AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request the grant of a patent for an invention described in the accompanying standard complete specification.

Applicant(s)/Nominated Person(s):

Danieli & C. Officine Meccaniche SpA, of Via Nazionale, 33042 Buttrio (UD), ITALY

Invention Title:

"LINED PIPE FOR FORMING SPIRALS FOR SPIRALLING MACHINES AND THE RELATIVE RECONDITIONING METHOD"

Name/s of Actual Inventor/s:

Alfredo POLONI and Fausto DE MARCO

Basic Convention Application Details

Application No: Country: Application Date:
UD96A000181 IT 26 September 1996

Drawing Number recommended to accompany the Abstract: Figure 1.

Address for Service: SHELSTON WATERS
60 Margaret Street
SYDNEY NSW 2000 (Code: SW)

DATED this SECOND day of SEPTEMBER 1997
Danieli & C. Officine Meccaniche SpA

File: 20077.00
Fee: $280.00
CONVENTION - COMPANY - NON-PCT
(By Employment Contract & Applicant is Applicant in Basic Appln.)

(Section 29(1)
Regulation 3.1(2)

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NOTICE OF ENTITLEMENT

We, DANIELI & C. OFFICINE MECCANICHE SpA

of Via Nazionale - 33042 BUTTRIO (UD) - Italy

being the applicant and nominated person in respect of an Application for an invention
titled: Lined pipe for forming spirals for spiralling machines and the
relative reconditioning method

state the following:-

1. The person nominated for the grant of the patent has entitlement from the actual
inventor/s as follows:
   1. If a patent were granted to the actual inventor/s in respect of the invention the
      nominated person would be entitled to have the patent assigned to it.

2. The person nominated for the grant of the patent is the applicant of the basic
application/s listed on the patent request form.

3. The basic application/s listed on the patent request form is/are the first application/s
made in a Convention country in respect of the invention.

For and on behalf of

DANIELI & C. OFFICINE MECCANICHE SpA

(Signature) ..................................................  August 05, 1997 (Date)

Name: Giovanni COASSIN

Title: Manager

File: ...........................................

SHELSTON WATERS
60 MARGARET STREET, SYDNEY, AUSTRALIA

GL25(k)
A lined pipe to form spirals (11) of a spiral-forming head for spiralling machines for metallic wire, comprising a plurality of anti-wear inserts including an inner hollow for the passage of the metallic wire and an outer surface connecting with the inner surface of the spiral-forming pipe (11), the wear-resistant inserts (10) being substantially all alike with a substantially annular conformation and a longitudinal dimension ("l") mating with the minimum radius of curvature of the spiral-forming pipe (11), rounded front faces (10a) at least partially convex and an inner through hollow (12) comprising a first segment (12a) to lead in and introduce the metallic wire and a second segment (12b) substantially cylindrical following the first.

Method to recondition a spiral-forming pipe (11) of the spiral-forming head of spiralling machines for metallic wire, the pipe (11) including inside itself a plurality of wear-resistant inserts defining an inner hollow for the passage of the metallic wire and including an outer surface connecting with the inner surface of the spiral-forming pipe (11), the wear-resistant inserts (10) being inserted/extracted from the spiral-forming pipe (11) by means of a...
flexible cable element (13) including, at at least one of its ends (13b), constrainment means at least temporal (15) in contact with the inner hollow (12) and/or the front wall of the wear-resistant inserts (10), the cable element (13) with the wear-resistant inserts (10) being threaded from one mouth (11a, 11b) of the spiral-forming pipe (11) to take the first wear-resistant insert (110a) into an abutment position with an abutment element cooperating with the other mouth (11b, 11a), and therefore clamping the last wear-resistant insert with holding means, the wear-resistant inserts (10) being extracted from the spiral-forming pipe (11) by releasing the holding means and then by introducing the cable element (13) from the other mouth (11b, 11a) of the pipe (11), until the element of temporal constraint (15) comes into contact and then clamps itself against the inner hollow (12) and/or the front wall of the first wear-resistant insert (110a), thus extracting the whole assembly of wear-resistant inserts (10).
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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name of Applicant/s: Danieli & C. Officine Meccaniche SpA

Actual Inventor/s: Alfredo POLONI and Fausto DE MARCO

Address of Service: SHELSTON WATERS
                   60 MARGARET STREET
                   SYDNEY NSW 2000

Invention Title: "LINED PIPE FOR FORMING SPIRALS FOR SPIRALLING MACHINES AND THE RELATIVE RECONDITIONING METHOD"

The following statement is a full description of this invention, including the best method of performing it known to us:-

(File: 20077.00)
This invention concerns a lined pipe for forming spirals for spiralling machines and the relative method to recondition them as set forth in the respective main claims. The invention is applied in spiralling machines with a spiral-forming head used on semifinished products arriving from the hot rolling process, such as wire, rods, round pieces or similar.

