

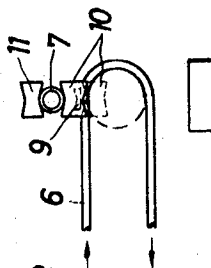
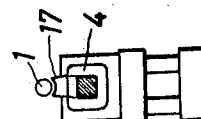
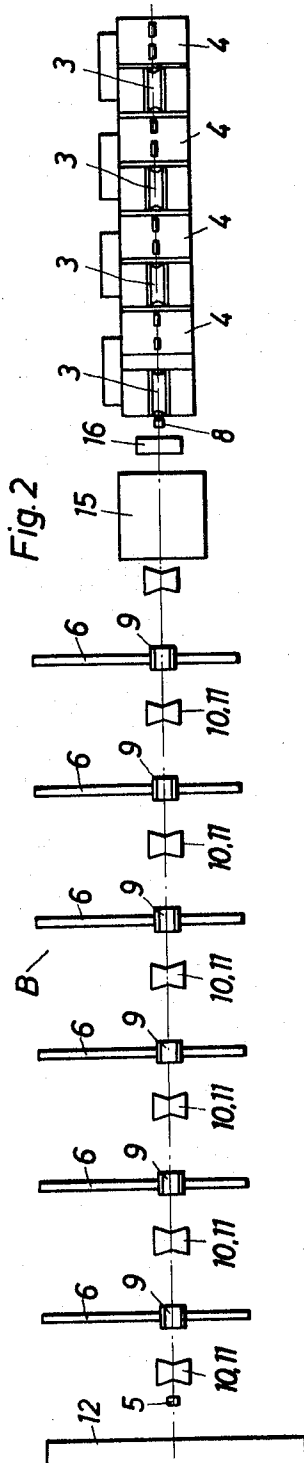
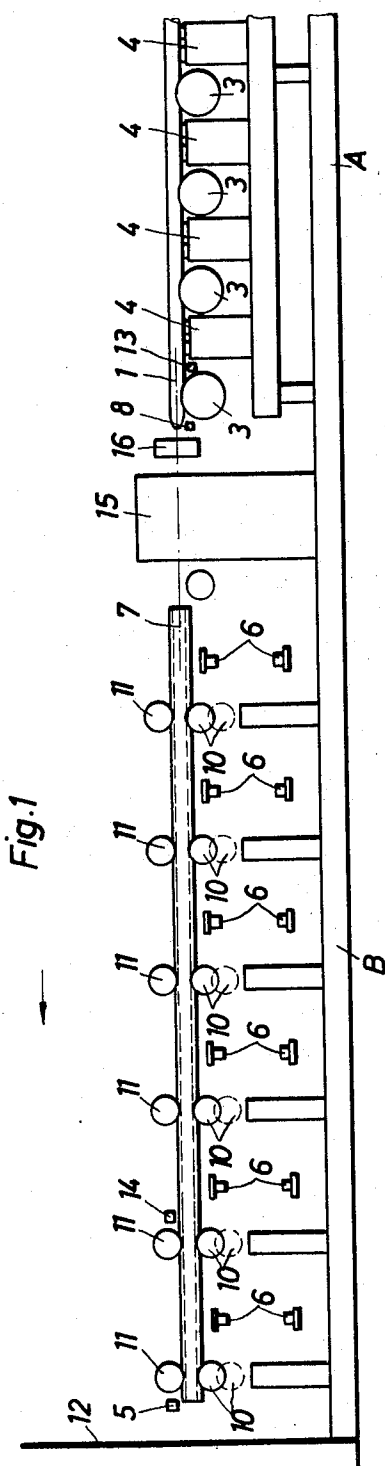
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METHOD AND MEANS FOR INTRODUCING A MANDREL INTO A TUBULAR BLOOM

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METHOD AND MEANS FOR INTRODUCING A MANDREL INTO A TUBULAR BLOOM

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ABSTRACT OF THE DISCLOSURE

A mandrel is introduced into a tubular bloom for subsequent rolling. The bloom lies in front of the rolling mill and is first moved slowly toward it, and the mandrel is pushed into and through the bloom at a velocity which is a multiple of that of the bloom to a point such that a predetermined length of the mandrel will protrude from the front end of the bloom, and the velocities of the two are then synchronized.

BACKGROUND OF THE INVENTION

The invention relates to a method and an apparatus for introducing a mandrel into a tubular bloom or shell, which subsequently is rolled out to a tube through a continuous rolling process.

It has been known, heretofore to roll thick-walled, hot shells over a mandrel on a continuous tube rolling mill which consists of one or several dual ("Duo") rolling frames which are mutually displaced by 90° and to form a seamless tube in this manner. The devices which are used for the introduction of the rolled stock and the mandrel are of a manifold variety.

