

PATENT SPECIFICATION

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(54) METHOD AND APPARATUS FOR SURFACE-TREATING A METAL WIRE, METAL EXTRUSION OR OTHER ELONGATED METALLIC MATERIAL

(71) We, KABEL-UND METALL-
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 GESELLSCHAFT, a body corporate or-
 ganised under the laws of Germany, of
 5 3000 Hannover, Vahrenwalder Strasse 271,
 Postfach 260, Germany, do hereby declare
 the invention, for which we pray that a
 patent may be granted to us, and the
 method by which it is to be performed, to
 10 be particularly described in and by the fol-
 lowing statement:—

The present invention relates to a
 method and an apparatus for surface-treat-
 ing a metal wire, metal extrusion or other
 15 elongated metallic material, for example a
 wire core which is to be plated.

In order to render the surfaces of rolled
 bars or wires clean and uniform, it is
 known first to pass the rolled material
 20 through a drawing die, next to feed it
 through a guiding means, and lastly to
 make the material thus prepared travel
 through a cutting means, whereby any im-
 purities and non-uniformities originally
 25 present on the surface of the material are
 eliminated (German Patent Specification
 No. 740,235). Downstream of the cutting
 means there may be a further drawing die
 whereby a higher mechanical strength can
 30 be obtained at the surface of the material.

The principal disadvantage of this
 arrangement is that the material which has
 passed through the (first) drawing die is af-
 terwards taken to the cutting means solely
 35 by a short guiding means, so that non-
 uniformities in the surface cannot always
 be avoided. This leads to certain dif-
 ficulties, more particularly if the treated
 material is to be used (for example) as a
 40 core on to which a surface layer is to be
 applied in a further treatment.

It is an object of this invention to enable
 an elongated metallic material to be given
 clean and uniform surface which will per-
 45 mit intimate contact to be made between

its surface and another metal layer applied
 thereupon.

According to the present invention, we
 provide a method of surface-treating a
 metal wire, metal extrusion or other elong- 50
 ated metallic material, wherein the elong-
 ated metallic material is supplied with an
 evaporating lubricant (as herein defined)
 and passed through a guiding means, is 55
 thereafter reduced in cross-section, and is
 thereafter pared, and wherein the parings
 thereby produced are detached at points
 which are at least 5 mm from the surface
 of the material. The material may be sup-
 plied with alcohol as the said lubricant. The 60
 term "evaporating lubricant" is in fact
 used herein to denote a lubricant having a
 volatility which is of an order comparable
 to that of alcohol, and the term "alcohol"
 65 is used herein with its ordinary meaning of
 "ethyl alcohol."

This supplying of the material with an
 evaporating lubricant has been found
 particularly advantageous for non-ferrous
 alloys, and more particularly for alumi- 70
 nium alloys. The reduction of the cross-
 section, which is preferably approximately
 5%, has the advantage that the surface of
 the material, which may be soft at the
 start, as in the case of an aluminium wire 75
 for example, can be hardened so that
 easier and more trouble-free paring removal
 is possible. As the material is reduced in
 cross-section just before the actual paring
 operation, even minor surface faults can be 80
 rectified; furthermore the material is pre-
 tensioned, so that it cannot deviate from
 the correct path during the subsequent par-
 ing. Thus, as the paring occurs just after
 the reduction in cross-section, no deviation 85
 is possible even at higher speeds. The
 economy of the operation is considerably
 increased by the accurate positioning of the
 material in connection with the reduction
 in cross-section. 90

As stated above, the parings are detached at points which are at least 5 mm from the surface of the material. This is necessary so that the movement of the parings is not adversely influenced by their being detached and so that the movement of the material is assisted, whereby high-quality pared surfaces are obtained.

If the material to be pared comprises a non-ferrous metal, e.g. aluminium, the introduction of an evaporating lubricant, e.g. alcohol, is particularly advantageous. For materials with oxidisable surfaces the passing through the guiding means, the reduction in cross-section and the paring are preferably effected under an inert gas, so that the material thus prepared can be further processed, e.g. plated, without difficulty.

A plating process which might thus follow the present paring step is described in German Published Specification ("Offenlegungsschrift") No. 2,052,462; in this, a surface-treated (i.e. pared) wire is enveloped under inert gas with a longitudinally fed copper strip bent round to form a tube. Thereafter a reduction in cross-section of at least 50% of the composite structure thus produced is effected, whereby an intimate metallurgical bond is formed between the core and the copper envelope.

In a method according to the invention it is advisable to employ an apparatus comprising a material guiding means which is in the form of a bushing, means for supplying the material with an evaporating lubricant (as herein defined), a drawing die, and a paring means placed not more than 6 mm behind the drawing die in the direction of travel of the material, rotary cutters being provided whereby parings produced by the said paring means are detached at points which are at least 5 mm from the surface of the material. The short distance between the drawing die and the paring means, i.e. the distance of not more than 6 mm just specified, is particularly valuable if a well pared surface is to be produced. It is possible by this means to obtain parings only a few tenths of a millimetre thick, so that the economy of the paring operation can be considerably increased.

