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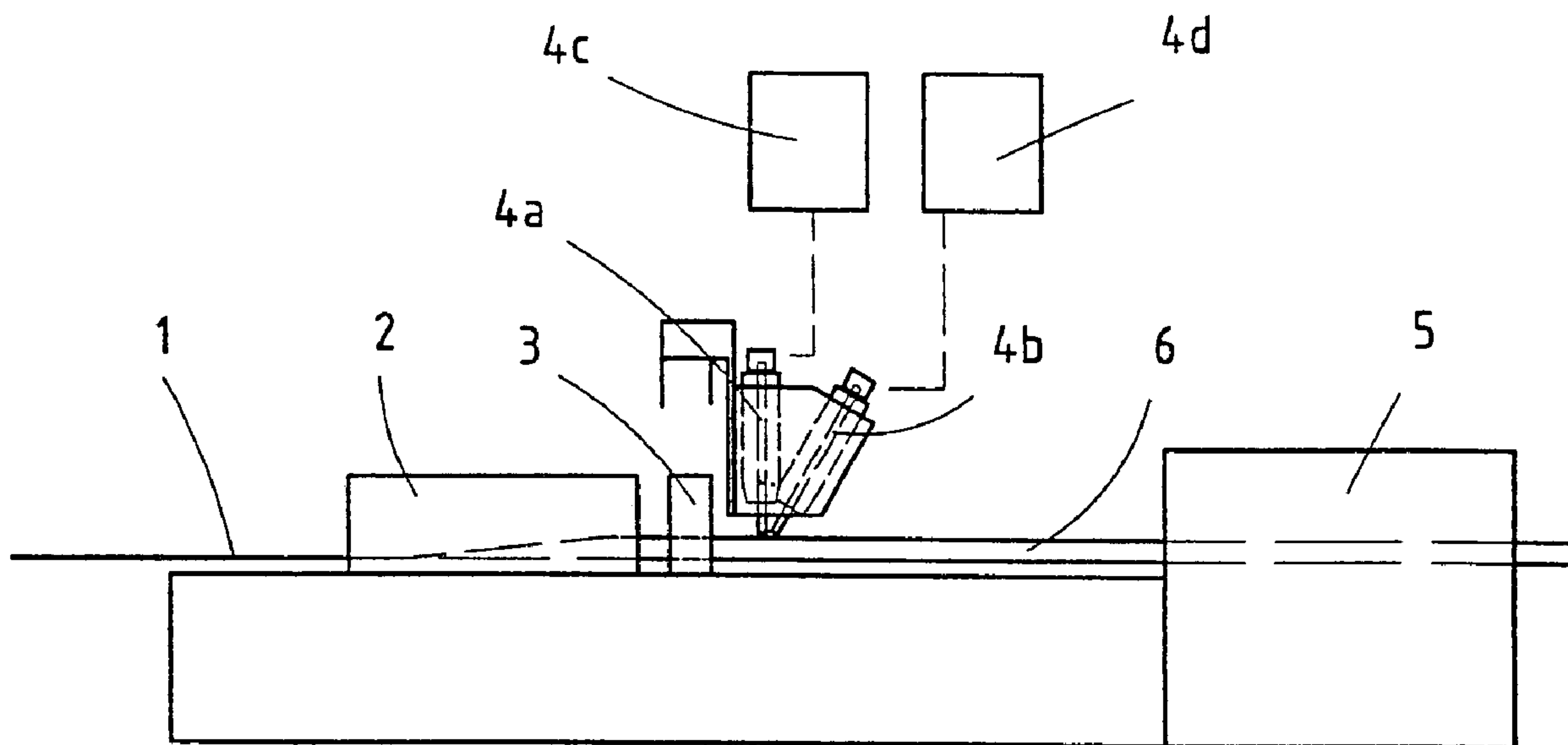
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(54) Titre : PROCEDE DE PRODUCTION CONTINUE DE TUBES METALLIQUES A SOUDAGE LONGITUDINAL

(54) Title: PROCESS FOR THE CONTINUOUS PRODUCTION OF LONGITUDINALLY WELDED METAL TUBES



(57) Abrégé/Abstract:

