PUBLISHED APRIL 27, 1943. BY A. P. C.

J. M. D. DE TAILLY ET AL

WIRE GLASS

Filed Jan. 29, 1938

Serial No. 187,733

4 Sheets-Sheet 1

Fig. 1

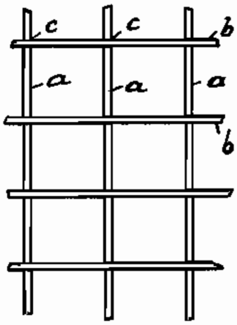

Fig. 8

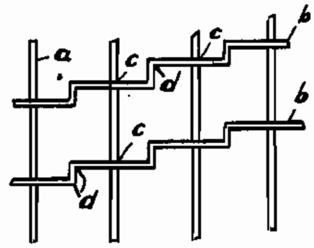

Fig. 2

Fig. 3

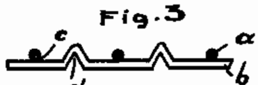

Fig. 4

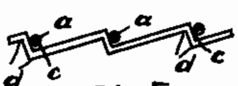

Fig. 5

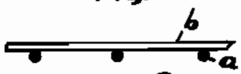

Fig. 6

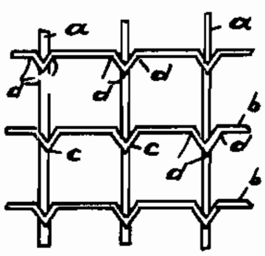

Fig. 7

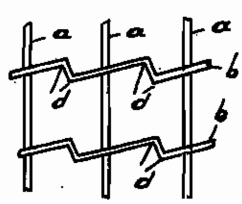

Fig. 9

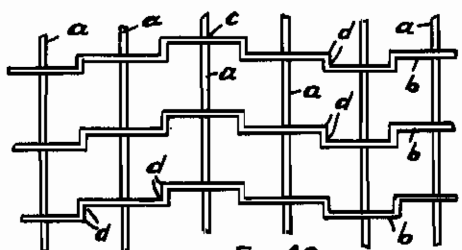

Fig. 10

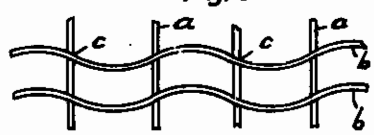

Fig. 11

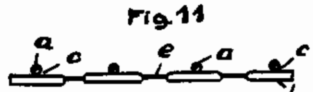

Fig. 12

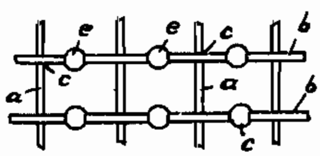

Fig. 13

Fig. 14

INVENTORS,
Jacques M. D. De Tailly
Jules A. Jafflin
by Dorsey, Cole & Garner
ATTORNEYS

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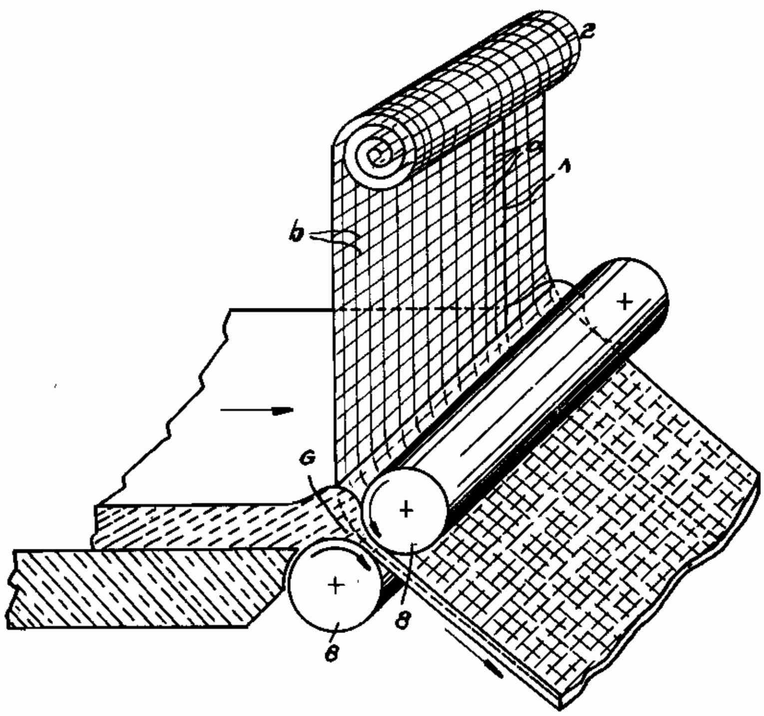
Fig. 1a



