

March 8, 1966

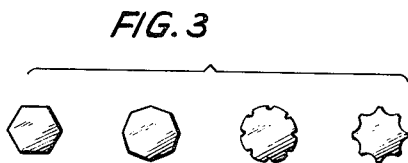
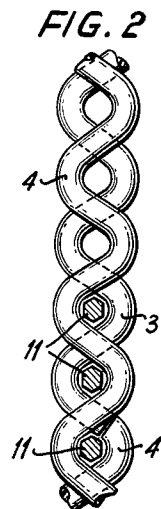
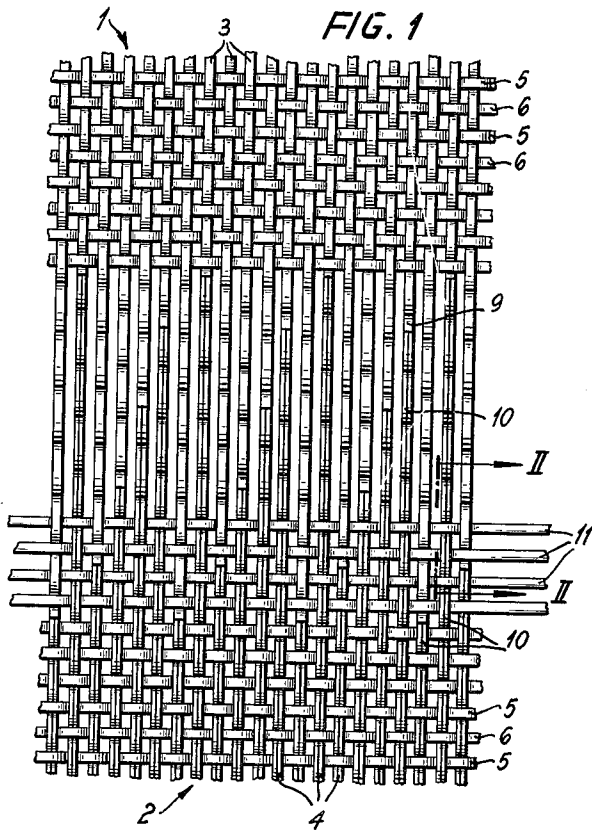
K. U. SCHUSTER