A process for the continuous production of longitudinally welded metal tubes is described, wherein a metal strip (1) is drawn from a strip supply and gradually shaped into a slit tube in a shaping station (2), the slit tube is welded in a welding system (4) along the edges of the strip, and the welded tube (6) is extracted by an extraction device (5). The welding system (4) is a protective gas arc welding system with several electrodes supplied by separate sources (4c, 4d) of welding current. The electrodes are arranged in succession in the direction of production. The welding system (4) has two welding devices (4a, 4b), whose electrode tips are directed at a common welding point. Only one of the welding devices (4a, 4b) is in operation at any given time, while the other welding device is in a standby position. When an electrode change becomes necessary, the arc of the welding device in the standby position is first struck by means of an auxiliary arc. The welding current intensity of the welding device presently in operation is then reduced, while the welding current intensity of the welding device in the standby position is simultaneously increased.

ABSTRACT

A process for the continuous production of longitudinally welded metal tubes is described, wherein a metal strip (1) is drawn from a strip supply and gradually shaped into a slit tube in a shaping station (2), the slit tube is welded in a welding system (4) along the edges of the strip, and the welded tube (6) is extracted by an extraction device (5). The welding system (4) is a protective gas arc welding system with several electrodes supplied by separate sources (4c, 4d) of welding current. The electrodes are arranged in succession in the direction of production. The welding system (4) has two welding devices (4a, 4b), whose electrode tips are directed at a common welding point. Only one of the welding devices (4a, 4b) is in operation at any given time, while the other welding device is in a standby position. When an electrode change becomes necessary, the arc of the welding device in the standby position is first struck by means of an auxiliary arc. The welding current intensity of the welding device presently in operation is then reduced, while the welding current intensity of the welding device in the standby position is simultaneously increased.

PROCESS FOR THE CONTINUOUS PRODUCTION OF LONGITUDINALLY
WELDED METAL TUBES

The invention concerns a process for the continuous production of longitudinally welded metal tubes.

Various welding processes for the continuous production of longitudinally welded tubes are known.

Processes that are used include not only the high-frequency resistance welding or
10 induction welding process but also the arc welding process (GTAW welding process) and the laser beam welding process. The laser beam welding process in particular has become increasingly important in recent years. Disadvantages of the laser beam welding process are the high capital costs and operating costs and the fact that the welding of metals with a bright surface, e.g., copper, causes problems, since a large portion of the laser energy is reflected by the bright metallic surface and thus is not available for the welding process. In addition, special precautions must be taken to protect personnel from misdirected laser beams.

The high-frequency welding process is characterized by high production rates, but the
20 weld seam leaves much to be desired, so that high-frequency-welded metal tubes are unsuitable for encasing plastic tubes or electrical cables.

DE 22 56 851 A describes a system for welding thin plates passing under a stationary welding head, especially for welding the longitudinal edges of a metal strip that has been shaped into a tube. The welding head of this system has three nonconsumable electrodes that are arranged in succession in the direction of the weld seam and supplied by separate current

sources. The use of three electrodes serves to increase the welding travel speed, i.e., all three electrodes participate in the welding operation. If one of the electrodes becomes worn out, the welding operation must be interrupted, with the result that the production process must be stopped and started up again or that, in the case of a continuous operation, the longitudinal seam is not welded over a certain length.

The service life of an electrode in the case of arc welding under a protective gas depends on the degree of contamination of the strip material that is used. In practice, lengths of up to 1,000 m can be produced in the case of the welding of aluminum strip.

The objective of the invention is to specify a process for producing longitudinally welded metal tubes with an arc welding system that makes it possible to produce long lengths without interruption of the welding operation.

In accordance with an aspect of the invention, the object is achieved with a process for the continuous production of longitudinally welded metal tubes, wherein a metal strip is drawn from a strip supply and gradually shaped into a slit tube in a shaping station, the slit tube is welded in a welding system along the edges of the strip, and the welded tube is extracted by an extraction device, and wherein the welding system is a protective gas arc welding system with several electrodes supplied by separate sources of welding current, and the electrodes are arranged in succession in the direction of production, characterized by the fact that the welding system has two welding devices, whose electrode tips are directed at a common welding point; that only one of the welding devices is in operation at any given time, while the other welding device is in a standby position; that when an electrode change becomes necessary, the arc of the welding device in the standby position is first struck by means of an auxiliary arc; and that the welding current intensity of the welding device presently in operation is then reduced, while the welding current intensity of the welding device in the standby position is simultaneously increased.

