into the cooling chamber of its own accord, it being important that most of the gas flow towards the incoming work. To this end, the vent at the inlet end of the

muffle will be relatively unrestricted and the gas admitted into the muffle will be under suitable pressure.

Due to the relatively high temperature differential between the reaction chamber or muffle and the work, the latter is passed through the muffle at relatively high speed especially when the work is relatively thin strip or small size wire. The speed at which the work may be passed through the reaction chamber is immaterial insofar as the cleaning effect of the activated hydrogen is concerned, since its effect on the heated work is immediate.

From the foregoing description it will be understood that the active cleaning agent is hydrogen and that insofar as the present invention is concerned it is immaterial whether the hydrogen be in a commercially pure state or whether it be produced as a result of thermal decomposition of a gas containing hydrogen in chemical combination.

While the invention is particularly well adapted to the continuous bright annealing of strand material such as wire and strip, nevertheless it is also applicable to the bright annealing of metals requiring a conveyor to carry it through the heat treating tube.

What we claim is:

1. In a method of preventing the formation of and removing surface tarnish on non-ferrous metals which are to be heat-treated at temperatures not substantially in excess of 1200° F., the steps comprising continuously passing a gas containing hydrogen through a heating chamber maintained at a temperature substantially in excess of 1200° F., moving the metal through said chamber in a direction opposite to the flow of the gas and at such a rate that the desired heat-treating temperature will not be exceeded, continuing the movement of the metal through a cooling chamber, and continuously passing through the cooling chamber in the same direction of flow as the metal some of the gases from the heating chamber.

2. In a method of preventing the formation of and removing surface tarnish on non-ferrous metals which require to be annealed at temperatures not in excess of 1200° F., the steps comprising continuously passing a gas containing hydrogen through a heating chamber maintained above 1200° F., passing the metal through said chamber in a direction opposite to the flow of said gas and at such rate that the desired annealing temperature will not be exceeded, continuing the movement of the metal through a cooling chamber, and continuously passing through the cooling chamber in the same direction of flow as the metal some of the gases from the heating chamber.

3. In a method of removing surface tarnish or oxide on non-ferrous metals while in a heated condition, the steps comprising heat-

ing the metal by moving it through an elongated heating chamber, initially heating a hydrogen gas out of contact with the metal to a temperature substantially the same as that of said chamber and continuously introducing the heated gas into said chamber intermediate the ends thereof, the temperature of said chamber being maintained above 1200° F. and the gas being capable of thermal decomposition with the liberation of hydrogen above 1200° F.

4. In a method of removing surface tarnish or oxide on non-ferrous metals while in a heated condition, the steps comprising heating the metal by moving it through an elongated heating chamber, initially heating a hydrogen gas out of contact with the metal to a temperature substantially the same as that of said chamber, continuously introducing the heated gas into said chamber intermediate the ends thereof, the temperature of said chamber being maintained above 1200° F. and the gas being capable of thermal decomposition with the liberation of hydrogen above 1200° F., and transferring the metal from said chamber to a cooling zone whereinto the gases from the heating chamber are free to flow.

5. In a method of removing surface tarnish or oxide on non-ferrous metals while in a heated condition, the steps comprising heating the metal by passing it through an elongated heating chamber, continuously introducing a heated gas into said chamber at a point intermediate the ends of said chamber, said gas containing free hydrogen gas, the heating chamber being maintained above 1200° F.

6. In a method of removing surface tarnish or oxide on non-ferrous metals while in a heated condition, the steps comprising heating the metal by passing it through an elongated heating chamber, continuously introducing a heated gas into said chamber at a point intermediate the ends of said chamber, the heating chamber being maintained above 1200° F., and the said gas being ammonia.

7. In a method of removing surface tarnish or oxide on non-ferrous metals while in a heated condition, the steps comprising heating the metal by passing it through an elongated heating chamber, continuously introducing a heated gas into said chamber at a point intermediate the ends of said chamber, and causing the gas to divide and flow the major portion towards the work inlet end of the chamber and the minor portion towards the work outlet end of said chamber, the heating chamber being maintained above 1200° F., and the gas containing hydrogen.

8. In a method of removing surface tarnish on metal articles while at a temperature ranging from 800 to 1200° F., the step comprising flowing in contact with said articles

a gas containing hydrogen at a temperature in excess of 1200° F.

In testimony whereof we affix our signatures.

ROYSEL J. COWAN.
ORVILLE E. CULLEN.

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CERTIFICATE OF CORRECTION.**Patent No. 1,905,810.****April 25, 1933.****ROYSEL J. COWAN, ET AL.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 24, strike out the words "of 1200°F"; page 3, lines 3 and 17, claims 3 and 4, respectively, for "hydrogen" read "hydrocarbon"; line 36, claim 5, for "gas" second occurrence, read "and"; and line 61, claim 7, before "gas" insert the word "said"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A. D. 1933.

(Seal)

M. J. Moore.
Acting Commissioner of Patents.