3,238,594

METHOD OF CONNECTING THE ENDS OF SCREEN FABRICS FOR
PRODUCING ENDLESS FORMING WIRES FOR PAPER MACHINES

Filed June 17, 1963

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

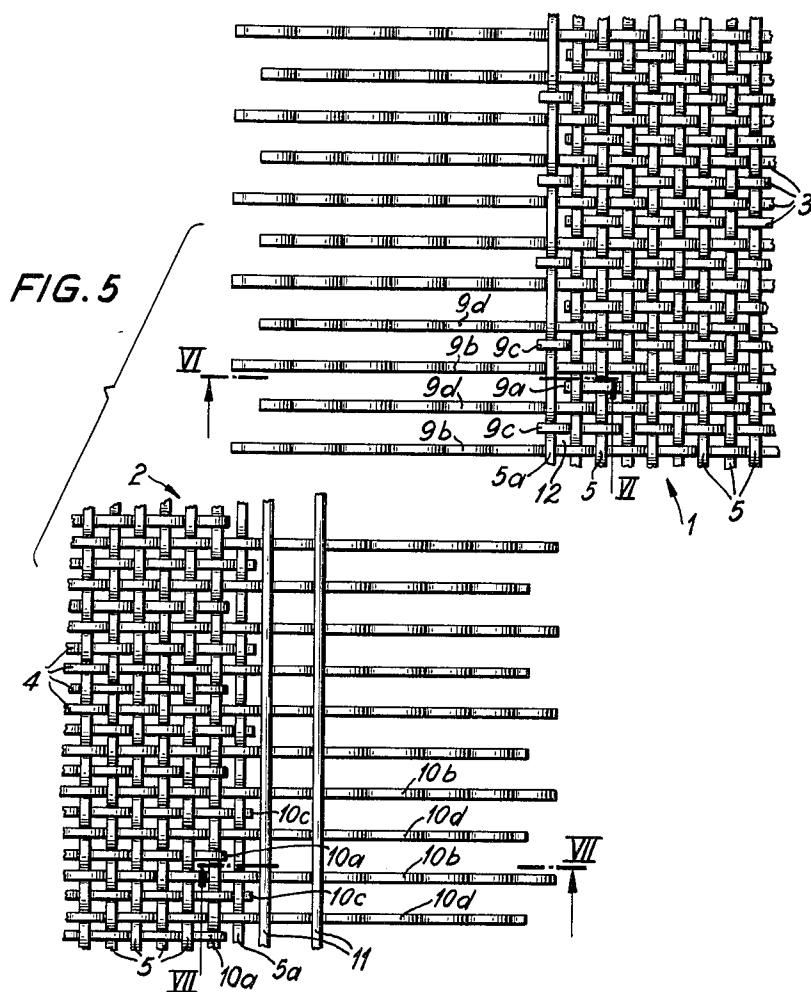


FIG. 6

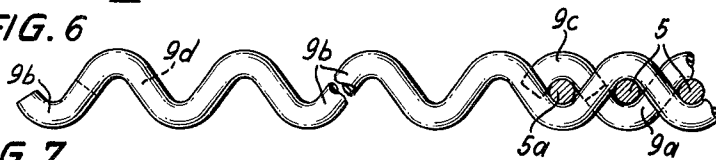
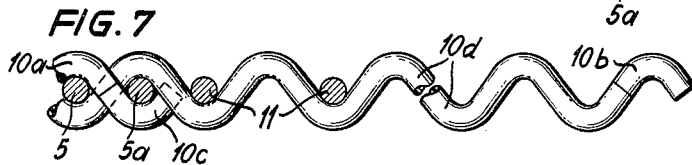


FIG. 7



March 8, 1966

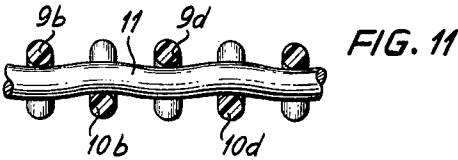
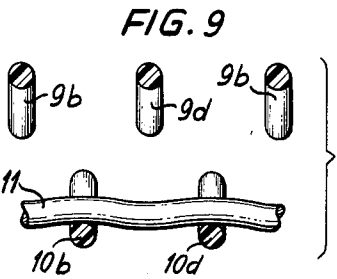
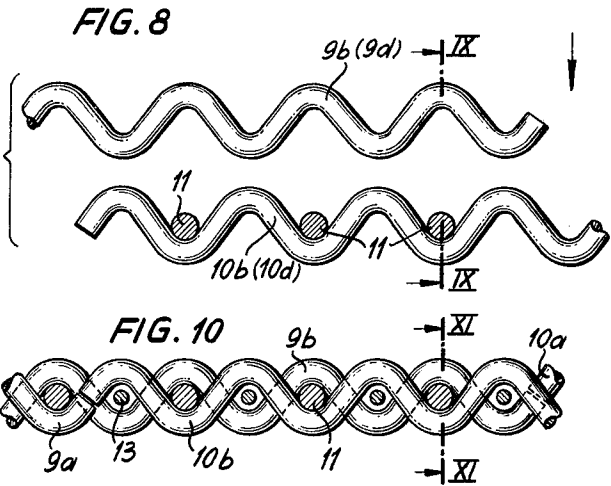
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METHOD OF CONNECTING THE ENDS OF SCREEN FABRICS FOR PRODUCING END- LESS FORMING WIRES FOR PAPER MA- CHINES

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Sch 31,641

10 Claims. (Cl. 28—72)

The present invention relates to a method of producing an endless forming wire for a paper machine from a strip of screen fabric in which at least the warp wires consist of a flexible plastic, and more particularly it relates to a method of interconnecting the end portions of such a fabric strip so as to produce an endless forming wire.