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Jacques M.D. De Tailly
Jules A. Jafflin
by Dorsey, Cole & Garner
ATTORNEYS

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Fig. 15

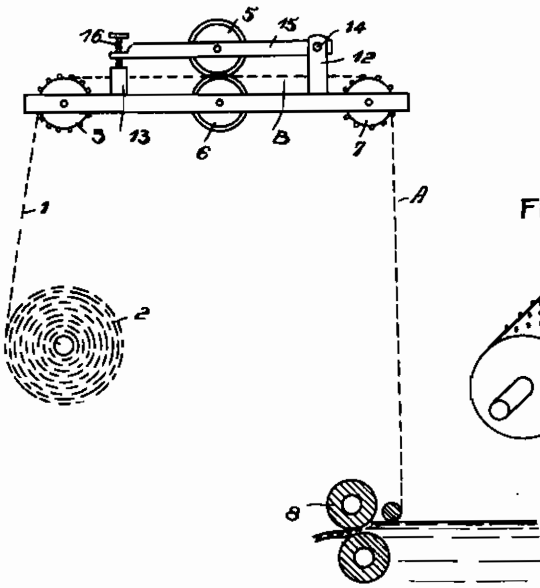


Fig. 17

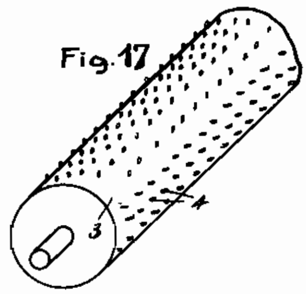
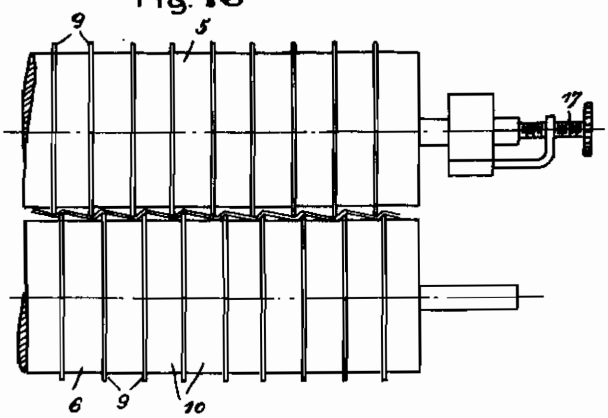


Fig. 16



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Jacques M.D. De Tailly
Jules A. Jafflin
by Dorsey, Cole & Garner
ATTORNEYS.

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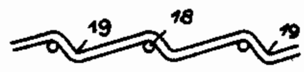
Fig. 18


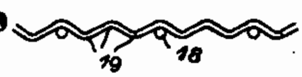
Fig. 19


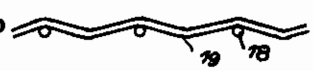
Fig. 20


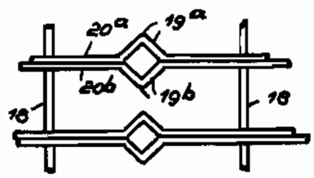
Fig. 21


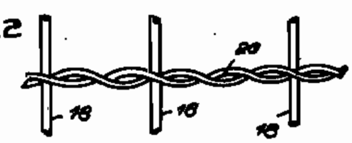
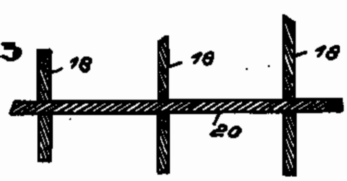
Fig. 22


Fig. 23


INVENTORS,
Jacques M. D. De Tailly
Jules A. Jafflin
by Lloney, Cole & Garner
ATTORNEYS.