As an example, chain drives are known, which through entrainment means (such as forks, pins, etc.) push the mandrel through the shell and by means of a mechanically adjustable stopping device introduce the mandrel and the shell jointly into the rolling mill along a pathway which had been accurately established. This joint introduction of mandrel and shell is frequently carried out by means of a second chain drive. In this case, the forces and accelerations which are necessary for the fast movement are not limited; however, in addition to the high expenditures for mechanical devices and their maintenance, the possibility does not exist of transmitting forces for slowing down the conveyed pieces. Since only the force which is necessary for the dissipation of the kinetic energy of the transported pieces (mandrel and thick-walled shell) can be generated, wherein said force corresponds to the product of weight and friction coefficient, one can only expect a slight delay action of the transported pieces. Therefore the contact between transported pieces and entrainment devices is always guaranteed, otherwise one cannot come up with an accurate definition of the position of shell with respect to the mandrel and thus jeopardize the work cycle of the rolling process. Since only relatively slight accelerations and velocities can be imparted to the rolled stock as well as to the mandrel, and moreover the drives do not operate continuously, but intermittently, during the transition periods to the individual load conditions (moving of the mandrel, joint moving of mandrel and shell), optimum regard cannot be given to the cooling of the hot shell.

Likewise, when such propelling devices are used and sudden transport stoppages occur as a result of obstacles, danger of breakage and therewith transport disturbances can be incurred unless costly measures (such as, for example, torque overload clutch) are provided for.

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The abovementioned disadvantages also pertain to the remaining known transport devices: for example, a spoon-shaped device which is propelled through chains, ropes or other mechanical or hydraulic driving means. Along a mechanically adjustable pathway it first transports the mandrel and subsequently jointly transports the mandrel and the thick-walled shell into the continuous rolling mill. All the abovementioned disadvantages are eliminated by the present invention.

SUMMARY OF THE INVENTION

It is among the principal objects of the invention to facilitate a rapid introduction of the mandrel and thereby secure a definite position of the mandrel in the tubular bloom, so that the rolling process can be executed without loss in time and always with the same accuracy of placement.

Further objects and advantages of the invention will be set forth in part in the following specification and in part will be obvious therefrom without being specifically referred to, the same being realized and attained as pointed out in the claims hereof.

Generally speaking, these aims are accomplished as follows: the bloom which lies in front of the rolling mill, in first moved slowly toward the rolling mill, while the mandrel with a velocity which amounts to a multiple of the bloom velocity is pushed in the same direction into and through the bloom to such a distance that a piece of the mandrel, the size of which corresponds to the length increase from bloom to finished tube, protrudes beyond the front end of the bloom. The velocities of bloom and mandrel are then synchronized and adjusted to the rolling velocity of the first rolling stand.

The device for the execution of this method is primarily characterized in that for the movement of the mandrel a roller-bed is provided having attraction means to generate friction which goes beyond the frictional connection brought about by the weight of the mandrel itself.

According to one form of execution, these attraction means include electromagnets which act upon the mandrel and are arranged below it. These electromagnets are connected with a polarity which changes with the guide motion of the mandrel. Seen in the direction of the mandrel's guide motion, a demagnetization spool is provided behind the roller-bed. The latter can be provided with a pressure-gas unit, which brings about an overpressure at the pole shoes.

A bloom driving apparatus is provided that includes off-set pairs of rollers and has an operating axis which lies in the elongation of the rolling bed axis.

The rollers that lie above the bloom can be adjusted in a stationary manner, whereas those rollers which lie below the bloom can be raised and lowered in vertical direction and can be pressed from below against the bloom.

The invention includes a photoelectric cell disposed behind the roller-bed and an infra-red cell provided behind the driving apparatus. Digital odometrical devices are provided which are located ahead of the photoelectric cell and the infra-red cell. A computer is connected to said digital odometrical devices which controls or guides the driving mechanisms of the rolling bed and the driving device.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

With the above and other objects of the invention in view, the invention consists in the novel methods, construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, certain embodiments of the same being illustrated

in the accompanying drawings and described in the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of a device in accordance with the invention;

FIG. 2 is a plan view thereof;

FIG. 3 is a fragmentary elevational view of a detail; and

FIG. 4 is an end elevational view partly in section.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the transport of the mandrel 1, the apparatus designed in accordance with the present invention includes a number of rollers 3 which are driven by electromotive means and are adjusted to the profile of the goods to be conveyed. The rollers 3, which are mounted in an adjustable manner above the corresponding bearing and holding devices, are set up together with electromagnets 4. The magnets 4 are arranged in adjustable manner between the rollers. They are on a mount base, the position of which can likewise be adjusted (FIGS. 1 and 2, section A). The electromagnets 4, which are screened in order to prevent stray fields, are laid out in such a manner that even at high stray losses they can exert a maximum pull on the mandrel 1, while overcoming an air gap 17 which measures a few millimeters. The degree of induction occurring in the mandrel 1 lies slightly below the saturation value corresponding to the raw material of the mandrel. Using a direct current voltage supply, the magnets 4 are fed in such a manner that successive magnets are polarized in opposite directions.