The forming wires for paper machines usually consist of endless screen belts which are made of strips of woven screen fabric with warp and weft wires. In order to attain a uniform forming wire, it is necessary to connect the two ends of such a fabric strip to each other in such a manner that the area of the connecting seam does not differ from the characteristics of the main body of the strip. Therefore, neither the warp nor weft wires should be superimposed on each other nor should two wires of the warp or weft lie directly adjacent to each other, and the entire screen belt of the forming wire including the seam area should have a uniform mesh size and not have any gaps.

If such a forming wire is made of metal wire, it is possible to connect the ends of the warp wires of the fabric strip by welding them to each other. This method cannot be employed, however, if the warp of the forming wire consists of plastic. The connecting seam has therefore in the past been produced by weaving or braiding in such a manner that after a certain number of weft wires were removed from the ends of the fabric strip, the exposed parts of the warp wires were bent out of the plane of the fabric, a so-called "auxiliary warp" of a width corresponding to the length of the exposed parts was then inserted transversely to the fabric length, and the exposed parts of the warp wires were passed individually into the auxiliary warp, thus forming weft wires. By making the exposed parts of the warp wires of unequal lengths, the transition points between the warp wires of one fabric edge and the warp wires of the other fabric edge were staggered so as not to lie adjacent to each other. However, at the points of transition the ends of the exposed warp wires were lying in pairs adjacent to each other within the fabric plane.

If the forming wire is of the type which is now very preferred in which all of the warp wires of the screen fabric consist of plastic and the weft wires consist either all of metal or alternately of plastic and of metal, the warp wires by being woven receive a corrugated shape. Although this corrugated shape of the warp wires at first remains at the edge portions of the fabric strip which are to be connected even after the weft wires are removed, it gradually flattens out to some extent, although it never disappears entirely unless it is flattened out completely by being stretched.

This, however, means that the screen apertures will increase in size which, of course, is very undesirable. Since when employing the mentioned method the exposed ends of the warp wires within the seam area do not extend parallel to the transverse direction of the screen fabric, but must be bent from the solid edge of the fabric into the shed of the auxiliary warp in the form of weft threads, the corrugations in the warp wires are

undesirable. Furthermore, since in the seam area the warp of the fabric becomes a weft, the corrugations which are formed do not have the same shape as in the body of the fabric, whereby the water-permeability of this area is additionally reduced, which results in defects in the paper web which is formed on the forming wire since less water is removed at the seam area than at the other parts of the forming wire. This deficiency is so serious that such forming wires for paper machines cannot even be employed for producing a paper which is fit for making newspapers.

It is an object of the present invention to provide a new method of connecting the ends of a screen fabric strip having a warp of plastic wires so as to form an endless forming wire in such manner that the above-mentioned disadvantages of the known method will be fully overcome.

The new method according to the invention permits the screen fabric of the forming wire to be provided with such a connecting seam that the seam area will have exactly the same mesh size water-permeability, surface shape, and durability as the remainder of the fabric. Furthermore, the area of the connecting seam according to the invention may be made relatively narrow and the same connection may be produced within a relatively short time.

According to the new method, the ends of the warp wires of plastic at the transverse edge portions of the screen fabric strip are at first heat-set and thus fixed. The warp wires of these edge portions are then cut off at different lengths in a manner so that the corresponding wires of both edge portions complement each other. All of the weft wires within the area of the cut wire ends are then withdrawn so that within this area only the warp wires remain. The two edge portions are then fitted together so that the corresponding wire ends abut end to end against each other. From one lateral edge of the screen fabric new weft wires are then threaded or drawn through the aligned corrugations of the adjacent warp wires of both edge portions.

Since these corrugations are heat-set and the exposed parts of the warp wires remain in a fixed position and the ends of the corresponding wires abut against each other, a transverse strip is formed at the seam area which, except for the cuts between the wires, corresponds exactly to the shape and structure of the main body of the screen fabric.