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ALIEN PROPERTY CUSTODIAN

WIRE GLASS

Jacques Marie Darodes de Tailly, Saint-Remy, and Jules Albert Jaffiin, Chalon-sur-Saone, France; vested in the Alien Property Custodian

Application filed January 29, 1938

The present invention relates to the manufacture of wire glass, that is to say sheets or objects of glass in which a wire netting is embedded in the mass of glass.

The manufacture of such objects, which is well known in itself, consists in a general manner in introducing the wire netting into the mass of glass while the latter is in the plastic state. In particular when it is desired to manufacture a sheet of wire glass, use is made of a glass rolling machine and the wire netting is introduced into the mass of melted glass before the latter enters the rolling zone.

The present invention is more especially concerned with the manufacture of wire glass of the type in which the wire netting is constituted by square or rectangular meshes formed by wires assembled together, for instance by welding, at their points of junction.

With this kind of netting, which avoids the difficulties of manufacture of so-called "woven" nettings, the wires extending in a direction form a layer located wholly on one side of the wires extending in the other direction and the assembly of the elements of the netting is ensured by welding at the points of contact of the wires with one another. In nettings of this kind, the wires are rectilinear from one end to the other of the netting.

The utilization of such nettings for the manufacture of wire glass is highly interesting and the advantage is further increased when it is desired to manufacture this glass in the form of a continuous sheet. As a matter of fact, in this case, which is itself employed in the form of a band of considerable length, has the advantage of having one of its series of wires parallel to the direction in which glass is driven, which facilitates the drive of the netting without the latter having a tendency to be deformed. It follows that the other series of wires is then parallel to the axis of the rolling elements. Therefore, the netting has warp wires which are parallel to the direction of the drive and weft wires which are perpendicular to this direction.

In glass sheets of this kind, as they are made at the present time, the netting often has deformations. In particular, the sides of some meshes, instead of being rectilinear, are curved. Furthermore, this curvature or deformation of the sides, instead of being uniform, differs from one portion of the sheet or object to another portion. While it is negligible at certain points, it is on the contrary exaggerated at other points. Consequently the product has an irregular appearance which greatly reduces its value. These defects, and the lack of regularity thereof, are particularly considerable when a continuous sheet is manufactured by rolling. In the product thus manufactured, the warp wires are perfectly rectilinear, whereas the weft wires are very much curved in some portions of the sheet and very little curved in other portions, and in the zones where they are deformed, their curved parts are located in different respective planes.. Therefore, the general appearance is highly irregular and consequently little satisfactory. In a general manner, it is believed that these deformations are due to the obstacle constituted by the mass of glass surrounding the netting to the free expansion or contraction of the netting, for instance under the influence of heat, and that the differences in the amplitude or the appearance of the deformations, from one zone of the netting to another zone, result from the fact that the wire meshes react differently for overcoming this resistance opposed by the surrounding mass of glass. In any case, the defective appearance of the wire netting in these wire glass products is caused rather by the irregular distribution of the deformations of the wires of the netting than by the value of the deformation itself.

The chief object of the present invention is to permit of obtaining wire glass products, in the form of sheets or other objects, having a more satisfactory appearance as a consequence of the fact that the deformations of the wires of the netting, which can be made practically invisible, are regular and regularly distributed.

The essential feature of the present invention consists in making use of a netting in which either the whole or merely a part of the wires have been deformed in advance in a predetermined manner between a fixation or weld point and the next fixation or weld point.

Owing to this preliminary deformation, the expansion or contraction of the wire, which may have a tendency to exist between these two points in the course of the manufacture, on the one hand is not prevented, and on the other hand, when it takes place, does not produce any substantial difference in the appearance of the corresponding wire.

It follows that the expansions or contractions of the netting, instead of accumulating their effects in certain zones, as it is the case with the prior methods of manufacture, take place everywhere, that is to say in a uniform manner, and in each mesh, the modification of shape is practically invisible. By giving the wires, in the netting before its is embedded in glass, preliminary deformations of a regular character, we obtain an appearance of the finished product which is also regular, so that the commercial value of the product is considerably increased, which is the result to be obtained.

According to the particular mode of manufacture of the product, the deformations to be imparted to the netting may be of various kinds.

