METHOD OF AND APPARATUS FOR CONTINUOUSLY PRODUCING WELDED LIGHT CONSTRUCTION BEAM SECTIONS, IN PARTICULAR I- OR T-BEAMS

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Method and apparatus for the continuous production of welded light-construction beam sections, particularly I- and T-beams, wherein the web and the flanges of equal wall thickness are slit from a single strip of rolled steel, brought together into the desired cross-sectional form and joined by longitudinal-seam welding. Strip guiding devices are provided which preferably comprise vertically and horizontally displaceable arms and run-in rollers. Advantageously one of the strip guiding devices is rotatable about a horizontal axis.
METHOD OF AND APPARATUS FOR CONTINUOUSLY PRODUCING WELDED LIGHT CONSTRUCTION BEAM SECTIONS, IN PARTICULAR I- OR T-BEAMS

BACKGROUND OF THE INVENTION

This invention relates to a method of continuously producing welded light-construction beam sections, in particular I- or T-beams which may have profiled flanges and a profiled web of rolled steel strips, wherein the strips of equal wall thickness forming the flanges and the web are joined by longitudinal-seam-welding. Thus produced beam sections have the following advantages over sections produced in one piece by hot rolling: Given the same static parameters, they are considerably lighter than hot rolled beam sections, which means that the modern building industry can make considerable savings not only in material but also in labour and transport expenses. Investigations and calculations have proved that, as far as strength properties are concerned, the longitudinal-seam-welded beams are superior to the sections produced by hot rolling. Particularly I-beams can be optimally dimensioned as concerns their moment of inertia and their section modulus. Furthermore, when the flange-sheets or plates are profiled, the longitudinal rigidity (butt safety) of the beams can be increased advantageously.

It has been known (see Austrian Pat. No. 263,505) to continuously produce light-construction beam sections, such as I- or T-beams by longitudinal-seam-welding of two or three strips. In this known method each strip part, i.e., the strip for the web and the strips for each flange, respectively is taken from a feeder group of its own, consisting of an uncoiler, a flattener, a looper and a welding device for joining a strip end with the beginning of a new strip. The individual strips are then brought together in the desired position relative to each other and are welded to form a beam section.

The above mentioned known method is subject to a series of disadvantages. In particular for reasons of production, the sheet coils for the individual strips have differing lengths. Therefore as in a continuous operation the strip end of one coil must be transversely welded with the beginning of the strip of the following coil, it is inevitable that the transverse welding seams both of the flanges and of the web — according to the differing lengths of the two strips — lie at different points on the finished beam, sometimes relatively far apart. The transverse welding seams, which affect the mechanical properties of the beam, must then be cut out, which results in a relatively high waste and many short lengths of the finished beams. Also, unless a production plant of the above described type disposes a separate looper for each strip that is to be welded, another difficulty arises, i.e., the plant must be stopped each time the strip end is welded together with the beginning of a strip. Thus the productivity of the plant is diminished. Furthermore, the waste as well as the production of short lengths increases. Moreover, the known plants require a large operating staff for carrying out the above mentioned manipulations.

SUMMARY OF THE INVENTION

This invention has as its object the avoidance of the described disadvantages and difficulties. It is particularly an object of the invention to make the continuous production of welded light-construction beam sections, such as I- or T-beams, more economical than in the past, to simplify the construction of the plant and to make it reliable, thereby reducing stoppages to a minimum and decreasing the waste and reducing the operating staff. The object of the invention is achieved by a process for continuously producing welded light-construction beam sections, particularly I- or T-beams, having, if desired, profiled flanges and/or a profiled web, wherein the strips of equal wall thickness forming the flanges and the web are joined by longitudinal-seam-welding. The strips forming the flanges and the web are slit from a single strip of rolled steel and after trimming of their edges the individual strips may be brought together by guiding devices to form the desired cross section.

According to a preferred embodiment of the invention, the strips forming the flanges and/or the web are profiled either before they are brought together to form the desired cross sectional structure or after they have been welded.

The advantage of profiling after welding is that, while the strips are brought together to obtain the desired cross sectional form, one need not yet take into consideration the increased rigidity, which is achieved by profiling, i.e., one can work with smaller radii of curvature, which takes up less room.

The invention also comprises a plant for carrying out the described method. This plant is characterized in that a sheet slitting device is arranged behind the uncoiler for the sheet coils and guiding devices are provided for bringing together the slit strips in the desired cross sectional form.