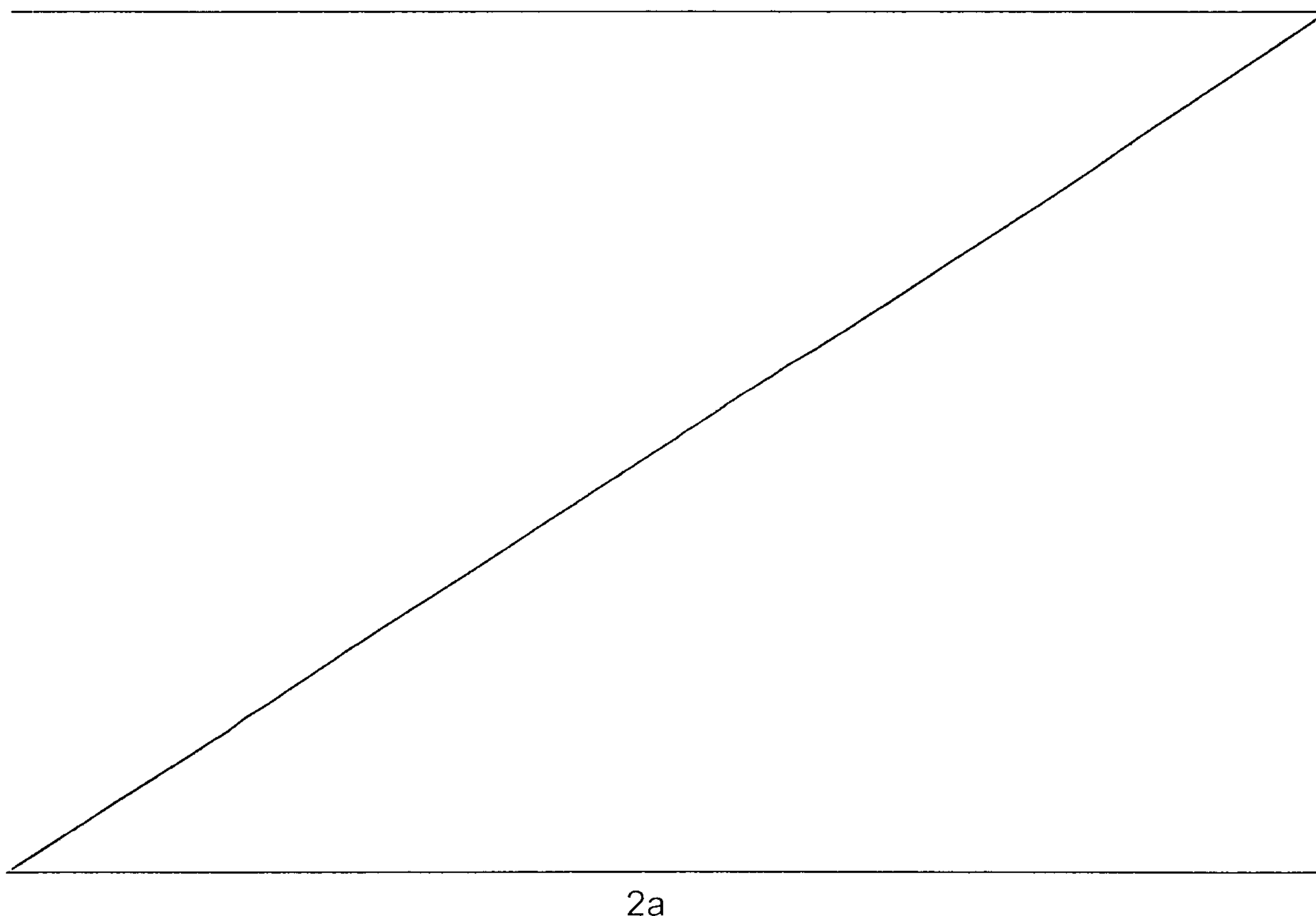
In addition to the advantages directly apparent from the statement of the objective, the invention offers the further advantage that the production does not have to be interrupted and that productivity can thus be increased.