In some cases, it will be sufficient to give in advance a predetermined deformation in each mesh to only the weft wires. Or only a portion of the meshes will be deformed in advance, say every second mesh of the netting.

In other cases a predetermined deformation will be given in advance to all the wire elements which compose each mesh.

It may also be advantageous, according to another feature of the invention, to associate at least two deformed wires in such manner as to obtain a composite wire, either a warp wire or a weft wire having either a general rectilinear appearance or any other desired shape.

According to another feature of the present invention, the metal wire netting is given the above mentioned predetermined deformations only when it is going to be utilized for the manufacture of wire glass, that is when it is being embedded in the mass of glass forming the product.

The use of metal wire nettings which are deformed just prior to being incorporated into the glass article involves some advantages:

In particular, it permits of modifying the shape or the distribution of the preliminary deformations without interrupting the manufacture, the wire glass sheet that is obtained being always kept in movement in a continuous manner.

Furthermore, it is possible to modify the amplitude of the preliminary deformations according to the needs, and in particular according to the thickness of the glass sheet and the rate of feed thereof and also according to the temperature and the composition of the glass mass. It is thus possible to limit these preliminary deformations to the minimum that is necessary.

Finally, this method permits of dispensing with the storing of large amounts of wire nettings having various respective preliminary deformations, since, these preliminary deformations can be given during the application of the method any desired distribution and shape.

The shaping of the wire netting in order to give it any desired preliminary deformations can be made by means of any suitable devices. Preferably, this operation is performed in such manner that the deformation is made in a single step for every weft thread and that the increase of length of the mean fibre caused by the deformation is compensated by a permanent elongation of the weft wire itself. In this way, there is no substantial reduction of width of the metal wire netting.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a plan view diagrammatically showing a wire netting of the type with which the present is concerned;

Fig. 1*a* is a diagrammatical view illustrating the manner in which the wire netting is incorporated into the glass sheet;

Figs. 2, 3 and 4 are sectional views of three different types of netting to be used in connection with the present invention;

Fig. 5 is a sectional view of another type of netting according to the present invention;

Figs. 6, 7, 8, 9 and 10 are plan views of various other types of nettings according to the invention all of which correspond in section to the view of Fig. 5;

Fig. 11 is a sectional view showing another form of netting according to the invention;

Fig. 12 is a plan view of a netting according to Fig. 11;

Figs. 13 and 14 are sectional views of other forms of wire nettings to be used in carrying out the present invention;

Fig. 15 is a diagrammatic elevational view of a machine for deforming the wire netting according to the invention;

Fig. 16 is a detail view on an enlarged scale of the shaping rollers;

Fig. 17 is a perspective view of a rolling element provided with small projections for the guiding and maintaining of the wire netting;

Figs. 18, 19 and 20 are sectional views showing different shapes of the deformed netting used according to the present invention;

Figs. 21, 22 and 23 are plan views showing various embodiments of wire nettings including composite wires.

In Fig. 1, reference character *a* represents the warp wires and *b* the weft wires. According to the usual practice in the manufacture of nettings with welded meshes, the weft threads are all located on the same side of the warp wires. Such an arrangement is visible in this figure. At each contact point c, a weld fixes the weft threads to the warp wires.

Fig. 1*a* shows, in perspective, how a wire netting 1 of this kind, unrolled from a roll 2, is incorporated into the finished article, by being caused to pass, together with the sheet of glass G, between rolling elements 8. It results clearly from this view that, while the warp wires, or longitudinal elements *a*, which are kept constantly tensioned, remain always rectilinear, it is not possible to prevent the weft wires, or transverse wires *b*, from being twisted and deformed in an irregular manner.

In order to avoid this drawback according to the present invention, we make use of nettings which, as shown by Figs. 2, 3 and 4 (which are sectional views in planes at right angles to the warp wires *a*) include weft threads *b* which have received in advance a predetermined deformation.

For instance, as shown by Figs. 2 and 3, the wire is bent at *d*, between two consecutive warp wires. Or, alternately, as shown by Fig. 4, the deformation is located close to the warp wires.

In the arrangements according to Figs. 1, 2, 3 and 4, the deformations are made in planes perpendicular to the general plane of the netting.

