

The invention relates to a process for producing comparatively thin-walled pipes having a longitudinal seam produced by resistance welding, in particular rainwater downpipes, having a diameter of 50 to 200 mm and a wall thickness of 0.50 to 1.50 mm, from a strip, preferably an endless strip, of zinc or wrought zinc alloys, preferably of zinc-copper-titanium alloys, to form a rounded profile provided with a longitudinal slit extending on either side of the plane of symmetry, in which the long edges defining the longitudinal slit are heated to welding temperature in a comparatively short zone, are brought together to form a V-shaped gap at the weld point and are butt-welded together by upsetting.

DE-PS 26 07 970 describes a process and an apparatus for producing thin-walled pipes with an inlaid solder and made of non-ferrous metals. In this case, profiles are rounded from strips of sheet metal of appropriate size, the long edges of which profiles overlap in the region of the longitudinal seam which is produced by soldering, forming a joint. Once a solder strip has been laid in the joint, the overlapping long edges of the rounded profile are pressed against one another, heated by addition of heat and the longitudinal seam connection of the pipe is soldered. According to DIN 18641, such overlapping seams may also be produced by welding. However, it is regarded as a disadvantage that both the pipe length which can be produced and the maximum achievable soldering or welding rate of 8 m/min are limited. Furthermore, the overlapping seams adversely affect the aesthetic effect of the pipes to a not inconsiderable extent.

US-A-2 817 364 describes a process for producing comparatively thin-walled pipes, preferably aluminium pipes, with a welded long seam by high-frequency induction pressure welding. In this process, a metal strip is chamfered on its long edges, then rounded to give a tubular cross-section, then the long edges are heated to melting temperature in a short zone and are brought together and butt-welded, forming a V-shaped gap at the weld point.

10 The object of the present invention, departing from the process described first hereinbefore, is the continuous, automatic production of longitudinally-welded pipes of any length desired which meet the aesthetic requirements which are usual today in the building industry.

15 This object is achieved in that the long edges of the strip which are machine-cut before roll-shaping to produce the parallelism thereof are placed parallel opposite one another, forming the longitudinal slit, and are heated to a welding temperature which is below
20 melting temperature in a zone 0.2 to 1.5 mm wide and 0.5 to 2.5 mm long and are welded together in the plastic state.

25 In order to obtain a perfect welded seam, it is necessary to machine-cut the end faces of the long edges of the strip running parallel to one another before roll-shaping, so that in the case of a rounded profile they can be placed parallel opposite one another without difficulties in the upset welding region. The machine-cutting operation also removes the oxide film. These
30 measures avoid irregular introduction of heat, energy losses, one-sided formation of burrs, strong localised

overheating with melting-on of the strip material, edge dislocation and also overlapping of the long edges.

5 For strip thicknesses of 1 mm or more, it is appropriate to machine-cut the end faces of the long edges of the strip at an angle of more than 0 to 10°, since this then ensures that the end faces of the long edges can be placed parallel opposite one another in the upset welding region.

10 Within the scope of the preferred configuration of the process according to the invention, the long edges of the rounded profile are heated to at least 350°C in the comparatively short zone.

15 The angle of the V-shaped longitudinal gap at which the long edges of the pre-rounded profile are brought together in the weld point is limited by the deformation properties of the strip. The long edges are forced practically out of the inclination into the horizontal plane before welding, and are therefore under great tensile strain, but this must not exceed the elastic region in order to avoid buckling. It is therefore expedient for the V-shaped longitudinal gap to have an angle of 3 to 10°, preferably 5 to 7°.

25 To produce the welded seam, the long edges of the rounded profile which are heated in a short zone to at most melting temperature are pressed together by upsetting in the weld point and welded together, the compression path being 0.5 to 3 times the thickness of the strip. If the comparatively short zone of the long edges is heated beyond the melting point of the strip material, melting may occur in the zones, and hence

30

formation of a weld seam, the quality of which does not meet the mechanical-technological requirements set.

High-frequency induction pressure welding is particularly suitable for producing the weld seam.

- 5 A high quality of the weld seam can be achieved when the high-frequency power in the heating zone is 5 to 150 KVA, preferably 5 to 100 KVA.

10 For the purpose of machining the strip according to the process of the invention in one pass, the following are arranged in a row: a machining apparatus for the parallel-cutting machining of the long edges of the strip, a plurality of horizontal pairs of bending rollers between which the strip is shaped into a rounded profile with a longitudinal slit running on both sides
15 of the plane of symmetry, at least one horizontal pair of guide rollers by means of which the long edges of the rounded profile are made parallel and the middle land of the strip remains in the plane of symmetry during shaping, a coil inductor for heating the long edges of
20 the rounded profile in the heating zone, at least one vertical pair of upsetting pressure rollers by means of which the long edges of the rounded profile are brought together at the weld point and placed parallel opposite one another and are joined together in the plastic state
25 by constant upsetting pressure, and optionally a severing device for cutting off the pipe sections from a pipe string which has been produced.

30 In order to avoid unbending of the rounded profile, it is expedient to arrange a vertical pair of side rollers after each pair of bending rollers.

A preferred configuration of the upper roller of the pair of guide rollers bringing about the parallel orientation of the long edges of the rounded profile consists in that a cylindrical ring is provided in the plane perpendicular to the roller axis in the base of the roller, which ring sinks into the longitudinal slit of the rounded profile and against the side faces of which the long edges are pressed.

The maximum efficiency of the coil inductor and hence an optimum transfer of heat into the long edges of the rounded profile in the region of the heating zone can be achieved when the thickness of the annular gap between the external diameter of the rounded profile and the internal diameter of the coil inductor is 0.5 to 5 mm.