Thus the residual magnetism which has been built up by the preceding magnet is at once reduced again, through magnetic reversal, by the magnet which, in transport direction, follows next in line. The residual magnetism which remains in the mandrel 1 when it passes through the last magnet is destroyed in the demagnetizing spool 16. After the mandrel leaves the roller bed the magnets are disconnected; in each case after a short counter-energizing period, so that here too no residual magnetism remains behind. Through media which flow out of fine nozzles and by means of overpressure, accumulations of ferromagnetic impurities on the magnetic poles are prevented and, after said magnets have been switched off the magnetic poles are cleaned by freeing them from any accumulated dust particles.

Because of the high magnetic supplementary force $P_{\text{additional}}$ which, on the basis of the large air gap surface 17 is adjusted to the transported goods, can only be transmitted by the stationarily arranged magnets 4, the transport rollers 3 are loaded by a multiple of the weight of the mandrel. Through the force, $(G + P_{\text{additional}}) \times \mu$, which can be transmitted by the driving devices of the rollers 4 onto the mandrel 1, high acceleration and retardation values (for example 5 meters per second, square and more) can be attained, yielding considerable forces in the transport axis.

In combination with a digital odometric device 13 which, in a slip-free manner, engages with the mandrel, a position accurate steering of the mandrel is accomplished. This is at the highest possible utilization of acceleration, velocity and retardation forces, so that the apparatus can optimally oppose the colling of the rolled stock.

For transporting the rolled stock, namely the bloom or shell 7, the device according to the instant invention includes a number of upper and lower rollers which are propelled by electromotive means and are adjusted to the profile of the goods to be conveyed. Each pair of upper and lower rollers form a propelling device.

While the upper rollers 11 can be adjusted as to position, they are usually arranged in a stationary manner for the normal operational cycle.

The lower rollers 10 in accordance with a preferred embodiment of the instant invention can be jointly adjusted vertically in such a manner by a hydraulically operated, pressure controllable rapid lifting stroke.

During this upward stroke, the rolled shells which had been conveyed to said lower rollers by means of a prime chain mover 6 (FIGS. 2, 3), which is provided with seats or bearing surfaces 9, can be lifted from said prime chain mover and tightly pressed in the roller axis against the previously described upper rollers 11. Through this method which is developed in accordance with the instant invention and entails the rolled stock delivery from the prime chain mover 6 into the driving devices 10 and 11, an optimum careful treatment or protection of the rolled stock is achieved.

A digital odometrical device 14, which is likewise connected with the rolled stock in a slip-free manner permits accurate steering of the rolled stock 7 with respect to its position to the mandrel 1 and to the continuously operating (so-called "Konti") rolling mill.

The operation of the above described embodiments of the invention is as follows:

The mandrel 1 which is received from a cooling vessel is conveyed by means of conventional interjectors through a delivery grate (not illustrated) to the roller bed 3. As soon as the mandrel 1 has reached this position, the magnets 4 are switched on.

By means of a longitudinal measuring device, the exact length of the shell 7 was determined after the preceding rolling process. The position of the shell 7 within the intake or feeder roller bed 10, 11 is defined by a stop on the transport through the prime chain mover 6. The mandrel 1, after it has passed the photo cell 8 which determines its exact position can be brought into a waiting position, after travelling a certain path at slow speed which is controlled by the digital odometric device 13. In this waiting position, the head of the mandrel 1 remains a short safety distance from the end of the shell 7.

The shell 7 which is conveyed by the seats or bearing surfaces 9 of the prime chain mover 6, is stopped, and then lifted by the lower rollers 10 to the rolling center and is pressed by regulatable pressure against the upper rollers 11 (FIG. 1, section B and FIG. 3). Once the shell 7 has reached this basic position, motional actions of differentiable acceleration and velocity, of both the mandrel 1 and the shell 7, are simultaneously initiated. During the ensuing operation, the mandrel 1 is driven through a lubricating device 15 and into the shell 7.

For the purpose of an accurate determination of its position, the shell 7 is led past an infra-red cell 5 with a relatively slow velocity, whereby its momentary position is defined by the digital odometric device 14 which is coupled with it. This slow motion of the hot shell 7 in the direction towards and continuously operating (the so-called "Konti") rolling mill 12 is arranged in accordance with the instant invention so that the heat removal through the propelling rollers 10 and 11 cannot effect to a great degree a localized temperature difference.

