United States Patent

Stabler

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[45] **Sept. 26, 1972**

[54] **DEVELOPING APPARATUS**

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[52] **U.S. Cl.**.....**95/93,** 95/100

[51] **Int. Cl.**.....**G03d**

[58] **Field of Search**.....95/89 R, 89 A, 93, 100

[56] **References Cited**

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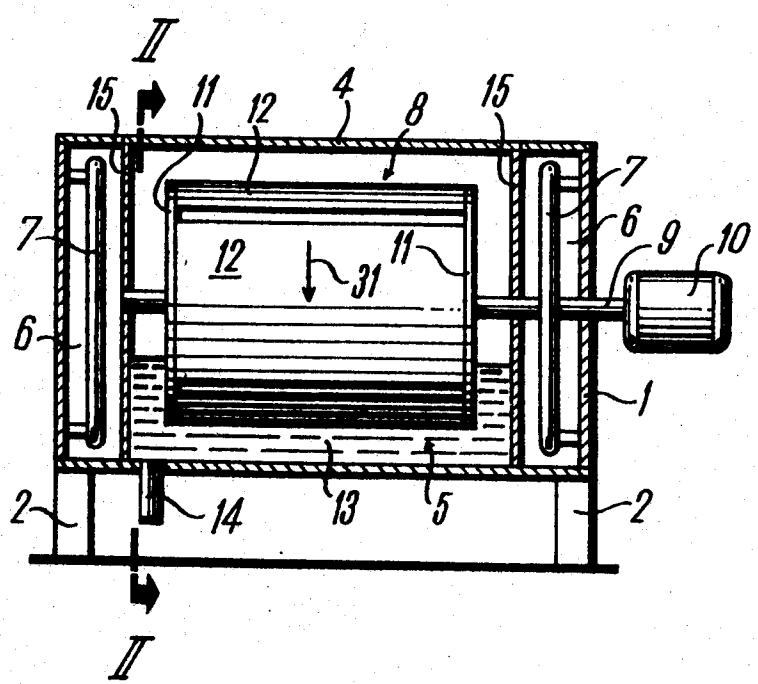
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Assistant Examiner—Fred L. Braun
Attorney—Karl F. Ross

[57] **ABSTRACT**

An apparatus for processing photographic sheet materials comprising a container for holding a processing liquid, a shaft rotatable in the container and a pair of parallel disklike walls mounted on the shaft which are spaced from each other to permit a plurality of sector-shaped supporting shells to be resiliently clamped between the two walls. These shells when inserted between the two walls extend coaxially to the shaft, and each of these shells is adapted to carry some of the sheet material to be processed which may be connected to these shells anywhere outside of the container.