The state of the art covers machines to obtain spirals from metallic wire of various diameters comprising a spiral-forming rotary head with a pipe to form the spirals. In these machines the semifinished product arriving from the rolling line is introduced, by the appropriate feeding device, inside the pipe of the spiral-forming head.

The rotary movement of the spiral-forming head, as the metallic wire passes through it, whether this wire be smooth or with protuberances, subjects the relative spiral-forming pipe to strong stresses which can compromise its structural integrity and/or the original geometric configuration.

These stresses are added to the tangential thrusts of the metallic wire as it passes through and cause conditions of friction, and therefore of wear, on the inside of the pipe which are particularly serious.

As the pipe is worn, the machine becomes unbalanced and, when the pipe is replaced, the machine needs rebalancing.

For this reason the spiral-forming pipe of the spiral-forming head is achieved on the understanding that in certain operating conditions it is integrated and lined internally with auxiliary elements possessing high characteristics of resistance to wear.

This solution, although it ensures a longer duration of
the spiral-forming pipe and therefore fewer interventions on
the same, it also causes problems connected with the high
costs of procuring and reconditioning the pipe due to its
more complex structure and the fact that it cannot be partly
interchanged.

US-A-4.074.553 teaches to use tubular inserts made of
wear-resistant material which are introduced and clamped
inside the spiral-forming pipe. These tubular inserts have,
on the outer surface, abutment ridges and self-centering
ridges which allow them to be reciprocally assembled in
order to define a transit channel for the metallic wire
inside the spiral-forming pipe.

The particular conformation of these wear-resistant
inserts, which includes ridges and grooves on the outer
surface, as well as particular conformations of the front
and rear end to achieve reciprocal connection, involves high
production costs and assembly costs.

The longitudinal dimension of these inserts, moreover,
since it must be such as to allow for the above-mentioned
grooves and ridges, cannot be less than certain values,
which causes problems in positioning the inserts themselves
inside the spiral-forming pipe.

Mounting the inserts, moreover, defines a channel of a
segmented type which is not particularly suitable to the
spiral development of the pipe.

This solution moreover, causes considerable problems
during the replacement of the inserts, as the spiral-forming
pipe must necessarily be dismantled or even the pipe and
also the relative rotary support.

The particular and specific conformation of the inserts,
moreover, prevents them from being interchangeable.

The replacement or reconditioning operations are therefore
expensive, long and laborious, and cause long interruptions
to the spiralling cycle and considerable costs. Moreover, these operations must be carried out by many workers, as dismantling and assembling the spiral-forming pipe is extremely complex.

The present applicants have therefore designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterised in the respective main claims, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to provide a lined pipe to form spirals for spiralling machines which is simple, functional and practical, allowing a rapid reconditioning and therefore limited down times of the cycle and extremely reduced costs.

A further purpose of the invention is to facilitate the operations of inserting/extracting the lining, allowing it to be done by one worker alone.

A further purpose is to obtain a wear-resistant lining composed of inserts of a single type, of small size and of simple shape and therefore economical to obtain and adaptable to the spiral-shaped development of the spiral-forming pipe.

It is also a purpose of the invention to be able to rotate the inserts randomly and obtain a restoration of the transit channel without replacing the inserts themselves for a number of times, even more than 10 restorations.

The wear-resistant inserts which make up the lining of the pipe according to the invention are substantially composed of an annular element with an outer diameter mating with the inner diameter of the spiral-forming pipe inside which the inserts must be introduced and a reduced inner diameter mating with the diameter of the metallic wire.
The inner hollow of the wear-resistant inserts has a first connecting or lead in portion and a second, substantially cylindrical portion.

The outer surface of these wear-resistant inserts is substantially cylindrical, which gives an extremely simple production process and makes it very easy to insert/extract them. Moreover, the reduced longitudinal dimension of the wear-resistant inserts, which varies from 20 to 40 mm, advantageously 30 mm, gives them characteristics which make them extremely adaptable to the spiral-shaped development of the spiral-forming pipe.

