The invention relates to a rotary ironer comprising at least one essentially horizontally located ironing roller having a circular-cylindrical surface and being rotatably journalled about an axis of rotation through the centre of the roller, and wherein, for each ironing roller, there is provided an ironing pan, wherein the ironing pan is configured from two flexible, essentially rectangular steel plates that are mutually spaced apart, but being closely joined along their periphery, whereby they combine to form a hollow, flexible ironing pan that is able to adapt to the circular-cylindrical surface of the ironing roller and wherein, on the ironing pan at one or more positions along the axis of rotation of the ironing roller, is configured one or more supply pipes, integrally with the ironing pan, for supplying steam to the cavity of the ironing pan. The invention is characterised in that the integral supply pipes at each position on the ironing pan are configured as separate pipes, there being on the integral supply pipes at each position configured separate coupling flanges/stubs for connecting steam supply pipes to the integral supply pipes.
ROTARY IRONER FOR IRONING ESSENTIALLY RECTANGULAR PIECES OF CLOTH

[0001] The present invention relates to rotary ironers for ironing in particular substantially rectangular pieces of cloth, such as bed linen and tablecloths, and wherein the rotary ironer comprises at least one essentially horizontally arranged and rotatably journaled ironing roller that has two ends, and wherein the ironing roller is provided with an ironing pan that encloses a part of the circumference of the ironing roller essentially throughout the entire length of the ironing roller, and wherein the ironing roller and the ironing pan thus form a supply side, whereby by means of the ironing roller the piece of cloth is pulled into the abutment area between the ironing roller and the ironing pan, and a discharge side opposite the supply side, wherein the piece of cloth is yet again pushed out of the ironing roller.

[0002] Conventional rotary ironers of this kind very often comprise a very rigid and inflexible ironing pan that is configured with very large material thicknesses. These rotary ironers are most often heated by means of condensing steam, the ironing pan being able to easily resist the super-atmospheric pressure of the steam to be supplied to the ironing pan in order to obtain the desired ironing temperature.

[0003] It is a problem of these prior art ironing pans that even very small irregularities in the surface of the ironing pan that faces towards the ironing roller during use will result in varying friction, which is undesirable in rotary ironers for the sake of ensuring as good and reliable ironing of the pieces of cloth as possible. The prior art inflexible ironing pans therefore involve quite a lot of machining of the rigid and inflexible ironing pan to ensure that it matches the ironing roller well. However, it is an advantage of these rotary ironers that, once the ironing pan as such is completely machined, it is dimensionally very stable and thus yields a high degree of freedom for configuring other component parts in the rotary ironer without thereby entailing diverse friction conditions.

[0004] Additionally it applies that the rigid pans expand in case of increasing pressure and temperature, which means that the contact pressure between roller and pan decreases to each side due to this expansion. The contact pressure being of considerable consequence to the drying capacity of the rotary ironer, this means that—albeit the increasing temperature gradient entails more thermal energy—the thermal and pressure expansion of the rigid pan involves a loss of capacity. The same phenomenon occurs when the felt coating on the rotary ironer is worn, whereby the diameter of the roller is reduced.

[0005] In order to avoid the drawbacks of the above-mentioned technique, steam-heated ironing pans have been devised that are very flexible, thereby enabling them to elastically adapt to the outer shape of the ironing roller.

[0006] Examples of such ironing pans are taught in eg EP Patent No. 573,402, DE patent application No. 19757756 and U.S. Pat. No. 3,118,240, wherein the ironing pans are configured of two flexible, substantially rectangular steel plates that are spaced apart, except that they are closely joined along their periphery and in a number of spot joints within the periphery, whereby they combine to form a hollow flexible ironing pan, and wherein—on the ironing pan at each of the ends of the ironing roller—one or more supply tubes is/are configured that are integral with the ironing pan for supplying steam to the cavity of the ironing pan.

[0007] By the latter rotary ironers it is known to supply steam via a tubular system joined to the ironing pan by welding and extending longitudinally of the ironing pan and the ironing roller from a coupling flange/stub at the one end of the ironing roller. In order to counteract that these tubular systems cause the flexible ironing pan to be deformed by thermal expansion and contraction of the tubular members to contract, these tubular systems are provided with one or more relief areas in the form of bends that increase the elasticity of the tubular system in that these bends allow the tubular system to be deformed in principle like a harmonica.