In order to facilitate the insertion of the weft wires, the invention further provides that the cross-sectional area of the front ends of these wires is reduced by stretching or rolling the same, preferably along a distance exceeding the width of the fabric strip. After these reduced weft wire parts have been threaded through the corresponding corrugations in the warp wires, they are drawn further until the following full-section weft wires are inserted into the entire width of the fabric. A very narrow seam area as well as a very secure connection may be attained by making the weft wires which are to be newly drawn-in of an angular cross section with a maximum diameter equal to that of the weft wires of the main body of the fabric. When employing metallis weft wires of such a shape for the newly drawn-in part, the edges of these wires will be impressed into those warp wires which consist of plastic so that any sliding of the warp and weft wires relative to each other will be prevented. The edges of these weft wires are preferably made of an angle greater than 90° in order to prevent them from cutting into the warp wires. All of the newly inserted weft wires preferably consist of metal, although they may also consist of metal and plastic alternating with

each other in the same manner as in the main body of the fabric.

The length of time and the amount of effort required for producing the connecting seam may be further reduced and the opposite ends of the fabric strip may be connected to each other still more securely if after the warp wires of the edge portions of the fabric have been heat-set and fixed, all adjacent warp wires within each group of a recurrent series are cut off at each transverse edge portion so as to have different lengths and to be complementary to the corresponding warp wires of the other transverse edge portion, so that all pairs of opposite warp wires of both edge portions have the same total length. The difference in length between all of those warp wires which have parallel corrugations only needs to amount to the length of a few screen apertures of the fabric, but should amount at least to the length of one screen aperture. All of the ends of the warp wires which have been cut off at both edge portions of the fabric strip are then removed together with all of the weft wires within the area in which these ends were cut off, except the last weft wire closest to the shortest warp wires in each edge portion. New weft wires are then laid from above into the upwardly open corrugations of the exposed warp wires of one transverse edge portion of the fabric strip. These newly inserted weft wires are preferably the same weft wires which were previously removed. Thereupon, the exposed warp wires of the other edge portion of the fabric strip are placed over these weft wires and between the warp wires of the first edge portion. Into the screen apertures which are thus formed at the various corrugations the missing number of weft wires are then threaded or drawn-in from the lateral sides of the fabric. The two transverse edge portions are thus connected to each other in such a manner that, except for the staggered cuts between the corresponding warp wires of both edge portions, the area of the connecting seam does not differ from the remainder of the screen fabric. The difficult operation of threading or drawing-in the new weft wires has to be carried out with only one half of the wires which are required within the seam area. Since the weft wires which are at first placed from above into the upwardly open corrugations are the same as were previously removed, they already have the same corrugations as the weft wires of the remainder of the fabric and thereby prevent the warp wires from shifting in lateral directions.

The operation of inserting the weft wires from the side of the fabric into the alternate courses which are still open after the transverse edge portions are fitted together and the first group of weft wires has been laid into the upwardly open corrugations of the warp wires may be facilitated by first threading thinner stiff wires through these open courses and by then replacing these thin wires successively by weft wires of the same thickness as that of the other weft wires of the fabric.

The width of the area of the connecting seam may be further reduced by making the weft wires which are to be newly inserted of a material which consists of a thin core of metal wire which is provided with a coating of a weldable thermoplast, and by heating this metal core by an electric current after the weft wires have been threaded or drawn-in so that the plastic coating will be welded together with the warp wires. If this method and material is applied, only 4 to 6 weft wires will be required within the seam area in order to connect the ends of the fabric strip securely to each other.

The most important features and steps of the new method insofar as they are capable of being graphically illustrated, as well as structural details of the weft wires which are preferably employed in this method will become more clearly apparent from the accompanying drawings and the following detailed description thereof.

In these drawings:

FIGURE 1 shows an enlarged plan view of two sec-

tions of a screen fabric strip adjacent to the transverse edge portions to be connected in the position after the warp wires have been withdrawn, and after the ends of the warp wires have been placed end to end and some of the new weft wires have been threaded into the seam area;

FIGURE 2 shows an enlarged cross section which is taken along line II—II of FIGURE 1;

FIGURE 3 shows end views of four examples of weft wires of different angular cross-sectional shapes;

FIGURE 4 shows an enlarged elevation of a part of a weft wire of a hexagonal cross section, the front portion of which is of a reduced diameter;