These characteristics of adaptability are increased by the substantially spherical or curved conformation of the front faces of the inserts which allows them to be arranged in continuous contact even in the arched portions of the spiral-forming pipe.

According to the invention, the inlet mouth of the spiral-forming pipe communicates with the inlet to the inner hollow of the first wear-resistant insert.

According to the invention, the wear-resistant inserts are inserted into the spiral-forming pipe, and extracted from it, by means of a flexible cable element or a similar or comparable element.

This cable element has, in correspondence with at least one of its ends, means to temporally constrain the inserts.

According to the invention, in order to restore the transit channel without replacing the inserts, the inserts are extracted by means of the flexible cable element, they are made to rotate randomly around the flexible cable element, then they are re-inserted; in this way the preferential channel which had been created is removed, and the transit channel is restored to optimum conditions.

In one embodiment of the invention, in correspondence with
a first end, the cable has constraining means of the type which can be disassociated from the cable itself and cooperating with the front face of the insert, while in correspondence with the second end the cable has constraining means of the type which come into contact with the inner hollow of the inserts.

The lining is introduced, in one embodiment of the invention, by progressively threading a desired number of inserts onto the cable, as they are constrained, at the first end of the cable and therefore cannot come unthreaded from the above-mentioned constraining means.

The second end of the cable is then introduced from the outlet mouth of the spiral-forming pipe until it comes out of the inlet mouth of the same pipe.

When all the inserts are located inside the spiral-forming pipe, the constraining means of the dissociable type, are removed from the cable and the cable itself is unthreaded from the spiral-forming pipe.

Subsequently, in correspondence with the outlet mouth of the spiral-forming pipe, are introduced holding means for the inserts which are therefore clamped between the holding means and the abutment means associated with the inlet mouth of the spiral-forming pipe.

The inserts are extracted from the spiral-forming pipe by inserting the first end of the cable into the inlet mouth, until it comes out from the outlet mouth of the spiral-forming pipe. By pulling the first end of the cable, the constraining means of the second end come into contact with the inner hollow of the first insert; this first insert, constrained to the cable, is therefore dragged together with all the others towards the outer part of the spiral-forming pipe.

The attached figures are given as a non-restrictive
example and show a preferred embodiment of the invention as follows:

Fig.1 shows a front view of a spiral-forming pipe with a lining which is replaceable by means of the method according to the invention;
Fig.2 shows the section "A-A" of Fig.1 as the wear-resistant inserts are being inserted;
Fig2a shows the section "A-A" of Fig.1 when the inserts have been completely inserted;
Fig.3 shows the view from "B" of Fig.2a;
Fig.4 shows a partly sectioned view from above of the spiral-forming pipe of Fig.1;
Fig.5 shows the enlarged view of the detail "X" from Fig.4 when the wear-resistant inserts have been completely inserted;
Fig.5a shows the detail "X" from Fig.4 as the inserts are being extracted;
Fig.6a shows the first form of embodiment of the insert;
Fig.6b shows a variant of Fig.6a.

The spiral-forming pipe 11 according to the invention includes inside itself wear-resistant inserts 10 of an annular conformation defining an inner hollow 12; this hollow 12 comprises, in this case, a first lead in segment 12a, which is shaped like a truncated cone, and a second substantially cylindrical segment 12b, with a section which substantially coincides with the lesser section of the first segment 12a.

The outer diameter "D" of the wear-resistant insert 10 is slightly less than the inner diameter of the spiral-forming pipe 11; while the inner diameter "d" of the cylindrical segment 12b of the inner hollow 12 is correlated in size to the diameter of the metallic wire.

The insert 10 has rounded front faces 10a outwardly convex
so as to adapt better to the geometry of the spiral-forming pipe 11.

In the embodiment shown in Fig.6a, the rounded shape extends over the entire surface of the front face 10a of the wear-resistant insert 10.

In the variant shown in Fig.6b, the rounded shape extends only on at least part of the outer circumference of the hollow 12 in such a way as to give a better connection between adjacent wear-resistant inserts 10.

The longitudinal dimension "l" of the wear-resistant inserts is between 20 and 40 mm, advantageously with a nominal value of about 30 mm.