[0008] However, another problem that occurs in case of the latter flexible ironing pans that are heated by condensing steam is that the desired temperature on the surface of the ironing pan presupposes that steam is supplied under a certain pressure. This means that, in principle, the ironing pan is considered to be a pressurized container, which means that safety precautions are to be made during construction of the ironing pan.

[0009] Thus, it is the object of the present invention to provide a rotary ironer and an ironing pan, whereby the safety is increased—other things being equal, while simultaneously the loads, if any, of the tubular system on the ironing pan are further reduced.

[0010] In accordance with the invention this is obtained by the integral supply tubes being at each position on the ironing pan configured as separate tubular members in that, on the integral supply tubes, at each position there are configured separate coupling flanges/stubs for coupling of steam supply tubes onto the integral supply tubes.

[0011] The integral steam supply tubes being at each position longitudinally of the ironing roller and thus at each position on the ironing pan separated from each other rather than constituting a welded supply tube that extends along the entire ironing pan, it is thus ensured that no power influences are transmitted as a consequence of thermal expansions and contractions via these tubes like to the ironing pan. Simultaneously it is obtained that the overall volume of the tubular system can be reduced considerably, in particular due to the prior art relief zones welded onto the ironing pan being redundant, whereby, other things being equal, providing a higher degree of safety, the safety in connection with pressurized containers being often calculated as the overall volume of the container multiplied by the pressure to which the container is exposed.

[0012] By a preferred embodiment there is exclusively configured integral steam supply tubes in particular centrally on the ironing pan seen in relation to the axis of rotation of the ironing roller.

[0013] By an alternatively preferred embodiment such supply tubes are configured exclusively at each end of the ironing pan, and in this context the overall container volume of the ironing pan is advantageously further reduced by the coupling flanges/stubs being configured at each their end of the ironing roller and hence the ironing pan.

[0014] By a further preferred embodiment the steel plate that, during use of the rotary ironer, faces towards the
ironing roller is configured from black steel or ferritic steel, which, other things being equal, entails that a lower steam pressure can be applied than was necessary in the event that stainless steel was used, as it is known in particular from DE patent application No. 19757756 and EP patent No. 577402; black steel or ferritic steel usually having a conductivity that is up to four times as high as stainless steel.

In this context, both the steel plates that form the ironing pan are further advantageously constituted of black steel or ferritic steel, whereby undesired deformations of the ironing pan due to differences in the thermal expansion coefficient of the plates are thus avoided.

By a further preferred embodiment of the invention the steel plate that faces towards the rotary ironer during use is constituted of a plate with a material thickness of between 2 and 6 mm. And preferably between 3 and 5 mm. And the steel plate that faces away from the rotary ironer during use has a material thickness of between 0.75 and 2 mm, and preferably between 1 and 1.5 mm. Thereby an extremely flexible ironing pan is obtained which is extremely easy to manufacture by use of conventional welding process without an ensuing need for considerable further processing of the surfaces of the rotary ironer to ensure a uniform friction and a uniform contact pressure between the ironing pan and the pieces of cloth that are pulled through the rotary ironer by the abutment of the rotating ironing roller thereon.

Additionally, the ironing pan may further comprise one or more discharge pipes for collecting and discharging condensed steam from the ironing pan interior, by configuring such discharge pipes at the bottom of the ironing pan in the normal use position thereof such discharge pipes will be located on a bent and thus relatively rigid area of the ironing pan, which means that high demands are not made to reducing the effect by which the discharge pipes influence the ironing pan.

In a preferred embodiment, the integral supply pipes are in flow communication and attached to the ironing pan at each of the corners of the rectangular steel plates, whereby steam is supplied to the rotary ironer at the uppermost edges thereof, and at each of the ends of the ironing pan seen relative to the normal use position. This ensures good distribution of heat on the surface of the ironing pan.

Furthermore, in this context, two of the integral supply pipes located at least at the one end of the ironing pan advantageously extend from the ironing pan and slantingly there below, thereby entailing a further reduction of the impact exerted by the integral supply pipes on the ironing pan.

A further reduction of the influence of the integral supply pipes on the ironing pan is furthermore achieved provided the two integral supply pipes at the one end of the rotary ironer are provided with each their coupling stub/flange for releasable coupling of steam supply pipes to the integral supply pipes.

By a further preferred embodiment of the invention the integral supply pipes at the one end of the ironing pan are releasably coupled to one or more steam supply pipes that extend longitudinally of the ironing pan and towards the opposite end thereof. Hereby it is achieved that the ironing pan can easily be coupled to an existing steam supply plant at the one end of the rotary ironer.