9 Claims, 7 Drawing Figures



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SHEET 1 OF 3

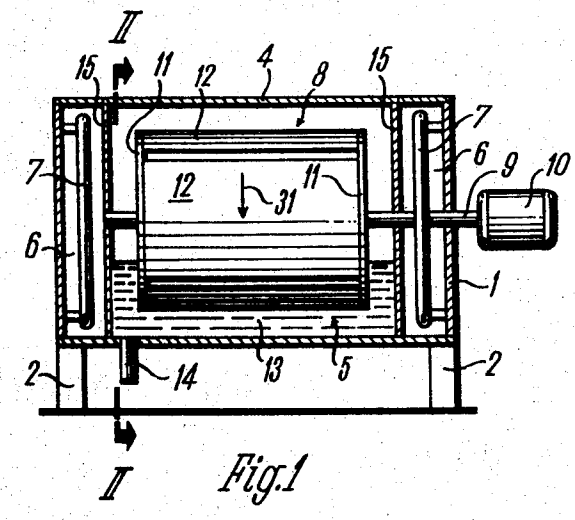


Fig.1

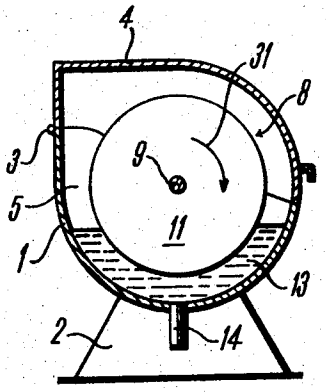


Fig.2

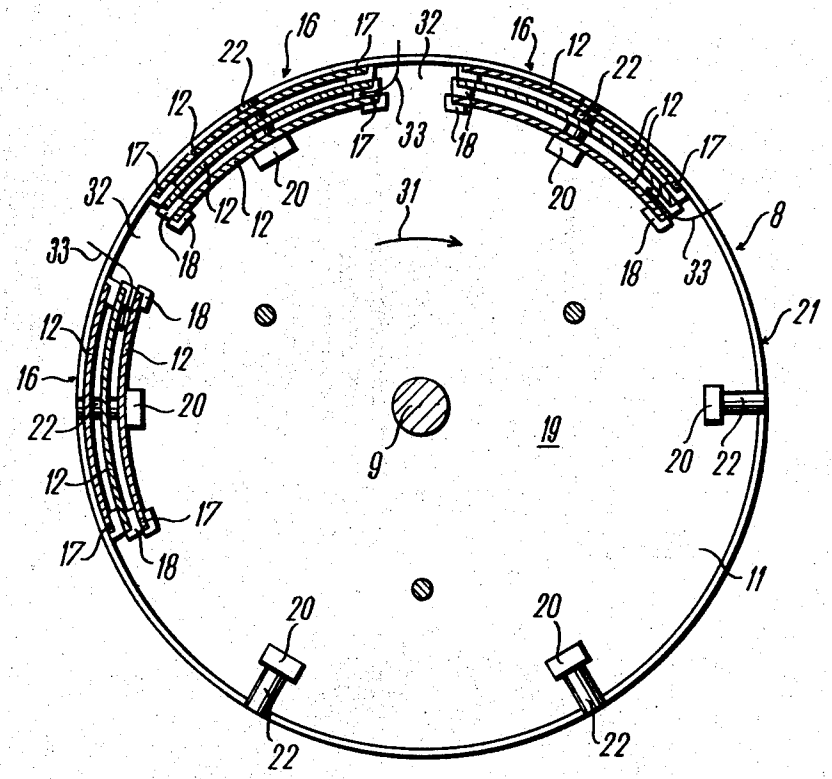


Fig.3

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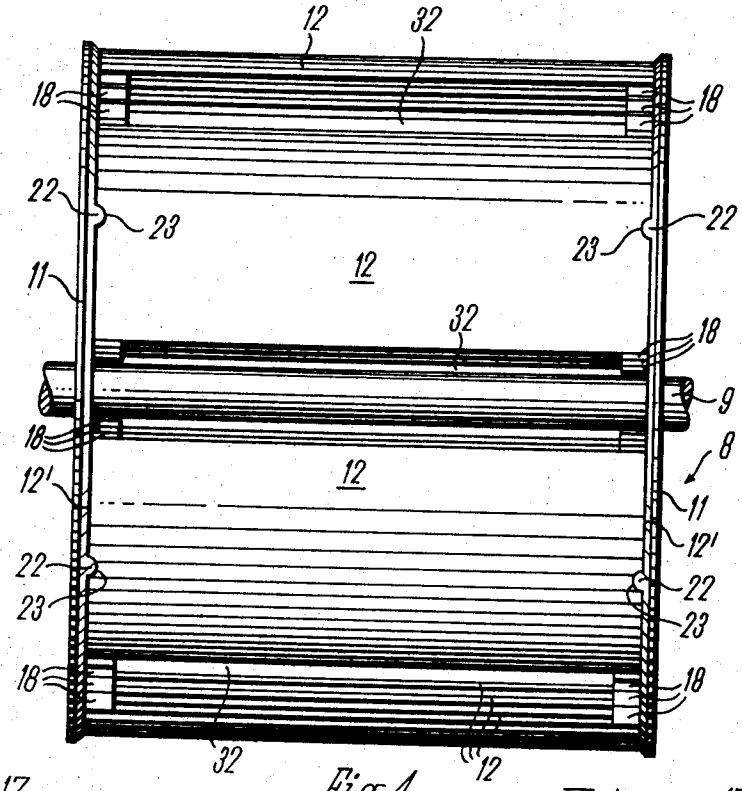