It follows that, when a netting of this kind is introduced, it is incorporated into the mass of glass which forms the sheet or other object of glass to be obtained, for instance as illustrated by Fig. 1*a*, and when said netting has been subjected, as a consequence of its manufacture, to the same causes which, in the articles made prior to this invention, produced irregular and therefore objectionable deformations, each of the preliminary deformations *d* will be modified under the effect of these causes, but:

a. This modification of the deformations will take place in all of the meshes and it will be produced in the portion of the wire already deformed because this portion constitutes a weak point which is more liable to undergo deformation than the straight portions of said wire;

b. This modification will be the same for all the meshes of the netting; and

c. It will take place in the plane of the preliminary deformations, that is to say, in the examples above considered, in planes at right angles to the general plane of the netting.

The netting will thus keep, in the finished product, a regular appearance. In particular, if the object is observed in a direction perpendicular to the general plane of the netting, the latter will still look as if all its wires were rectilinear.

Figs. 5 to 10 relate to a netting in which the deformations, instead of being made in planes at right angles to the general plane of the netting, are made in this general plane, the same reference characters representing the same elements as in the above described Figs. 1 to 4.

In the example shown by Fig. 6, the preliminary deformations *d* are localized each in the vicinity of the warp wires *a*.

In the example shown by Fig. 7, the preliminary deformations are made at the middle points between two consecutive warp wires.

These embodiments permit of obtaining the advantages above mentioned, the deformations taking place in the predeformed portions. Furthermore, no swelling of the external glass surface is produced.

Instead of giving the weft wires a general direction substantially at right angles to the direction of the warp wires, they can be given an oblique direction, by providing preliminary deformations according to the present invention. An arrangement of this kind is shown by Fig. 8. In this example, the preliminary deformations are made substantially at the middle points between two consecutive warp wires, but they might also, according to the invention, be provided close to the warp threads, for instance in close proximity to the welds between respective warp and weft wires.

Likewise, as shown by Fig. 9, the mean direction of the weft wires, which include predetermined preliminary deformations, may correspond to the shape of a broken line.

The weft wires may also be given an undulated shape, the very undulations producing the preliminary deformations which ensure the desired result according to the present invention.

Such an arrangement is shown by Fig. 10, in which a complete undulation of a weft wire corresponds to two consecutive meshes. Of course, the undulation might be longer and correspond to more than two meshes.

Also, according to the present invention, the preliminary deformations, instead of being located in planes at right angles to the general plane of the netting or in this plane, might be provided in any oblique planes. These planes may even vary from one weft wire to the next one or vary along a given weft wire. For instance, making use of arrangements such as those shown by Figs. 8 to 10, the deformation may be made along a helical surface.

It should be well understood that the predetermined preliminary deformations imparted to the wires of the netting may be of any desired shape and kind. For instance, these preliminary deformations may consist in modifications other than those concerning the shape of the weft wires. In particular, they may relate to the section of the wire. By providing preliminary variations of the section of the wire, the deformations are localized and arranged in such manner that they correspond to a given arrangement of the elements of the finished article.

In Figs. 11 and 12, we have shown an example in which the weft chains are deformed at *e*, having for instance flattened portions which localize subsequent deformations and cause them to occur in planes at right angles to the general plane of the netting.

These preliminary deformations concerning the section of the wires may be combined with preliminary deformations such as those above described.

The wire nettings according to the present invention are produced in any suitable manner, the preliminary deformations being imparted to the wires before the welding or fixation of the wires to one another, or eventually after said welding or fixation.

As shown by Figs. 13 and 14, it is possible to make use of the preliminary deformations given to the wires for connecting them together either by welding (Fig. 13) or by pinching (Fig. 14). By deforming simultaneously the warp wires and the weft wires, this double deformation can be arranged to produce the fixation by hooking.

As a matter of fact, it should be noted that, in the various examples above described, no preliminary deformations of the warp threads are provided because, for practical purposes, in the manufacture of wire glass sheets through the usual method, the warp wires do not undergo any deformation. However, it should be well understood that this does not constitute a necessary limitation.