In the apparatus referred to in the last preceding paragraph, the drawing die is preferably carried by a mounting which is adjustable with respect to the paring means from the outside of the apparatus, the paring means being stationary; for example the drawing die may be adapted to be adjusted, from the outside of the apparatus, by the displacement, in the direction of travel of the metallic material, of surfaces oblique to that direction of travel which co-operate with other surfaces ob-

lique to that direction of travel which are presented by the drawing die mounting.

If desired the paring means may have one or more passages whereby coolant and/or lubricant can be supplied to the material. For non-ferrous metals with which there might be a risk of cold welding taking place, it is advantageous to use alcohol. This evaporates as a coolant, and its vaporisation is particularly important in cases in which the material is required to be introduced afterwards into an inert gas chamber. If the material is to be passed through the guiding means, reduced in cross-section, and pared, while under an inert gas, the paring means may advantageously be accommodated in a housing which is open towards the bottom or which at least has downwardly directed apertures for the removal of the parings.

As indicated above, we provide rotary cutters to detach the parings at points which are at least 5 mm from the surface of the material; these rotary cutters ensure a disintegration of the parings after their free travel away from the pared material. The free and unobstructed removal of the parings is an important factor in the production of a well pared surface which is free from cavities, scratches and the like.

The invention will now be explained in greater detail with reference to the accompanying diagrammatic drawings, in which:—

Figure 1 shows in vertical axial section an aluminium wire surface-treating apparatus in accordance with the present invention, and

Figure 2 is an end elevation of the same apparatus.

In the surface-treating of elongated metallic materials having an oxidisable surface, e.g. aluminium wire, we use an apparatus which, as shown in Fig. 1, has a housing 2 provided with a transparent cover 1, into which inert gas can be introduced through passages not shown in the drawing. Within an outer bushing 3 provided in the housing 2, guide plates 4a and 4b are mounted; these can be moved to and fro in the axial direction by means of adjusting spindles 5 each provided with a collar disc 6, so that certain oblique surfaces of a guide bushing 7 which are in alignment with similarly-inclined oblique surfaces of the guide plates 4a and 4b can be utilised to produce a displacement of an inner bushing 8 and hence a displacement of a drawing die 9. The inner bushing 8 forms the material guiding means whereby the elongated metallic material (not shown in the drawing) is conducted to the drawing die 9. Both the inner bushing 8 and the drawing die 9 are accommodated in an intermediate bushing 10. The dotted lines in

Figure 1 show possible routes whereby the requisite evaporating lubricant may be fed to the material before it reaches the drawing die 9. When the drawing die 9 has to be replaced, the intermediate bushing 10 can be taken out carrying with it the inner bushing 8 and drawing die 9.

By means of the oblique surfaces of the guide bushing 7 and the oblique surfaces of the guide plates 4a and 4b, and by means of the adjusting spindles 5 each provided with a collar disc 6, the drawing die 9 can be displaced in the direction transverse to the direction of travel of the material, so that a perfect adjustment of the material with respect to the paring means is possible. Fig. 1 shows two to four sets of guide plates, all four of which can be adjusted by means of the adjusting spindles 5. For this purpose the adjusting spindles 5 each have two screw-threads, one left-handed and the other right-handed. The four sets of guide plates, two of which are shown in the drawing, are arranged at angular intervals of 90° around the guide bushing 7 so that the adjustment of the drawing die 9 can be effected by means of a rectangular locating assembly. The guide plates are supported externally in grooves provided in the outer bushing 3, and the inclination of the oblique surfaces on the guide bushing 7 is matched, as indicated above, by the inclination of the oblique surfaces of the guide plates. In the adjustment of the drawing die 9, which becomes necessary if the material travelling through is being pared on one side only and must therefore be centred with respect to the drawing die 9, those adjusting spindles 5 which have to be rotated to effect displacement in the requisite direction must be rotated simultaneously, in opposite senses of rotation, so that the guide plates on one side of the guide bushing 7 move up on the contiguous oblique surfaces and those on the other side move down. The collar disc 6 of each adjusting spindle 5 locates it in its correct axial position between the guide bushing 7 and intermediate bushing 10, and ensures the uniform displacement of the respective guide plates. Two clamping members 11 clamp the guide bushing 7 to the outer bushing 3, which is screwed to the housing 2. On the side adjacent to the paring means, there is a sealing plate 12 which protects the parts of the apparatus upstream thereof from the parings and also prevents the lubricant from running out of the section of the apparatus upstream thereof. A flange 13 keeps the sealing plate 12 in the correct position with respect to the outer bushing 3.