Fig.4

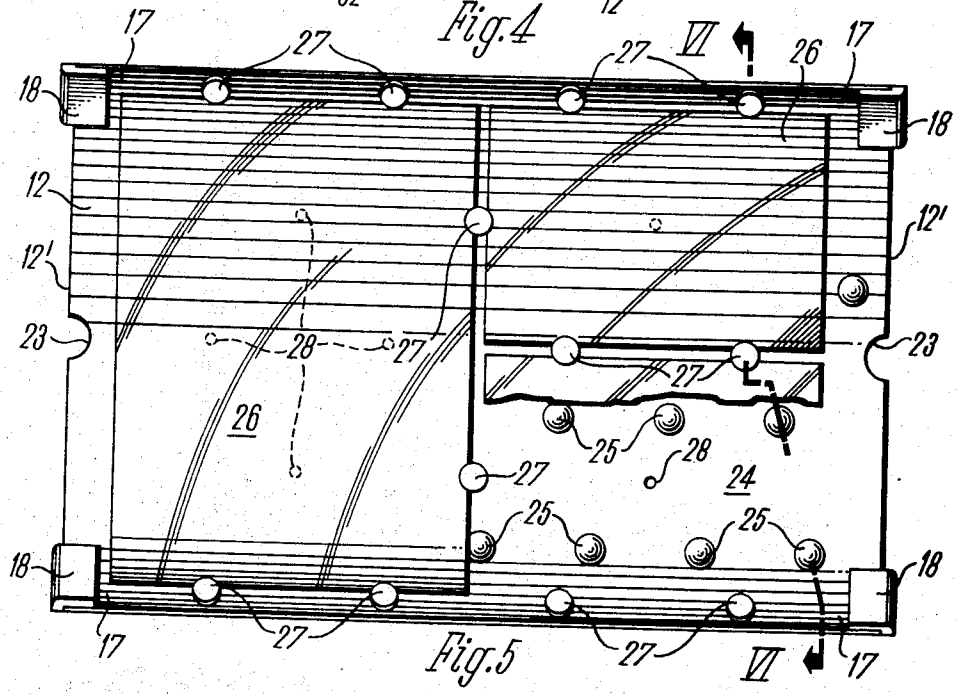


Fig.5

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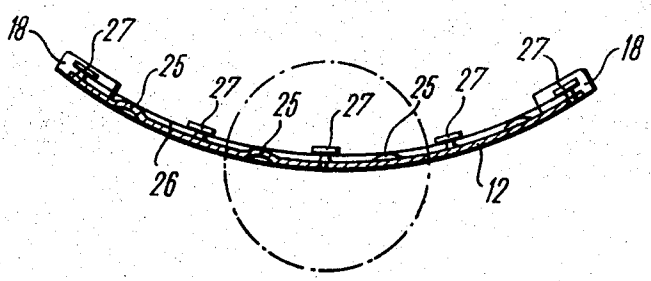


Fig.6

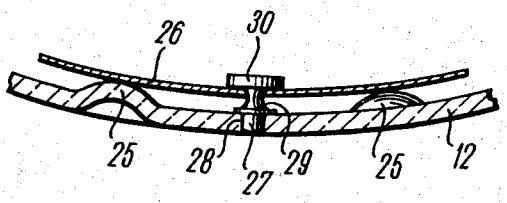


Fig.7

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DEVELOPING APPARATUS

The present invention relates to an apparatus for processing photographic sheet materials such as films or prints in a container which by means of a cover or the like may be opened or closed light-tight and in which at least one drumlike cage is mounted which comprises a pair of parallel disklike walls which are mounted on a rotatable shaft and are connected to each other by longitudinally extending supports which are peripherally spaced at equal distances from each other and are adapted to carry the photographic material to be processed and are to be at least partly submerged in the particular processing liquid which has been filled into the container and may after each stage of the treatment of the material be drained from this container and be replaced by another processing liquid for another stage of the treatment.