The invention is explained in greater detail on the basis of the specific embodiments that are schematically illustrated in Figures 1 and 2, where:

Figure 1 is a schematic representation of an apparatus used to carry out the process according to a preferred embodiment of the invention; and

Figure 2 is a graph showing the current intensity I of the two molding devices according to time.

A metal strip 1 drawn from a strip supply (not shown) is fed to a shaping station 2, in which it is gradually shaped into a tube with a longitudinal slit by shaping cones or shaping rolls, which are not shown separately. The tube with a longitudinal slit that emerges from the shaping station 2 then passes through a shaping ring 3, which serves to hold the longitudinal edges of the



metal strip 1 in an abutting position.

A welding system 4 is arranged immediately after the shaping ring 3. It consists of the welding devices or welding torches 4a and 4b, which are arranged in succession in the production direction. Each welding device has a nonconsumable electrode (not shown).

The welding devices 4a and 4b are combined into a unit in a mounting (not shown), as described, for example, in the above-cited document DE 22 56 851 A.

10 The welding device 4a is preferably vertically oriented, whereas the welding device 4b is oriented at an acute angle of inclination to the longitudinal axis of the metal tube of preferably 30-85°. This embodiment guarantees that the welding device 4a or its electrode comes very close to the shaping ring 3 and thus prevents the longitudinal edges of the metal tube from moving apart.

Each welding device 4a and 4b has its own controllable welding current source 4c and 4d, respectively.

After the welding system 4, an extraction device 5 takes the welded tube 6 and conveys it to another station for further processing, which, for example, can be an extruder for applying a layer of plastic on the welded tube 6.

20 The process of the invention is carried out, for example, in the following way:

Initially, only one of the welding devices 4a and 4b is used in the welding operation, e.g., welding device 4a. If it is then determined that the electrode of welding device 4a has become worn out, an auxiliary arc is struck by means that are already well known between the tube passing through the welding system and the electrode of welding device 4b. The auxiliary arc has no effect on the arc of the welding device already in operation, but it guarantees stable burning of the arc of the welding device in the standby position. The welding current of welding