In the manufacture illustrated by Fig. 15, we make use of a metal wire netting **1** wound on a roller at **2** and originally in the form of any ordinary rectangular or square-meshed netting. This netting, after leaving roller **2**, is caused to pass on a roller **3**, provided with small projections **4**, then between two shaping rollers **5**, **6** and finally along a roller **7**, also provided with small teeth or projections. When leaving the apparatus, the metal wire netting enters the machine for the manufacture of wire glass diagrammatically represented by rollers **8**.

The shaping rollers **5** and **6** are provided with annular projections, of little thickness, the ridge of which may be rounded. These annular projections are located at regular intervals on both of the shaping rollers, with a distance from one to the next one corresponding to the length of the undulation of the wire that is to be obtained. Furthermore, the position of rollers **5** and **6** with respect to each other is adjusted in such manner that the annular projections of each of the rollers engage into the grooves **18** limited by said annular projections, on the other roller.

One of the shaping rollers, for instance the lower roller **6**, is mounted on a rigid frame **11**, which may also support the toothed rollers **3** and **7**. On this frame **11** are also mounted supports **12** and **13**. Support **12** pivotally carries, about axis **14**, a movable frame **15** on which the upper shaping roller **5** is journalled. Support **13** carries screws **16** which permit of adjusting the distance between the axes of the shaping rollers **5** and **6**.

The apparatus also includes screws **17** which act at the end of the shaft of roller **5** in such manner as to modify the relative transverse position of the two shaping rollers.

Owing to this double adjustment, the weft wires can be undulated with the desired shape and amplitude, the length of the undulation being equal to the distance between two consecutive annular projections on the rollers.

As above explained, rollers 3 and 7 are provided with teeth or projections 4. These teeth enter between the wires of the netting substantially in the same manner as the teeth of a pinion engage into the links of a chain. The function of the first roller 3 is to ensure a perfect guiding of the netting with respect to the shaping rollers 5 and 6, both in the longitudinal and in the transverse direction, while the function of the other roller 7 is to render uniform the length of the shortest warp threads as they are passing into the melted glass and before the rolling generatrix.

With this arrangement, the wire netting enters in the correct relative position between the shaping rollers and it is not moved transversely between them. In a likewise manner, the weft wires remain at right angles to the warp wires which in turn cannot be displaced and cannot be moved in the width of the wire glass ribbon.

The effort tending to bring the shaping rollers toward each other and which is necessary for obtaining the desired deformation of the weft wires can be produced by the weight of the upper roller 5, which can be made heavy for this purpose. To the action of this weight we may add the action of an external force, preferably adjustable, acting also upon roller 5.

On the other hand, the efforts for driving the shaping system can be supplied either wholly or partly by the wire netting to be shaped, which is itself driven by the machine for the manufacture of wire glass. When the wire netting is to have a lower tension in portion A than in portion B, the difference can be compensated for by the application of an external additional force acting for instance upon toothed roller 7. This roller is then adapted to control the system of shaping rollers 5 and 6 same as roller 3 which in turn controls the unwinding of the netting roller 2. Roller 3 may be braked in any suitable manner in order to obtain a suitable tensioning of the wire netting during its operation.

Of course, the specific apparatus just above described is given merely by way of example and it should be understood that we can employ, according to the present invention, any suitable apparatus for imparting preliminary deformations to the netting wires prior to using said netting for the manufacture of wire glass.

For instance, the apparatus in question might include merely the shaping rollers above described.

Also, instead of making use of shaping rollers for deforming the weft wires, we may obtain the same result by passing the wire netting between two jaws which are given an alternating movement toward and away from each other, this movement taking place in synchronism with the feed of the wire netting. The teeth of these jaws which come into contact with the weft threads deform them in the same manner as the rollers above described. Of course the minimum spacing between the jaws and also their relative transverse positioning might be adjustable.

According to still another embodiment, we can associate a roller carrying an annular projection such as 9 with a movable jaw.

Figs. 18, 19 and 20 are sectional views in planes at right angles to the weft wires 16, showing examples of preliminary deformations imparted to said weft wires by the apparatus above described prior to the introduction of the netting into the mass of glass. These deformations 19 may be located either close to the warp wires (Fig. 18) or near the middle of the interval between two consecutive warp wires (Fig. 20). As shown by Fig. 19, we may provide multiple deformations between two warp threads.

JACQUES MARIE DARODES DE TAILLY.
JULES ALBERT JAFFLIN.