An apparatus of the type as above described has already been disclosed by the German Pat. No. 1 225 488, in which the cage is designed similar to a paddle wheel the individual vanes of which serving as supports of the material to be developed are rigidly secured to the parallel end walls of the cage and form slightly arcuately curved surfaces which extend spirally from their outer to their inner ends so that at their inner ends they are spaced at smaller distances from each other than at their outer ends. Some of the numerous disadvantages of a cage of this construction are the following: Primarily, it is rather difficult and requires considerable time to insert the photographic material into the gaps between the adjacent vanes which are rigidly secured to the end walls of the cage within the liquid container. Furthermore, since the openings between the outer ends of the adjacent vanes are larger than those between their inner ends, the cage can be rotated only in the direction toward the outer ends of the vanes and the velocity of flow of the respective processing liquid entering these outer openings and passing through the spaces between the adjacent vanes varies continuously because of the spiral relation and the funneling flow between them which has the result that an undesirable turbulence of the liquid occurs during this flow.

It is an object of the present invention to provide a developing or processing apparatus which eliminates the above-mentioned disadvantages and moreover may be manufactured very easily and at a low expense and may also be manipulated more easily than one of the apparatus of this type as were previously known.

For attaining this object the invention provides that the "cage" originally consists only of a pair of parallel disklike walls which are spaced from each other and are mounted on a rotatable shaft, and that these walls are provided with suitable means for removably connecting thereto and between them a plurality of sector-shaped supporting shells which are peripherally spaced from each other and all of which when inserted between these walls are arcuately curved coaxially to the shaft and are adapted to carry the photographic material which is to be processed. These removable supporting shells have the advantage that they can be loaded with films or prints before they are inserted between the disklike walls which are mounted on the shaft. A real cage is therefore formed only after the suppoting shells have been inserted between the disklike walls.

According to one preferred embodiment of the invention, the film or print capacity of the apparatus may be considerably enlarged by combining two or more individual supporting shells with each other into a set of radially adjacent shells when they are inserted between the mentioned end walls of the cage. The shells of each set are then supported on and spaced from each other at their opposite ends by feet or other spacing members which are resiliently clamped by the shells against the inner sides of the two end walls. Since each shell when inserted between these end walls is arcuately curved coaxially to the shaft, the gap between two radially shells of each set likewise extends arcuately and coaxially to the shaft. Consequently, these gaps have a substantially uniform width throughout their length so that during the rotation of the cage the processing liquid will flow uniformly and without turbulence along the surfaces of the photographic material in the direction of this rotation. This also permits the cage which is equipped with supporting shells carrying the photographic material to be rotated in either direction within the liquid container. Such a rotation in opposite directions is of advantage for certain processing operations. The individual shells or sets of shells should also be sufficiently spaced peripherally from each other so as to permit fresh processing liquid to flow along the surfaces of the photographic material on each shell and also through the gap of radially adjacent shells of each set.

It is another object of the invention to provide suitable means for preventing as much as possible the opposite surfaces of the films or prints to be processed from engaging with the surfaces of the supporting shells so as to insure that the respective processing liquid will act fully upon the film or print surfaces during the operation of the apparatus. According to one preferred embodiment of the invention, these means may simply consist of small wartlike projections on the surfaces of the supporting shells which face the surfaces of the films or prints. The films or prints then only have a substantially pointlike engagement with the wartlike projections on one side of the supportion shells.

Another feature of the invention consists in the provision of holding plugs or the like which may be easily inserted into and removed from bores in each supporting shell and the heads of which slightly overlap some parts of the outer edges of the films or prints to be processed on the supporting shells.

These and additional features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which:

FIG. 1 shows a longitudinal section of the apparatus according to the invention when in operation;

FIG. 2 shows a cross section which is taken along the line II — II of FIG. 1;

FIG. 3 shows an enlarged cross section of the cage of the apparatus according to FIG. 1, which is only partly equipped with supporting shells;

FIG. 4 shows a side view of the cage according to FIG. 3;

FIG. 5 shows a view of the inner concave side of an individual supporting shell;

FIG. 6 shows a cross section which is taken along line VI—VI of FIG. 5; while

FIG. 7 shows an enlarged view of a part of FIG. 6 as defined therein by a circle as shown in dot-and-dash lines.

In the drawings, FIGS. 1 and 2 illustrate the developing apparatus according to the invention which comprises an outer container 1 which is mounted on feet 2 and provided with a cover 4 which is pivotable about the longitudinal axis of a hinge 3 to permit the container 1 to be opened or closed light-tight. This container 1 is divided into a large central chamber 5 and two smaller lateral chambers 6 in each of which one or more light tubes 7 are mounted.