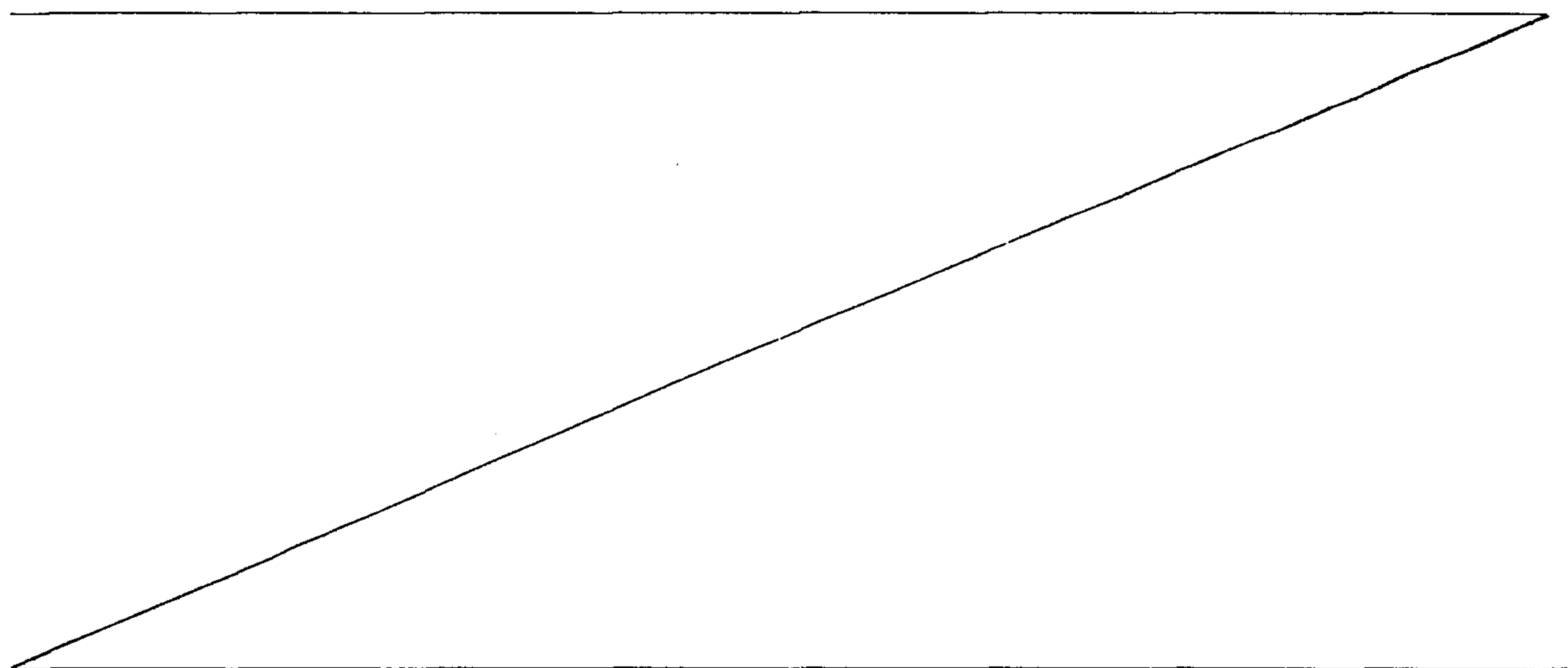
device 4a is then gradually reduced, and the welding current of welding device 4b is simultaneously increased. The important consideration here is that the sum of the welding currents of the welding devices 4a and 4b more or less corresponds to the current intensity necessary for welding the longitudinal seam of the tube. After the welding current intensity of welding device 4b has reached the required magnitude, welding device 4a is shut off, and the electrode can be replaced.

The electrode is replaced by pulling it up and out, as described in EP 676 256 B.

10 When the electrode of welding device 4b becomes worn out, the operation described about is repeated in the same way.

The process of the invention can be used with special advantage in the production of so-called composite tubes. In this process, a layer of adhesive is first applied to a plastic tube. The metal strip 1 is then formed into a metal tube around the plastic tube, and its longitudinal slit is then welded. The inside diameter of the metal tube is somewhat larger than the outside diameter of the plastic tube that has been provided with a layer of adhesive. After the weld seam has cooled, the welded metal tube is pulled down onto the plastic tube. Finally, a layer of adhesive is applied to the metal tube, and a layer of plastic is applied by extrusion.

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The composite tubes produced in this way are flexible, light, and diffusion-proof. They are preferably used in floor heating systems.

In Figure 2, the welding current intensity I of the two welding devices 4a and 4b is plotted as a function of time t . The welding current intensity of welding device 4a (labeled 4a) initially runs at a constant magnitude. If it is then determined that the electrode of welding device 4a is worn out, an auxiliary arc (see 4b.1) is struck between the tube passing through the welding system and the electrode of welding device 4b. The welding current strength of welding device 4b is then gradually increased, while the welding current strength of welding device 4a is simultaneously reduced.

WHAT IS CLAIMED IS:

1. Process for the continuous production of longitudinally welded metal tubes, wherein a metal strip is drawn from a strip supply and gradually shaped into a slit tube in a shaping station, the slit tube is welded in a welding system along the edges of the strip, and the welded tube is extracted by an extraction device, and wherein the welding system is a protective gas arc welding system with several electrodes supplied by separate sources of welding current, and the electrodes are arranged in succession in the direction of production, characterized by the fact that the welding system has two welding devices, whose electrode tips are directed at a common
10 welding point; that only one of the welding devices is in operation at any given time, while the other welding device is in a standby position; that when an electrode change becomes necessary, the arc of the welding device in the standby position is first struck by means of an auxiliary arc; and that the welding current intensity of the welding device presently in operation is then reduced, while the welding current intensity of the welding device in the standby position is simultaneously increased.
2. Process in accordance with claim 1, characterized by the fact that an electrode is replaced by pulling it up and out of the welding device and pushing a new electrode down and into the welding device.
3. Process in accordance with claims 1 or 2, in which the last stage of the
20 shaping station is a shaping ring that guides the slit tube, characterized by the fact that the welding device adjacent to the shaping ring is arranged vertically, and the second welding device, which is arranged after the first welding device in the direction of travel of the tube, is arranged at an angle of inclination to the longitudinal axis of the metal tube of preferably 30-85°.