If necessary, a magnet core which cooperates with the coil inductor may be located in the interior of the rounded profile in order to achieve the greatest possible concentration of the high-frequency current in the heating zone of the long edges of the rounded profile.

Generally, the arrangement of a vertical pair of upsetting pressure rollers is sufficient for bringing together and upsetting the long edges of the rounded profile in the weld point. However, the action is improved if three upsetting pressure rollers arranged diagonally to each other in one plane at an angle of 120° or four at an angle of 90° are inserted at the point of the vertical pair of upsetting pressure rollers.

Optionally, the upsetting pressure rollers may be succeeded by another vertical pair of side rollers, in

order to prevent the weld seam, which is still hot, from bursting open.

5 After welding, the weld seam is expediently smoothed externally, but optionally also inside the pipe string, by means of a deburring device. Then the pipe string is calibrated by a plurality of pairs of calibration rollers.

The invention will be described in greater detail below with reference to drawings and an embodiment.

10 Fig. 1 shows a diagrammatic side view of an automated production device,

Fig. 2 shows a diagrammatic top view of the automated production device,

15 Fig. 3 shows a top view of the heating-upsetting-welding region,

Fig. 4 shows a front view of the upper roller of the horizontal pair of guide rollers for the parallel alignment of the long edges of the rounded profile.

20 An endless strip (2) 0.65 mm thick and 297 mm wide, made of a zinc-copper-titanium alloy and coiled on to a double reel (1), runs through the rollers (3) into the welding apparatus (4) in which the end of the strip (2) located in the roll-shaping section (11) is welded to
25 the start of the subsequent strip. In the next step, the long edges (5) of the strip (2) are machine-cut by means of planing tools, not shown in detail, located on the run-in table (6), such that the end faces of the

long edges (5) run parallel to one another in order to set the planar surfaces required for the welding thereof. The strip (2) is then introduced into the roll-shaping section consisting of six horizontal pairs of bending rollers (7), each of which is succeeded by a vertical pair of side rollers (8), and two subsequent horizontal pairs of guide rollers (9), in which one cylindrical ring (10) each time is attached in the base of the upper roller, in which section the strip (2) is shaped into a rounded profile (12) with a longitudinal slit (13) which is open on the top and runs on either side of the plane of symmetry. The pairs of side rollers (8) prevent the profile (12) from unbending. Then the long edges (5) of the rounded profile (12) are placed parallel opposite one another in the region of the pairs of guide rollers (9) in that the cylindrical rings (10) of the two upper rollers sink into the longitudinal slit (13) of the rounded profile (12). Then the profile (12) is passed through the coil inductor (14) and in so doing a section of the long edges (5) which is approximately 1 mm wide and about 1.5 mm long is heated to a temperature of 410°C. Then the profile (12) runs through a vertical pair of upsetting rollers (15), the long edges (5) being brought together at an angle of 6° in the weld point (17), forming a V-shaped slit (16), placed parallel opposite one another and welded by upsetting. In order to prevent the weld seam (18), which is still hot, from bursting open, a vertical pair of side rollers (19) is located directly after the vertical pair of upsetting rollers (15). Then the welded pipe string is calibrated by means of three horizontal, one vertical and one more horizontal pairs of calibrating rollers (20), with a testing apparatus (21) for the weld seam being located between the last horizontal pair of rollers (20) and the

preceding vertical pair of rollers. The pipe sections which are cut off automatically from the pipe string (18) in a desired length with a severing device (22) succeeding the calibration apparatus, which device may for instance consist of a floating saw, are laid on the shoot.

The advantages achieved with the invention consist in particular in that longitudinally welded pipes can be produced automatically and continuously from a strip made of zinc or wrought zinc alloys at a great speed of up to 200 m/min, the strength of the weld seam having the same values as that of the strip material with very good expansion and widening of up to 30%, so that the ends of the pipe sections can therefore also be widened without difficulty with respect to their insertion ability.



Claims

1. Process for producing comparatively thin-walled pipes having a longitudinal seam produced by resistance welding, in particular rainwater downpipes, having a diameter of 50 to 200 mm and a wall thickness of 0.50 to 1.50 mm from a strip, preferably an endless strip, of zinc or wrought zinc alloys, preferably of zinc-copper-titanium alloys, to form a rounded profile provided with a longitudinal slit extending on either side of the plane of symmetry, in which the long edges defining the longitudinal slit are heated to welding temperature in a comparatively short zone, are brought together to form a V-shaped gap at the weld point and are butt-welded together by upsetting, in which the long edges of the strip which are machined before roll-shaping to produce the parallelism thereof are placed parallel opposite one another, forming the longitudinal slit, and are heated to a welding temperature which is below melting temperature in a zone 0.2 to 1.5 mm wide and 0.5 to 2.5 mm long and are welded together in the plastic state.
2. Process according to Claim 1, characterised in that the end faces of the long edges of the strip are machine-cut running parallel to one another.
3. Process according to Claim 1, characterised in that the end faces of the long edges of the strip are machine-cut at an angle of more than 0 to 10°.
4. Process according to Claims 1 to 3, characterised in that the long edges of the rounded profile are heated to at least 350°C in the comparatively short zone.



- 5 5. Process according to Claims 1 to 4, characterised in that the long edges of the rounded profile are brought together at an angle of 3 to 10°, preferably 5 to 7°, at the weld point, forming a V-shaped longitudinal gap.
6. Process according to Claims 1 to 5, characterised in that the compression path at the weld point is 0.5 to 3 times the thickness of the strip.
- 10 7. Process according to Claims 1 to 6, characterised by the use of high-frequency induction pressure welding.
8. Process according to Claim 7, characterised in that the high-frequency power in the heating zone is 5 to 150 KVA, preferably 5 to 100 KVA.