FIGURE 5 shows two sections of the transverse edge portions to be connected in accordance with a modification of the inventive method in the position after the weft wires and the cut portions of the warp wires are removed from these edge portions;

FIGURE 6 shows an enlarged cross section which is taken along the line VI—VI of FIGURE 5;

FIGURE 7 shows an enlarged cross section which is taken along the line VII—VII of FIGURE 5;

FIGURE 8 shows an enlarged view of two exposed warp wires at the two edge portions of the fabric strip and, in cross section, of weft wires which are placed upon the warp wires of one edge portion;

FIGURE 9 shows a cross section which is taken along the line IX—IX of FIGURE 8;

FIGURE 10 shows an enlarged view of two warp wires with weft wires placed into alternate corrugations as in FIGURE 8 and with auxiliary weft wires threaded into the remaining corrugations; while

FIGURE 11 shows a cross section which is taken along the line XI—XI of FIGURE 10.

In FIGURE 1 of the drawings, the two transverse edge portions of the strip of screen fabric forming the ends which are to be connected to each other to form an endless forming wire are indicated at 1 and 2, and the warp wires of both edge portions 1 and 2 are indicated at 3 and 4. Although the corresponding warp wires in both edge portions actually are merely the ends of the same wire in the fabric strip, each of these warp wires 4 of the edge portion 2 is marked by an additional central line solely for the purpose of graphically distinguishing them from the warp wires 3 of the edge portion 1. All of the warp wires consist of plastic. Both edge portions 1 and 2 further contain weft wires 5 of metal and weft wires 6 of plastic alternating with each other and extending transversely of the fabric length. As indicated in FIGURE 1, the adjacent warp wires 3 and 4 of both edge portions 1 and 2 are cut off at different lengths in a manner so that the corresponding warp wire ends of both edge portions 1 and 2 complement each other and either a short end 9 of one warp wire 3 faces the long exposed end 10 of the corresponding warp wire 4, or vice versa. The weft wires within the marginal areas in which these warp wire ends are cut off are then removed from both edge portions 1 and 2. The two edge portions are then fitted together so that the cut ends of the corresponding warp wires 3 and 4 abut bluntly. Since the plastic warp wires of both edge portions 1 and 2 of the fabric strip have previously been heat-set and their corrugations are thus fixed, their exposed ends 9 and 10 within the seam area also remain crimped after the weft wires are removed. These crimped exposed ends 9 and 10 of all warp wires of both edge portions 1 and 2 then lie within the same plane. Thereupon, new weft wires 11, preferably of metal, some of which are shown in the lower part of the seam area in FIGURE 1 are threaded from a lateral side of the fabric through the corrugations in the exposed warp wires 9 and 10. FIGURE 2 illustrates a highly enlarged cross section which shows the position of two adjacent warp wires relative to each other and of a few newly inserted weft wires 11 therein. The width of the seam area which is shown greatly enlarged in FIGURE 1 may

5

actually be very narrow and amount to no more than about 5 to 7 mm. in a forming wire of a conventional mesh size for a paper machine.

The edge portions 1 and 2 of the screen fabric strip will be especially well connected to each other if the weft wires which are inserted have an angular cross section, as shown in FIGURES 2 and 3. The projecting edges of these weft wires should, however, have such wide angles that although they will be slightly impressed into the plastic warp wires, they will not cut into the same. These edges increase the adhesion of the plastic warp wires on the metallic weft wires to such an extent that the width of the seam area may be made very narrow without thereby reducing the durability of the forming wire. Since such a reduction in the width of the seam area also means that a smaller number of weft wires has to be threaded or drawn into the area, the amounts of time and effort which are required to connect the end portions 1 and 2 are also reduced.

The insertion of the weft wires between the exposed warp wires 9 and 10 of the edge portions 1 and 2 may be facilitated by making the front end portion 12 of each weft wire, as shown in FIGURE 4, of a length at least equal to the width of the fabric and of a diameter smaller than that of the actual weft wire. After the thinner end portion 12 is threaded from one lateral side of the fabric through the warp wires 9 and 10 and emerges at the other lateral side of the fabric, the full-size weft wire is then drawn by the end portion 12 fully into the fabric.