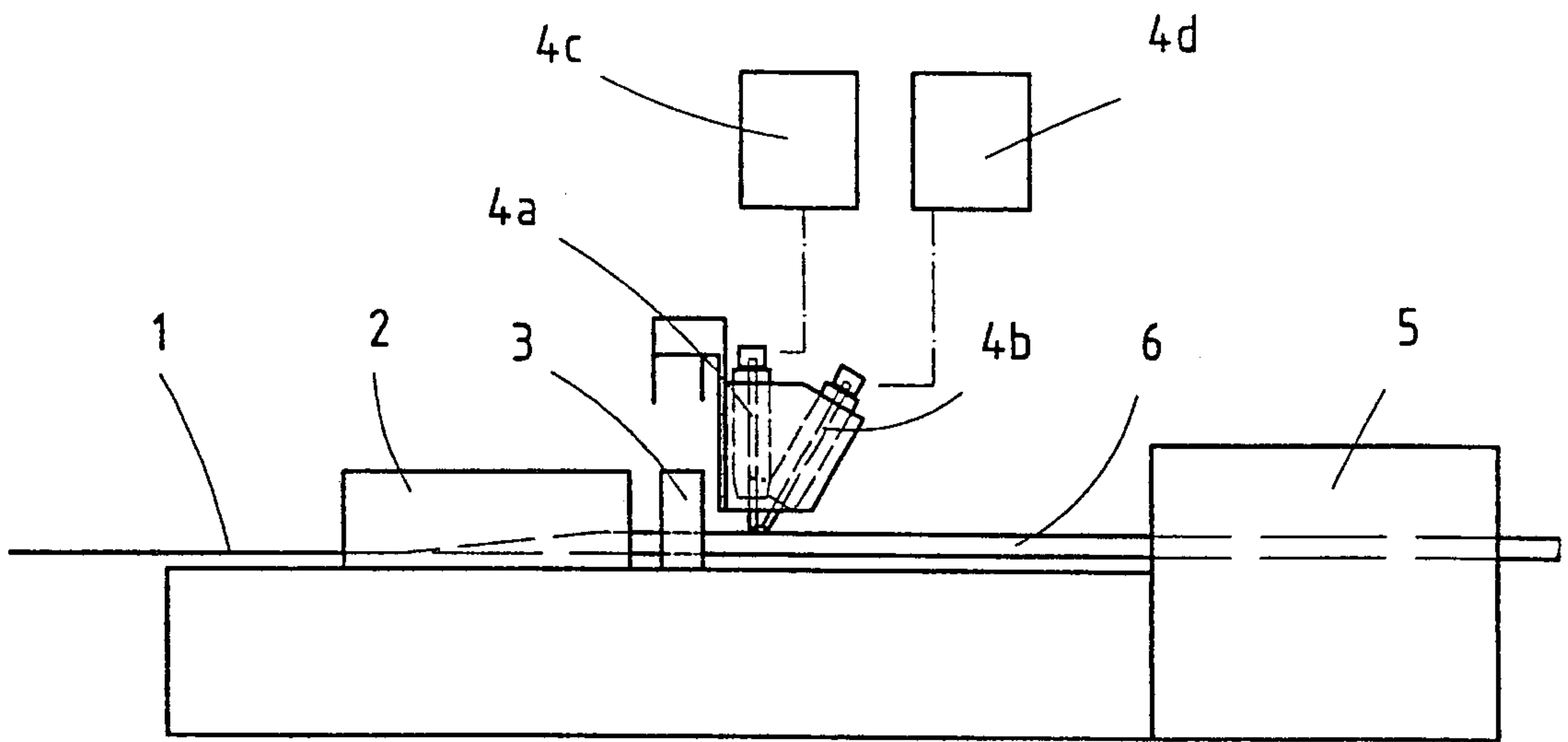


FIG. 1