In this case, the spiral-forming pipe 11 is solidly associated, in correspondence with its inlet mouth 11a, with a lead-in element 16 with an inner channel 17 shaped like a truncated cone, the lesser section of which substantially coincides with the greater section of the hollow 12 of the inserts 10.

The replacement of the wear-resistant inserts 10 is carried out by means of a flexible metallic cable 13 which has means to constrain the wear-resistant inserts 10 at its two ends 13a, 13b.

In correspondence with a first end 13a the cable 13 has, in this case, constraining means 14 of the removable type, in this case composed of a nut 114 associated with a thread made on this first end 13a.

In correspondence with the second end 13b the cable 13 has constraining means 15 cooperating with the truncated cone segment 12a of the hollow 12, in this case composed of a contrasting cone 115 which is of such a size that it will pass through the lead-in element 16 but not through the cylindrical segment 12b of the hollow 12.

The wear-resistant inserts 10 are inserted into the
spiral-forming pipe 11 of the spiral-forming head by threading, by means of the cable 13, a certain number of wear-resistant inserts 10 suitable to cover the entire length of the spiral-forming pipe 11, the cable 13 mounting the nut 114, on its first end 13a, which abuts on the outer part of the last wear-resistant insert 110b.

The second end 13b of the cable 13 is then introduced into the spiral-forming pipe 11 from its outlet mouth 11b until it comes out of its inlet mouth 11a.

The cable 13 is then pulled, thus causing the wear-resistant inserts 10 to be dragged into the spiral-forming pipe 11 until the first wear-resistant insert 110a is taken to the abutment position against the lead-in element 16.

The nut 114 is then unthreaded from the first end of the cable 13a thus allowing the cable 13 to be extracted from the inlet mouth 11a of the spiral-forming pipe 11.

Subsequently, means 18 to hold the wear-resistant inserts 10 are associated with the outlet mouth 11b of the spiral-forming pipe 11; in this case, these means 18 are composed of a fork 118 inserted into mating holes 19 made on the spiral-forming pipe 11 and including its own clamping means.

The wear-resistant inserts 10 are extracted from the spiral-forming pipe 11 by inserting the first end 13a of the cable 13, dissociated now from the nut 114, into the inlet mouth 11a until it comes out from the outlet mouth 11b.

The subsequent pulling of the cable 13 causes the contrasting cone 115 to come into contact with the truncated cone segment 12a of the hollow 12 of the first wear-resistant insert 110a. This contrasting cone 115, as it cannot pass through the hollow 12, causes the wear-resistant inserts 10 to be pushed towards the outlet mouth 11b and thus allows them to be extracted from the spiral-forming pipe 11.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Lined spiral-forming pipe for a spiral-forming head of spiralling machines for metallic wire, comprising a plurality of wear-resistant inserts having an inner hollow through which the metallic wire passes and an outer surface connecting with an inner surface of the spiral-forming pipe, the pipe being characterised in that the wear-resistant inserts are substantially all alike with a substantially annular conformation with a longitudinal dimension ("1") mating with the minimum radius of curvature of the spiral-forming pipe, rounded front faces at last partly convex and an inner through hollow comprising a first lead-in segment to introduce the metallic wire and a second following segment, substantially cylindrical.

2. Spiral-forming pipe as in Claim 1, in which there is a shaped inlet mouth with a lead-in element defining abutment means for the first wear-resistant insert.

3. Spiral-forming pipe as in Claim 1 or 2, in which the wear-resistant insert has a longitudinal dimension ("1") of between 20 and 40 mm.

4. Spiral-forming pipe as in any claim hereinbefore, in which the wear-resistant insert has a longitudinal dimension ("1") of about 30 mm.

5. Spiral-forming pipe as in any claim hereinbefore, in which the lead-in and introduction segment of the hollow in the wear-resistant insert is shaped like a truncated cone.

6. Spiral-forming pipe as in any claim hereinbefore, in which the wear-resistant insert has its outer surface connecting with the inner surface of the pipe of a cylindrical conformation mating with the inner diameter of the spiral-forming pipe.
7. Spiral-forming pipe as in any claim hereinbefore, in which the wear-resistant insert has its front face at least partly rounded.

8. Spiral-forming pipe as in any claim hereinbefore, in which the inlet diameter of the lead-in and introduction segment of the wear-resistant insert has a dimension coordinated to the outlet dimension of the passage hole of the lead-in element.