In a parer-housing bushing 15 is mounted a parer 16; the separation be-

tween the parer 16 and the drawing die 9 can be kept to a minimum, in addition to being kept to not more than 6mm as specified earlier, by the adoption of an appropriate construction for the intermediate bushing 10 and parer-housing bushing 15. In this connection the manner in which the parer 16 is mounted in the parer-housing bushing 15 can also be modified, if necessary. A passage 17 in the parer-housing bushing 15 conveys a lubricant, e.g. alcohol, to the parer 16. In the parer 16 itself, lubricant passages terminate close to, and thus permit the continuous lubrication of, the edges which engage the material. The number of lubricant passages in the parer 16 is determined having regard to the particular paring requirements and conditions of any given case.

In a recess in the parer-housing bushing 15 wherein it receives the parer 16, a round sealing ring 18 is provided to prevent any leakage of lubricant towards the exit. The sealing ring 18 is urged towards the parer 16 by a pressure ring 24 backed by a spring 25. Instead of this means of sealing, however, any other applicable sealing means may be adopted in order to seal the exit.

An outer parer bushing 26 is rotatably mounted by means of anti-friction bearings on the parer-housing bushing 15, and is driven by an electric motor 27 (Fig. 2). A belt 28 (for example) serves as transmission means for this purpose. An attachment 29 carrying rotary cutters 30 and 31 is secured to the outer parer bushing 26. The rotary cutters 30 and 31 are mounted, removably or non-removably, as desired, near the end face of the attachment 29. The rotary cutters 30 and 31 shown in Fig. 1 have different separations from the cutting edge of the parer 16, measured longitudinally and transversely to the axis of the parer 16. Their separation therefrom is determined according to the peculiarities of the parings of the particular metal being dealt with at any given time; thus according to the material used, the rotary cutters 30 and 31 can be freshly adjusted at the start of any new operation. In any case, however, the arrangement must be such that the parings produced are detached at points which are at least 5mm from the surface of the material, as specified earlier.

The belt 28 and outer parer bushing 26 are protected from parings and lubricants by a casing 32. Beneath the housing 2 there is a paring receptacle, which may be usable as a transport bin or which may have paring discharge means whereby the parings may be discharged into an ordinary transport bin. A filter and a pipe connection for the return of lubricant may ad-

vantageously be provided at the bottom of the paring receptacle.

Fig. 2 shows the surface-treating apparatus as seen from the material entry side.

- 5 The transport cover 1 is attached to the housing 2 by means of hinges 33, and is secured during paring by a fastening 34. The motor 27 is carried by a pivotable mounting 35 to enable the belt 28 to be

10 tensioned.

WHAT WE CLAIM IS:—

1. A method of surface-treating a metal wire, metal extrusion or other elongated metallic material, wherein the elongated metallic material is supplied with an evaporating lubricant (as herein defined) and passed through a guiding means, is thereafter reduced in cross-section, and is thereafter pared, and wherein the parings thereby produced are detached at points which are at least 5 mm from the surface of the material.

2. A method according to Claim 1, wherein the material is supplied with alcohol as the said lubricant.

3. A method according to Claim 2, wherein the material comprises a non-ferrous metal.

4. A method according to Claim 1, 2 or 3, wherein the material, after being passed through the guiding means, is reduced in cross-section by substantially 5% before being pared.

5. A method according to any of the preceding Claims wherein the material is passed through the guiding means, and reduced in cross-section and pared, under an inert gas.

6. A method according to Claim 1, substantially as described with reference to the accompanying drawings.

7. An apparatus suitable for performing the method of Claim 1, comprising a material guiding means which is in the form of a bushing, means for supplying the material with an evaporating lubricant (as herein defined), a drawing die, and a paring means placed not more than 6 mm behind the drawing die in the direction of travel of the material, rotary cutters being provided whereby parings produced by the said paring means are detached at points which are at least 5mm from the surface of the material.

8. An apparatus according to claim 7, wherein the drawing die is carried by a mounting which is adjustable with respect to the paring means from the outside of the apparatus, the paring means being stationary.

9. An apparatus according to Claim 8, wherein the drawing die is adjustable by the displacement, in the said direction of travel, of surfaces oblique to the said direction of travel which co-operate with other surfaces oblique to the said direction of travel which are presented by the drawing die mounting.

10. An apparatus according to Claim 7, substantially as described with reference to the accompanying drawing.

11. Elongated metallic material which has been surface-treated by a method according to any of Claims 1 to 6 or by means of an apparatus according to any of Claims 7 to 10.

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8. An apparatus according to claim 7, wherein the drawing die is carried by a mounting which is adjustable with respect to the paring means from the outside of the apparatus, the paring means being stationary.

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