The guiding devices for the strips suitably consist of guiding arms, displaceable vertically and horizontally and at least one pertaining pair of run-in rollers each. According to an advantageous embodiment of the invention at least one strip guiding device is rotatable around a horizontal axis, so that at least one strip may be twisted from the horizontal into the vertical. The method of the present invention and the plant for carrying it out present considerable advantages as against the processes practiced so far. This is made clear by the following comparison: When three strips are brought together for producing an I-profile in the known manner, three feeder groups separate from each other are necessary, each of which consists of a ramp for the sheet coils, a lifting table for the coils, an uncoiler, a coil opener, a flattener, a pair of end shears, a transverse-welding machine and a looper. The plant of the present invention requires only a single feeder group for a broader strip. The cutting or slitting device, the trimming device and the chip breaker, necessary for slitting the broad strip, do not involve any additional costs, because it is also in a known conventional plant that a broad sheet strip has to be first divided into three strips on a separate longitudinal dividing device, a trimming device with chip breaker, etc. and it must then be coiled up again, or one has to buy three considerably more expensive narrow, already divided sheet coils, instead of an untrimmed and less expensive hot rolled strip.

The main advantage of the invention lies in the fact that the stoppage periods caused by introducing a new sheet coil and welding it on to the previous coil end, are considerably diminished. Whereas formerly these stoppage periods amounted to about 50 percent of the entire production time, they come up to not more than
about 20 percent with the plant of the present invention. If one allows for all the other stoppage periods for maintenance and changing tools, this means that the productivity of the plant is increased by about 35 percent.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The method of the present invention and the plant for carrying it out, will now be described in more detail on the basis of an example with reference to the accompanying drawings in which:

FIG. 1 is a front view of a plant for the continuous production of an L-section with a plane web sheet and profiled flanges;

FIG. 2 is a top view of the plant of FIG. 1;

FIG. 3 is an enlarged front elevation of a guiding device for the slit strips;

FIG. 4 illustrates the device of FIG. 3 in a top view; and

FIG. 5 shows a profiling device.

**DESCRIPTION OF AN EXEMPLARY EMBODIMENT**

1. A coil ramp on which a sheet coil 2 is put. It rolls along a lifting table 3 to an uncoiler 4, from where the strip is guided to the flattener 6 via the coil opener 5. The strip runs via a pair of end shears 7 on to a welding machine 8, where the beginning of the strip is transversely welded to the end of the previous strip. The strip is now drawn continuously through the plant. It passes a looper 9 and a strip centering device 10 and is then divided into three separate strips 12, 13, and 14 by means of a slitting device 11. Strip 12 serves for forming the web and the strips 13 and 14 form the upper and the lower flanges, respectively. At the slitting device the strips can be trimmed, if desired, and the cut off edges may be crushed into small strips by a scrap crusher 15 and removed by a conveyor belt 16.

As illustrated in FIGS. 3 and 4 on an enlarged scale, the strips 12, 13, and 14 pass via a second looping table or looping pit 17 and after having passed guiding arms 18, 18' and 18'', which are adjustable to different heights, and deflexion rollers 19, 19', and 19'', the strips pass to strip guiding devices 20, 21, and 22, each of which pertains to one of the strips. One of the guiding arms, i.e., the guiding arm 18 for the strip 12 is rotatable around a horizontal axis, so that the strip 12 may be twisted into a vertical position. Moreover, the guiding arms 18, 18', and 18'' may also be horizontally displaceable transversely towards the direction of the passing strips, as is indicated by the double arrows (FIG. 4) to enable an adjustment of the plant strips of different widths.

The guiding device 20 for the web strip 12 and the guiding devices 21 and 22 for the upper flange strip 13 and the lower flange strip 14, respectively, are advantageously provided with adjustable pairs of run-in rollers and possibly with additional guiding elements (rollers, ledges, or the like), which guarantee this reliable guiding of the strip passing through. These strip guiding devices may suitably be horizontally displaceable on sliders, transversely to the direction of the passing strip. Thus when introducing the strip, any desired off-center position can be approached which the respective strip coming from the looper requires. When the beginning of the strip has been introduced into its respective guiding device, the device is displaced laterally, until the center of the strip lies in the respective production line. Lateral dislocations and torsions of the strips can be accommodated by the loops formed in the preceding looping pit 17.