A preferred embodiment of the invention will be described in detail in the following with reference to the drawing, wherein:

FIG. 1 is a sketch showing a rotary ironer according to the present invention, seen in a front view;
FIG. 2 is a sketch in the form of a sectional view along the line A-A shown in FIG. 1.
FIG. 3 is a sketch showing the ironing pan shown in FIGS. 1 and 2 with supply pipes and discharge pipes welded thereto. The ironing pan is shown in unfolded state and seen from the outside.
FIG. 4 is a sketch showing the ironing pan according to FIG. 3, wherein the welding spots are shown.
FIG. 5 is a sectional view through the ironing pan shown in FIG. 4.
Thus, FIG. 1 is a sketch showing an ironing pan seen in a front view, wherein the ironing pan comprises frame parts 1, wherein is configured an ironing roller 2 that can be caused by a not shown motor, by means of the gear 18, to rotate about the axles 4. Underneath the ironing roller an ironing pan 5 is provided in a conventional manner, on which supply pipes 6 are mounted at each end of the ironing pan 5. In accordance with the invention, it will appear that the two shown supply pipes 6 are not connected to each other; rather they are separate and each provided with each their mounting flange 8 for mounting of further steam supply pipes 7, only a few of which are shown.

Due to this above-mentioned separation of the shown supply pipes 6 in the two opposed ends of the ironing pan 5 it is thus achieved that impacts, if any, that were previously used for supplying steam to the prior art rotary ironers are reduced to a minimum with ensuing reduction of the risk of the elastic ironing pan being undesirably deformed.

Now FIG. 2 shows a sectional view of the ironing roller 2 shown in FIG. 1 with ironing pan 5, seen along the line A-A according to FIG. 1.
It will thus appear that the ironing roller 2 has a direction of revolution as illustrated by the arrow C around the centre D formed by the axles 4 shown in FIG. 1, whereby the ironing roller 2 and the ironing pan 5 form a feed slot 9 for the introduction of pieces of cloth between the ironing roller 2 and the ironing pan 5, following which the piece of cloth is transported between the ironing roller 2 and the ironing pan towards the outlet opening 10.

Now FIG. 2 shows that the supply pipes 6 shown in FIG. 1 are provided both at the inlet 9 and the outlet 10, such that pressurized steam is supplied to the ironing pan 5 via these supply pipes 6 that are yet again, via the shown coupling flanges 8 or stubs, coupled to not shown steam supply pipes.
As will appear from FIG. 2, the ironing pan 5 forms a yoke in which the ironing roller 2 can rest, and in a commonly known manner the ironing pan is suspended between the inlet 9 and the outlet 10 that thus forms the upper areas of the ironing pan in the normal use position thereof. Moreover FIG. 2 shows that in the ironing pan 5 a discharge pipe 11 is configured, as is shown in detail in FIG. 3. This discharge pipe 11 is, as shown, provided with a separate coupling flange or stub 12.
Thus, FIG. 3 shows the ironing pan 5 shown in FIGS. 1 and 2 in unfolded and plane state for the sake of overview. Thus the ironing pan 5 is, as will appear, constituted of two essentially rectangular plates, joined by welding, as will appear in further detail from FIG. 4, but wherein
the plate has an inlet edge 9a and an outlet edge 10a and an edge 14 at each end of the ironing pan plate. Furthermore, from FIG. 3 it will appear more clearly that the discharge pipe 11 is configured in a common conventional manner with pipe bends 13 that are configured with a view to reducing the forces by which the discharge pipe 11 influences the ironing pan 5 and that may occur in case of diverse expansions and contractions due to the heat expansion coefficients of the materials.

[0035] According to the invention the discharge pipe can be configured as two separate pipes with separate coupling flanges or stubs, as is provided in accordance with the invention in connection with the supply pipes 6. By the shown preferred embodiment, however, this alternative is not put to use due to the ironing pan being, in the area where the discharge pipe 11 is provided, configured to be relatively rigid due to the shape of the ironing pan.

[0036] Now, FIG. 4 shows the ironing pan 5 shown in FIG. 3 in the same unfolded state, but without the supply pipes 6 and discharge pipes 11 shown in FIG. 3. In turn, it is shown herein that the two plates are joined to each other by welding face to face in all the shown singular points 15 and at the periphery of the plates, which is constituted by the two end edges 14 and the inlet edge 9a and the outlet edge 10a in combination.