9. Spiral-forming pipe as in any claim hereinbefore, in which the outlet mouth cooperates with holding means of the last wear-resistant insert.

10. Spiral-forming pipe as in Claim 9, in which the holding means are form means cooperating with insertion holes in the spiral-forming pipe, there also being included clamping means for the fork means.

11. Method to recondition a spiral-forming pipe of a spiral-forming head in spiralling machines for metallic wire, the pipe including inside itself a plurality of wear-resistant inserts defining an inner hollow through which the metallic wire passes, the inserts including an outer surface connecting with the inner surface of the spiral-forming pipe, the method being characterised in that the wear-resistant inserts are inserted into/extracted from the spiral-forming pipe by means of a flexible cable element including, at least one end, at least temporal constraining means in contact with the inner hollow and/or the front wall of the wear-resistant inserts, the cable element, with the wear-resistant inserts being threaded from one mouth of the spiral-forming pipe until the first wear-resistant insert is taken to an abutment position against an abutment element cooperating with the other mouth and then clamping the last wear-resistant insert with holding means, the extraction of the wear-resistant inserts from the spiral-forming pipe being achieved, after the holding means have been released, by introducing the cable
element from the other mouth of the pipe, until the temporal constraining means is taken into contact with, and then clamps itself against the inner hollow and/or the front wall of the first wear-resistant insert and thus the whole assembly of wear-resistant inserts is extracted.

12. Method as in Claim 11, in which the introduction of the cable element with the wear-resistant inserts is achieved from the outlet mouth of the pipe until the first wear-resistant insert is taken to an abutment position against a lead-in element associated with the inlet mouth of the pipe, while the extraction of the wear-resistant inserts is achieved by introducing the cable element from the inlet mouth of the pipe until the temporal constraining element is taken into contact with the inner hollow of the first wear-resistant insert.

13. Method as in Claim 11 or 12, in which the wear-resistant inserts are extracted by means of the cable element, are made to rotate randomly on the cable element and are re-inserted and clamped.

14. A lined spiral-forming pipe substantially as herein described with reference to any one of the embodiments of the invention shown in the accompanying drawings.

15. A method to recondition a spiral-forming pipe substantially as herein described with reference to any one of the embodiments of the invention shown in the accompanying drawings.

DATED this 2nd day of September 1997.

DANIELI & C. OFFICINE MECCANICHE SpA

Attorney: STUART M. SMITH
Fellow Institute of Patent Attorneys of Australia of SHIELSTON WATERS
ABSTRACT

A lined pipe to form spirals (11) of a spiral-forming head for spiralling machines for metallic wire, comprising a plurality of anti-wear inserts including an inner hollow for the passage of the metallic wire and an outer surface connecting with the inner surface of the spiral-forming pipe (11), the wear-resistant inserts (10) being substantially all alike with a substantially annular conformation and a longitudinal dimension ("l") mating with the minimum radius of curvature of the spiral-forming pipe (11), rounded front faces (10a) at least partially convex and an inner through hollow (12) comprising a first segment (12a) to lead in and introduce the metallic wire and a second segment (12b) substantially cylindrical following the first.

Method to recondition a spiral-forming pipe (11) of the spiral-forming head of spiralling machines for metallic wire, the pipe (11) including inside itself a plurality of wear-resistant inserts defining an inner hollow for the passage of the metallic wire and including an outer surface connecting with the inner surface of the spiral-forming pipe (11), the wear-resistant inserts (10) being inserted/extracted from the spiral-forming pipe (11) by means of a flexible cable element (13) including, at at least one of its ends (13b), constrainment means at least temporal (15) in contact with the inner hollow (12) and/or the front wall of the wear-resistant inserts (10), the cable element (13) with the wear-resistant inserts (10) being threaded from one mouth (11a, 11b) of the spiral-forming pipe (11) to take the first wear-resistant insert (110a) into an abutment position with an abutment element cooperating with the other mouth (11b, 11a), and therefore clamping the last wear-resistant insert with holding means, the wear-resistant inserts (10) being extracted from the spiral-forming pipe (11) by
releasing the holding means and then by introducing the
cable element (13) from the other mouth (11b, 11a) of the
pipe (11), until the element of temporal constraint (15)
comes into contact and then clamps itself against the inner
hollow (12) and/or the front wall of the first wear-
resistant insert (110a), thus extracting the whole assembly
of wear-resistant inserts (10).