As the heat potential of the mandrel is low as compared to that of the shell 7, the mandrel 1 will receive a large quantity of heat from said shell 7 after it engages the shell. For this reason it is helpful to keep the contact-time between the mandrel 1 and the shell 7 as short as possible prior to the actual rolling process.

It is therefore necessary to introduce the mandrel 1 into the shell 7 with the highest possible acceleration (for example, 5 meters per second squared and more) and a corresponding velocity and equal retardation, after passing a lubricating device 15.

The stretching which can be divided into forward and a backward direction is dependent on the construction of the roller mill 12 which is used in the rolling process. The element of length is also established with which the mandrel 1 must protrude, in the rolling direction, from the shell 7 prior to the start of the rolling process. This

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protrusion of the mandrel 1 from the shell 7 will be for a certain calculable distance, and is controlled, through a computer, by the digital odometric devices 13 and 14 which operate in differential connection. The computer then computes the particular point along the travelled path at which the retardation steps are to be initiated. This particular point is determined from the mandrel velocity and the shell velocity, the mandrel retardation of 5 meters per second squared, and more, the computed distance between the mandrel 1 and the shell 7, as well as from the velocity with which the mandrel 1 and shell 7 are driven in. This is arranged to correspond to the rolling velocity of the first rolling frame of the so-called "Konti" roller mill 12.

The retardation is kept constant up to the time at which the velocity with which the mandrel and the shell are driven-in is attained. While taking the same factors into account, the shell 7 is correspondingly accelerated from the slow travel time to the driving-in velocity, so that mandrel and shell are synchronously introduced into the first rolling frame of the so-called "Konti" rolling mill 12.

After the first rolling frame of the continuous tubero-rolling-mill 12 has become engaged with the mandrel, the velocity of the rolled stock 7 and of the mandrel 1 is only determined by the rolling mill 12 itself.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent is as follows:

1. A method for the introduction of a mandrel into a hollow tubular bloom, which subsequently is rolled out through continuous rolling in a rolling mill having frames, which bloom lies in front of the rolling mill,

comprising the steps of first moving the bloom with a slow velocity toward the rolling mill, thereafter pushing the mandrel with a velocity which amounts to a multiple of the bloom velocity into and through the bloom to such a distance that a piece of the mandrel, the size of which corresponds to the length increase from bloom to finished tube, will protrude from the front end of the bloom,

and subsequently synchronizing the velocities of bloom and mandrel and adjusting the synchronized velocity to the rolling velocity of the first rolling frame.

2. A device for the introduction of a movable mandrel into a movable hollow tubular bloom situated in front of a rolling mill, comprising, in combination,

a first roller bed operable for moving said bloom with a slow velocity in a direction towards said rolling mill

a second roller bed operable for moving the mandrel in the same direction though with a velocity which amounts to a multiple of the bloom velocity into and through the bloom, said second roller bed including means operable to generate a friction in addition to

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the gravitational frictional connection brought about by the weight of the mandrel itself.

3. A device, as claimed in claim 2, wherein the means to generate friction include electromagnets which act upon the mandrel and are arranged below the same.

4. A device, as claimed in claim 3, wherein the magnets are connected with a polarity which changes with the movement of the mandrel.

5. A device, as claimed in claim 2, wherein viewed in the direction of the movement of the mandrel, a demagnetizing spool is disposed behind the roller-bed.

6. A device, as claimed in claim 3, said magnets having pole shoes, and a pressure gas unit, which creates an overpressure at said pole shoes.

7. A device, as claimed in claim 2, said first roller bed having an axis, first driving means for moving said bloom comprising pairs of rollers and having an operating axis which lies in the elongation of the roller bed axis, some of said rollers lying above the bloom being adjustable in a stationary manner, and others of said rollers being arranged below the bloom and being operable to be raised and lowered in vertical direction and to be pressed from below against the bloom, and second driving means for moving said mandrel.

8. A device as claimed in claim 9, said second measuring combination including a photoelectric cell disposed behind the second roller bed and operable for determining the position of said mandrel viewed in the direction of the movement of the mandrel, said first measuring combination including an infrared cell disposed behind the said first driving means, and operable for determining the position of said bloom, said odometric devices being disposed frontally of said photocell and said infrared cell, and a computer connected to said odometric devices and to said photocell and said infrared cell and controlling said first and second driving means.

9. A device as claimed in claim 7, further comprising a first measuring combination of position measuring means with an odometric device disposed in the path of movement of said bloom in said first roller bed, a second measuring combination of position measuring means with an odometric device disposed in the path of movement of said mandrel in said second roller bed, computer means operatively connected to said first and second measuring combinations, and said computer means controlling said first and second drive means to determine the points at which the predetermined changes in the movements of said mandrel and of said bloom are to be initiated.

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