[0037] Furthermore, FIG. 4 shows the supply apertures 16 that form the passage for steam from the supply pipes 6 to the interior of the ironing pan 5 and the corresponding discharge apertures 17 that form passage from the interior of the ironing pan 5 to the discharge pipes 11.

[0038] Finally, FIG. 5 shows a detail of the ironing pan 5 shown in FIG. 4, shown in a sectional view. From here it will thus appear that the two plates, joined by welding, have mutual contact merely via the two above-mentioned welded areas and, between these, they are configured such that they create a flow path that allows steam to pass across the entire surface of the ironing pan from the supply openings 16 to the discharge openings 17. This configuration can be performed as a pre-shaping of the one of the plates, but is preferably performed by providing a powerful hydraulic super-atmospheric pressure between the plates after they have been joined by welding.

1. A rotary ironer comprising at least one essentially horizontally located ironing roller that has a circular-cylindrical surface and is rotatably journaled about an axis of rotation through the centre of the roller, and wherein, for each ironing roller, there is provided an ironing pan having two ends and between these two ends forming a yoke in the form of a cylinder face that partially encloses a part of the circumference of the ironing roller essentially in the full length of the ironing roller, and wherein the ironing roller and the ironing pan thus form a supply side, where the piece of cloth will, due to the rotation of the ironing roller, by means of the ironing roller be pulled into the abutment area between the ironing roller and the ironing pan, and a discharge side, opposite the supply side, where the piece of cloth is yet again pushed out of the ironing roller, and wherein the ironing pan is configured from two flexible, substantially rectangular steel plates that are mutually spaced apart, but being closely joined along their periphery, whereby they combine to form a hollow, flexible ironing pan that is able to adapt to the circular-cylindrical surface of the ironing roller and wherein, on the ironing pan, at one or more positions along the axis of rotation of the ironing roller, is configured one or more supply pipes, integrally with the ironing pan, for supplying steam to the cavity of the ironing pan, characterised in that the integral supply pipes at each position on the ironing pan are configured as separate pipes, there being on the integral supply pipes at each position configured separate coupling flanges/stubs for connecting steam supply pipes to the integral supply pipes.

2. A rotary ironer according to claim 1, characterised in that integral steam supply pipes are configured essentially centrally on the ironing pan, seen in relation to the axis of rotation of the ironing roller.

3. A rotary ironer according to claim 1, characterised in that at least integral steam supply pipes are configured at both ends of the ironing pan, seen in relation to the axis of rotation of the ironing roller.

4. A rotary ironer according to claim 3, characterised in that the coupling flanges/stubs are configured at each end of the ironing pan.

5. A rotary ironer according to claim 1 or 2, characterised in that the steel plate facing towards the ironing roller during use of the rotary ironer is made of black steel or ferritic steel.

6. A rotary ironer according to claim 5, characterised in that both the steel plates that form the ironing pan are made of black steel or ferritic steel.

7. A rotary ironer according to claim 1, wherein the steel plate facing towards the ironing roller during use has a material thickness of between 2 and 6 mm, and in that the steel plate facing away from the ironing roller during use has a material thickness of between 0.75 to 2 mm.

8. A rotary ironer according to claim 1, wherein the ironing pan further comprises one or more discharge pipes for collecting and discharging condensed steam from the ironing pan interior, said discharge pipe(s) being configured at the area on the ironing pan which is located lowermost in the normal in-use position of the ironing pan.

9. A rotary ironer according to claim 1, wherein the integral supply pipes are in flow communication with and attached to the ironing pan at each of the corners of the rectangular steel plates, whereby steam is supplied to the ironing pan at the uppermost edges thereof.

10. A rotary ironer according to claim 9, characterised in that, at least at the one end of the ironing pan, two of the integral supply pipes extend from the ironing pan and slantingly there below.

11. A rotary ironer according to claim 10, characterised in that the two integral supply pipes at the one end of the ironing pan are provided with each their coupling stub/flange for releasable coupling steam supply pipes to the integral supply pipes.

12. A rotary ironer according to claim 10 or 11, characterised in that, to the integral supply pipes at the one end of the ironing pan, one or more steam supply pipes is/are releasably coupled that extend longitudinally to the ironing pan and towards the opposite end of it.

13. A rotary ironer according to claim 7, wherein the steel plate facing towards the ironing roller during use has a material thickness of between 3 and 5 mm, and in that the steel plate facing away from the ironing roller during use has a material thickness of between 1 and 1.5 mm.

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