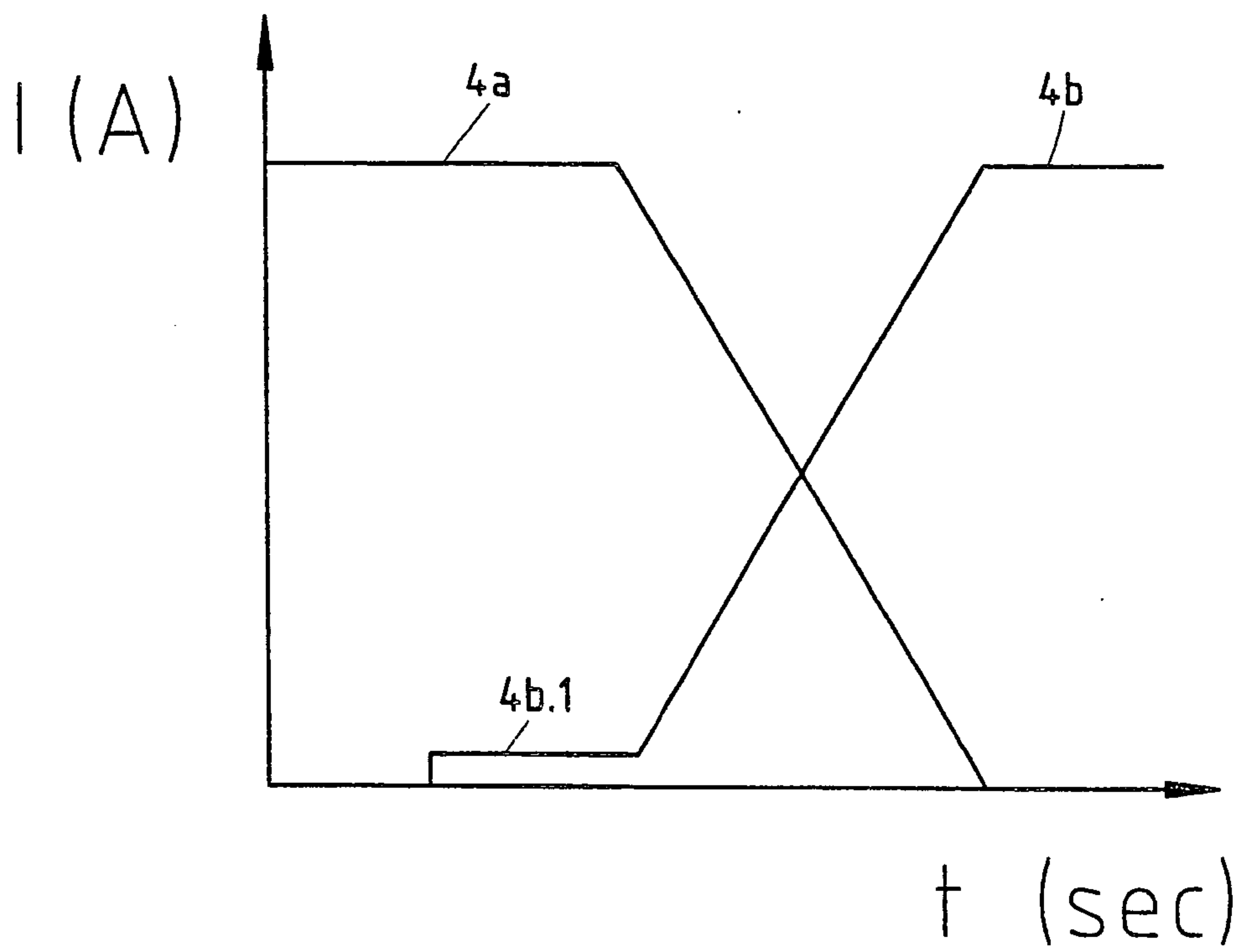


FIG. 2