FIGURES 5 to 11 illustrate a modification of the method according to the invention which permits the transverse edge portions of the screen fabric strip to be still more easily connected to form an endless forming wire for a paper machine.

As shown in FIGURE 5, the corrugations in the adjacent warp wires 3 of each course are crimped in opposite directions. Thus, each course contains two series of warp wires which hereafter are identified as the first series and the second series and the corrugations in each of which extend parallel, that is, in lateral alignment with each other. All of the warp wires 3 of the first series of both edge portions of the fabric strip which have parallel corrugations are cut off to short lengths 9a and 9c or 10a and 10c, respectively, which differ from each other only by the length of a few screen apertures 12 and preferably by the length of only one screen aperture. All of the warp wires 3 of the second series, the corrugations of which are crimped in the opposite direction but which are likewise parallel to each other, have considerable lengths 9b, 9d or 10b, 10d, respectively, which differ from each other exactly like the short warp wires 3 of the first series. The lengths of the warp wires of both series in both transverse edge portions therefore complement each other so that, when the corresponding warp wires of both edge portions are connected so as to abut against each other, all of the warp wires of both series have one uniform length.

The method according to this modification of the invention is carried out in the following manner:

After the warp wires of both transverse edge portions 1 and 2 are cut off in the manner as above described and the cut-off portions are removed together with the weft wires 5 within this area, the remaining wire ends 9b to 9d and 10b to 10d are exposed, but are still crimped with their original corrugations since the warp wires of both edge portions were previously heat-set. The only warp wire ends which are not exposed are those of the shortest wires 9a and 10a which lie behind the last weft wires 5a. The ends of the warp wires 9c and 10c which project by the length of one screen aperture beyond the wires 9a and 10a lie therefore directly in front of the last weft wires 5a. The mentioned warp wires 9a, 9c and 10a, 10c belong to the first series. The exposed ends of warp wires 9b, 9d and 10b, 10d of the second series differ by the same length from each other. Con-

6

sequently, the corresponding opposite warp wires 3 of both edge portions 1 and 2 complement each other to a uniform total length. Weft wires 11, preferably those which were previously withdrawn, are then layed from above into the upwardly open corrugations of the exposed ends 10b and 10d of the warp wires 3 of the transverse edge portion 2 and thereafter as shown in FIGURE 8 the exposed warp wires 9b and 9d of the other transverse edge portion 1 are placed over the newly applied weft wires and between the adjacent warp wires 10b and 10d. The ends of the longest exposed warp wires 9b and 10b should then engage over the last weft wires 5a which were not removed from the fabric, and the ends of all corresponding warp wires of both edge portions 1 and 2 should abut end to end against each other. Into the remaining open corrugations between the layed-in weft wires 11 either auxiliary weft wires 13 of a smaller diameter as shown in FIGURE 10 are then at first threaded which are subsequently replaced by normal weft wires or the normal weft wires are immediately threaded into the remaining open corrugations. If the exposed warp wires 9c and 10c exceed the warp wires 9a and 10a by more than the length of one screen aperture, for example, by the length of three apertures, weft wires are threaded from one lateral edge of the fabric into the upwardly open corrugations of the wires 9a and 10a along the width of the fabric before the other weft wires are placed into the upwardly open corrugations of the transverse edge portion 2 and the other transverse edge portion 1 is then placed over the edge portion 1. Instead of laying the weft wires into the upwardly open corrugations of the wires 10a to 10d of the transverse edge portion 2, they may, of course, also be layed into the corrugations of the wires 9a to 9d of the edge portion 1 and the transverse edge portion 2 may then be placed thereon.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims. Thus, for example, although my invention has been described particularly with reference to the connection of the free ends of a screen fabric to produce an endless forming wire for a paper machine, the new method may, of course, also be applied for connecting other types of screen fabrics and screen fabrics for other purposes.