The central chamber 7 contains a cage 8 which is mounted on a shaft 9 which, in turn, may be driven from the outside of the container 1 by a motor 10 or by a crank or similar means so as to rotate the cage 8 within the chamber 5. Cage 8 comprises two circular disk-shaped walls 11 which extend parallel to and are spaced from each other and are mounted coaxially on shaft 9 and, if necessary, may be additionally secured to each other by bracing rods or the like between shaft 9 and the outer periphery of the walls 11, as indicated in FIG. 3. For complementing these end walls 11 to form a cage for supporting films or prints which are to be processed, arcuately curved supporting shells 12 are adapted to be removably clamped between the end walls 11 at substantially uniform peripheral distances from each other near the outer periphery of walls 11. Each of these supporting shells forms a sector of a circle which extends substantially coaxially to shaft 9. The central chamber 5 is adapted to hold a certain quantity of a processing liquid 13 which is required for the particular treatment of the films or prints and which may be filled into this chamber 5 when the cover 4 has been opened and may again be drained from chamber 5 through a drain pipe 14 after a valve, not shown, has been opened on this pipe.

In order to permit the photographic material which is held by the supporting shells 12 to be additionally exposed to light by means of the light sources 7 as mentioned above, the two partitions 15 in the container 1 between the lateral chambers 6 and the central chamber 5 and also all parts of cage 8 including the supporting shells 12 are made of a transparent plastic.

FIG. 3 shows an enlarged cross section of cage 8 as shown in FIG. 1. In this embodiment of the invention, six equal sets or groups 16 of supporting shells (only three sets of which are shown) are inserted between the end walls 11 of cage 8 at substantially equal peripheral distances from each other. Each of these sets 16 may consist, for example, of three individual supporting shells 12 which are equally spaced in radial directions from each other by spacing members 18 which are secured to the outer ends 17 of each shell and are adapted to press resiliently against the inner sides of the end walls 11. The innermost shell 12 of each set 16 when inserted engages centrally upon a pair of projections 20 which are secured to the inner sides 19 of walls 11. These walls are further provided with inwardly projecting ribs 22 between these projections 20 and the edge 21 of each end wall 11. These ribs 22 are adapted to engage into corresponding recesses 23 which are provided in the opposite outer edges 12' of shells 12 and prevent the shells from shifting in peripheral directions of walls 11.

As may be seen in FIG. 5 which shows a view of the inner or concave side of an individual supporting shell 12, the spacing members 18 which preferably consist of a resilient material project laterally beyond the edges 12' of each shell 12 and thus form resilient buffers which, when this shell is inserted between the end walls 11 of cage 8, will be compressed and thus clamp the shell 12 tightly against the walls 11 so as to be in a fixed position relative thereto.

As further shown in FIG. 5, the inner concave surface 24 of each supporting shell 12 is provided with wart-like projections 25 which are uniformly distributed over the entire surface 24 and the free central ends of which serve as pointlike supports for the films or prints 26 which, as shown in FIG. 5, may be of different outer dimensions. For holding these films or prints 26 in fixed positions on the supporting shells 12, small plugs 27 may be fitted into bores 28 which may be provided at any desired positions in each shell 12. These plugs 27 may also be easily withdrawn from the bores 28 into which they were plugged. As more clearly shown in FIG. 7, each of these plugs 27 is provided above its pin-shaped end with a flange 29 serving as an abutment and with a flat head 30 which, when the respective plug 27 is inserted into the proper bore 28, may hold down an edge portion of a film or print or of two adjacent films or prints in the manner as shown particularly in FIGS. 5 and 7.