It can be observed from the top views of the plant in FIGS. 2 and 4 that after having been placed into a vertical position by rotating the guiding arm 18, the strip 12 provided for the web is upset laterally by displacing the strip guiding device 20. However, the strips 13 and 14, that were provided for the flanges, are placed one above the other by an appropriate adjustment of the strip guiding devices 21 and 22. After this the strips 13 and 14 for the upper and the lower flanges, respectively, are profiled in the profiling machines 23' and 23'', while the web strip 12 is guided past the profiling machines without being profiled. In the welding machine 24 the three strips 12, 13, 14 are then brought together to form the desired L-section of the beam and are welded in a known manner. The welded beam section runs via a pull-out driving device 25, a cooling zone 26 and a straightening machine 27 to a severing device 28, where the section is cut in the desired length.

According to a modified embodiment of the invention, the profiling machines 23' and 23'' can be omitted and instead of them a profiling machine 23''' may be provided behind the pull-out driving device 25, as is indicated in FIGS. 1 and 2 in dotted lines. In this case the finished L-section is profiled. In FIG. 5, which illustrates a section of the profiling machine 23''', transverse to the direction of travel of the beam, the step of profiling the upper flange is shown. Reference numbers 29 and 30 refer to profiling rolls of machine 23'''. The finished sections pass via a roller table 31 to a piler 32, from where they are taken away.

**What we claim is:**

1. A method of continuously producing welded light construction beam sections, particularly I and T beams, having a web and at least one flange of equal wall thickness from a strip stock, comprising the steps of progressively slitting one end of a single length of strip stock to continuously form a web and at least one flange constituting strips, passing the web and flange constituting strips as they are formed through guiding devices to bring the strips together into the desired cross-sectional form by rotating at least one of the web and flange constituting strips into a plane different from the plane of the other constituting strips without changing the orientation of the as yet unslit portion of the single strip, and joining the web and flange constituting strips by longitudinal seam welding after the continually formed strips are brought together.

2. A method according to claim 1, wherein the web is profiled.

3. A method according to claim 1, wherein the at least one flange is profiled.

4. A method according to claim 1, wherein the web and at least one flange are profiled.

5. A method according to claim 1, wherein the strips are edge - trimmed prior to passing them through the guiding devices.

6. A method according to claim 1, wherein at least one of the web and flange constituting strips is profiled prior to being brought into the desired cross-sectional form with the other strips.
7. A method according to claim 1, wherein at least one of the web and flange constituting strips is profiled after having been welded to the other strips.

8. An apparatus for continuously producing welded light construction beam sections, particularly I and T beams, having a web and at least one flange of equal wall thickness from a single strip, which comprises a sheet coil supply and uncoiling means, a sheet slitting means arranged after the sheet coil supply and uncoiling means and adapted to progressively slit the end of the single strip to continuously form web and flange constituting strips, strip guiding means for orienting and bringing the strips together into the desired cross-sectional form by rotating at least one of the strips into a plane different from the plane of the other strip without changing the orientation of the sheet coil supply, and welding means for longitudinal seam welding of the web and flange constituting strips after they are brought together.

9. An apparatus according to claim 8 further comprising profiling means arranged before the welding means in the direction of travel of the strips.

10. An apparatus according to claim 8 further comprising profiling means arranged after the welding means in the direction of travel of the strips.

11. An apparatus according to claim 8, wherein the strip guiding means comprise vertically and horizontally displaceable guiding arms and at least one pair of run-in rollers associated with each arm.

12. An apparatus according to claim 8, wherein at least one strip guiding means is rotatable about a horizontal axis to twist at least one strip from a horizontal into a vertical position.

13. An apparatus for continuously producing welded light construction beam sections, particularly I and T beams, having a web and at least one flange of equal wall thickness from a single strip which comprises a sheet coil supply and uncoiling means, a sheet slitting means arranged after the sheet coil supply and uncoiling means in the direction of travel of the sheet and adapted to progressively slit one end of the single strip to form web and flange constituting strips, strip guiding means adapted to bring the strips together into the desired cross-sectional form, the strip guiding means comprising vertically and horizontally displaceable guiding arms and at least one pair of run-in rollers following each arm, at least one of the guiding arms being rotatable about a horizontal axis to twist at least one strip from a horizontal into a vertical position without changing the orientation of the sheet coil supply, and welding means following said strip guiding means for longitudinal seam welding of the web and flange constituting strips.

14. An apparatus according to claim 13 further comprising profiling means.

15. An apparatus according to claim 13 further comprising profiling means located after the welding means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Aschauer et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 2, "I-beams" should read --T-beams--;

Col. 3, line 52, after "plant" insert --to--; and

Col. 6, line 28, after "means" insert --located before the welding means--.

Signed and sealed this 1st day of April 1975.

(SEAL)

Attest:

RUTH G. MASON
Attesting Officer

G. MARSHALL DANN
Commissioner of Patents and Trademarks
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