Having thus fully disclosed my invention, what I claim is:

1. A method of interconnecting the end portions of a screen fabric strip having warp wires of plastic for producing an endless forming wire for a paper machine, comprising the steps of first heat-setting the corrugated end portions of the plastic warp wires in both transverse edge portions of said strip, then cutting the end portions of adjacent warp wires in each of said edge portions to different lengths and complementary to the lengths of the end portions of the same warp wires in the other edge portion, then removing the weft wires from the marginal areas between the shortest and longest warp wire ends so as to expose said ends, then fitting the exposed warp wire ends of both transverse edge portions together so that the corresponding warp wire ends in both edge portions abut bluntly against each other and lie within the same plane, and then inserting new weft wires from at least one lateral side of the fabric strip into and transversely through the aligned corrugations of the exposed warp wires of both edge portions.

2. A method as defined in claim 1, in which for facilitating the insertion of the weft wires from one lateral side of the fabric strip through the aligned corrugations of the exposed warp wires of both edge portions, each of said weft wires has a front leading part of a length at least equal to the width of the fabric strip and of a diameter

7

smaller than the diameter of the rear part to be finally inserted into said corrugations and to remain in said strip.

3. A method as defined in claim 1, in which the weft wires to be inserted from one lateral side of the fabric strip into the aligned corrugations of the exposed warp wires of both edge portions consist of metal wire.

4. A method as defined in claim 1, in which the weft wires to be inserted from one lateral side of the fabric strip into the aligned corrugations of the exposed warp wires of both edge portions have an angular cross section with wide-angular edges.

5. A method of interconnecting the end portions of a screen fabric strip having warp wires of plastic for producing an endless forming wire for a paper machine, comprising the steps of first heat-setting the corrugated end portions of the plastic wires in both transverse edge portions of said strip, then cutting the end portions of adjacent warp wires in each of said edge portions to different lengths and complementary to the lengths of the end portions of the same warp wires in the other edge portion so that all corresponding warp wires in both edge portions have the same total length and all warp wires in each edge portion having parallel corrugations differ by a small length equal to at least one normal screen aperture of said fabric from adjacent warp wires in said edge portion, then removing the cut-off parts of said warp wires and the weft wires within the area of each edge portion in which the warp wires were cut off, except the last weft wire in front of the shortest warp wires in each edge portion, then inserting weft wires from above into the upwardly open corrugations of the exposed ends of those warp wires in one of said edge portions in which said corrugations extend parallel to each other, then placing the exposed ends of the warp wires of the other edge portion with their downwardly open corrugations over the first edge portion so that the ends of the corresponding warp wires in both edge portions abut end to end against each other, and then inserting weft wires from at least one lateral side of the fabric strip into the aligned corrugations remaining between the oppositely directed corrugations of the exposed ends of the warp wires of both edge portions after said edge portions are placed over each other.

6. A method as defined in claim 5, in which for facilitating the insertion of the weft wires from a lateral side of the fabric into said aligned corrugations, at first auxiliary weft wires of a diameter smaller than that of the normal weft wires in said fabric are inserted into said aligned corrugations and passed through the width of the

8

fabric, and said auxiliary wires are then replaced successively by weft wires of said normal diameter.

7. A method as defined in claim 1, in which said new weft wires consist of metal wire with a coating thereon of a weldable thermoplast, and further comprising the step of heating said weft wires by passing an electric current therethrough so as to weld said coating together with said warp wires after said weft wires have been inserted into said corrugations.

8. A method as defined in claim 5, in which at least said weft wires which are inserted from a lateral side of the fabric consist of metal wire with a coating thereon of a weldable thermoplast, and further comprising the step of heating said laterally inserted weft wires by passing an electric current therethrough so as to weld said coating together with said warp wires.

9. A method as defined in claim 5, in which all of said weft wires which are inserted from above and from a lateral side of the fabric consist of metal wire with a coating thereon of a weldable thermoplast, and further comprising the step of heating said weft wires by passing an electric current therethrough so as to weld said coating together with said warp wires after said weft wires have been inserted.

10. A method as set forth in claim 5 wherein said weft wires which are inserted from above into the upwardly open corrugations are weft wires which previously were removed from the edge portion in which the warp wires were cut.

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DONALD W. PARK, *Primary Examiner.*