Before the developing apparatus as described above is to be used, it is first necessary to determine the particular outer dimensions of the films or prints 26 which are to be processed. The holding plugs 27 are then inserted in accordance with these dimensions into the proper bores 28 in the different supporting shells 26. Thereafter, the films or prints 26 are inserted into the shells 12 and the latter are then successively inserted into cage 8 by being clamped between the end walls 11 thereof. When this operation has been completed and all films or prints 26 are deposited in cage 8, the required processing liquid 13 is poured through the cover opening into the central chamber 5 of the container 1 and cover 4 is then closed. The developing or other processing operation may then be started by turning the cage 8 by means of the electric motor 10, for example, in the direction of the arrow 31, as shown in FIGS. 1 to 3. During this rotation of the cage, the processing liquid 13 enters the gaps 32 between the adjacent sets 16 of supporting shells and flows in the direction of the arrows 33 between the individual shells 12 of each set 16 and along both surfaces of the films or prints 26 which are held thereon, and the liquid then flows out of the rear ends of the gaps 32. During this flow, the processing liquid 13 covers both sides of the films or prints 26 only one side of which rests with a pointlike engagement on the wartlike projections 25 on the shells 12, while its other side is held down by the heads of the holding plugs 27 which engage with this side at some points of the edges of the films or prints 26.

When one stage of the processing operation has been completed, the drain pipe 14 is opened so that the respective processing liquid 13 will be drained out of the central chamber 5 of the container 1 and after this pipe has again been closed, the next required processing liquid may be filled into the chamber 5. If

the films or prints are to be once more exposed to light between two processing stages, this may be done very easily and quickly by means of the light tubes **7** which are located in the lateral chambers **6** of the container **1**. When the entire processing operation has been completed, the individual supporting shells are again removed from cage **8**, that is, from the end walls **11** thereof, whereupon the films or prints **26** may be removed from the supporting shells **12** at any desired location away from the apparatus where they may again be filled with films or prints for another series of processing operations.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.

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

1. An apparatus for processing photographic materials, comprising a container having a cover for opening the same and for filling a processing liquid into said container and for closing said container light-tight, means for draining said container, a shaft rotatably mounted in said container, means for driving said shaft, a pair of substantially parallel walls mounted on said shaft within said container and spaced from each other, a plurality of shell-like supporting members adapted when said cover is opened to be inserted between and removed from said walls so that the opposite ends of said supporting members are connected to said walls, said supporting members when inserted between said walls having a curvature extending substantially coaxially to said shaft, and connecting means for connecting photographic sheet materials to said supporting members so as to extend substantially parallel to and along said supporting members.

2. An apparatus as defined in claim **1**, in which the sides of said walls facing each other have projections, and the outer ends of said supporting members have corresponding recesses into which said projections are adapted to engage for maintaining said supporting members in fixed positions in radial and peripheral directions of said walls.

3. An apparatus as defined in claim **2**, in which a plurality of said supporting members when being inserted between said walls are adapted to be combined into sets of several individual supporting members extending parallel to each other in radial directions of said walls, and spacing members on the opposite ends of said supporting members for maintaining said supporting members of each set at substantially uniform radial distances from each other and substantially coaxially to said shaft.

4. An apparatus as defined in claim **3**, in which said projections on said walls are disposed in such positions that the opposite ends of the supporting members of each set will be separated peripherally from the ends of the members of the adjacent sets by gaps to permit the processing liquid to flow in the peripheral direction toward and along both sides of and from said sheet material on each supporting member during the rotation of said shaft together with said walls, said supporting members and said sheet material.

5. An apparatus as defined in claim **2**, further comprising resilient means on the outer ends of said supporting members and adapted to be resiliently compressed by said walls when said supporting members are inserted between said walls for clamping said members against said walls.

6. An apparatus as defined in claim **1**, in which when said supporting members are inserted between said walls, the inwardly facing concave sides of said supporting members have small projections upon which said sheet material is adapted to engage with a substantially point-like contact.

7. An apparatus as defined in claim **6**, in which each of said supporting members has a plurality of bores, said connecting means comprising a plurality of plugs adapted to be tightly inserted into and withdrawn from some of said bores and each having a head adapted to engage over an outer edge portion of said sheet material to hold the same substantially in pointlike engagement with said projections.

8. An apparatus as defined in claim **1**, in which said walls and said supporting members consist of a transparent material.

9. An apparatus as defined in claim **8**, in which at the outer side of at least one of said walls said container contains a transparent substantially vertical partition so as to divide said container into a larger chamber and at least one smaller chamber, said larger chamber containing said walls and adapted to be partly filled with a processing liquid, and light means in said smaller chamber adapted to permit said sheet material on said supporting members to be exposed through said partition to the action of said light means.

* * * * *