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MANUFACTURE OF DECORATIVE PLASTIC

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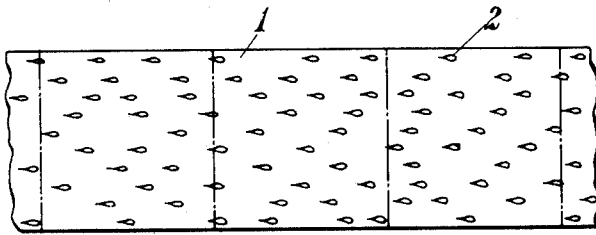


Fig. 1

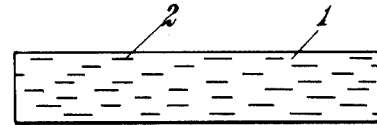


Fig. 2

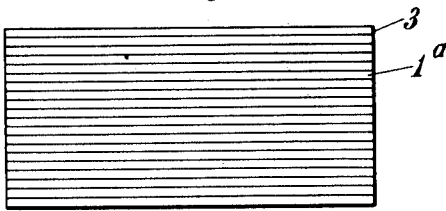


Fig. 3

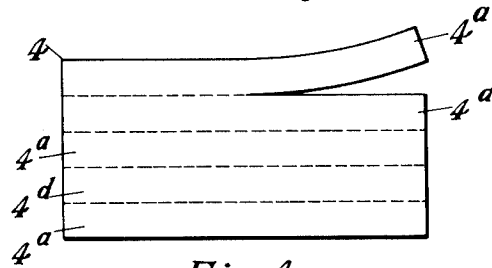


Fig. 4

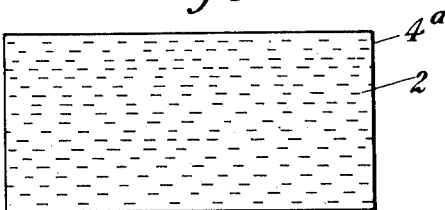


Fig. 5

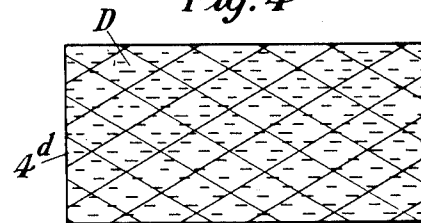


Fig. 6

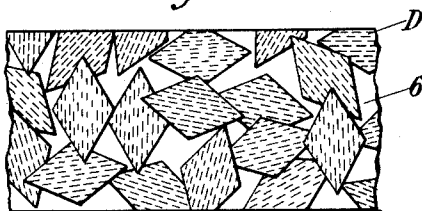


Fig. 7

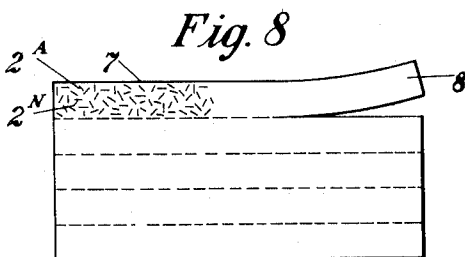


Fig. 8

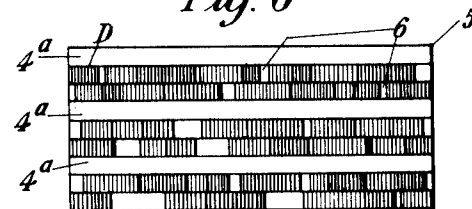


Fig. 9

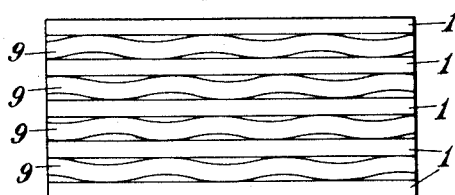


Fig. 10

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By his attorney
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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF DECORATIVE PLASTIC.

Application filed September 1, 1925. Serial No. 53,787.

This invention relates to the manufacture of decorative plastic, has particular relation to the making of plastic containing flake-like decorative particles, and has especially to do with the production of cellulose ester plastic containing "pearl essence", that is, imitation mother of pearl. The invention will be described with particular reference to imitation mother of pearl.

It has heretofore been proposed to make imitation mother of pearl by the addition of pearl essence to cellulose ester, e. g. cellulose nitrate, compositions at some stage of their manufacture, one procedure being to incorporate the essence in crude cellulose nitrate plastic while the plastic is being worked on the rolls. While, however, the general idea of using the essence in plastic to obtain mother of pearl effects is well-known, it has been found that much more is required than merely adding the pearl essence at haphazard, to obtain satisfactory effects and products. While dead looking imitation mother of pearl, dull, crude and without sheen, is not difficult to produce, high grade products that really look like genuine mother of pearl are difficult to produce. The problem is, to a considerable extent, one of proper distribution and orientation of the pearl essence. In consequence, the present invention relates to a considerable degree to this problem and many of the steps of the present procedure are recommended and used with a view to orientation.

Pearl essence, variously called "tincture of fish scales", "fish scale essence", "fish scale suspension", "essence d' Orient", and various other names, is a well-known product and need not be specifically described in detail here. Various patents and articles in the literature describe this substance, for example, the Scientific American of September, 1924, contains an article by D. K. Tressler describing "the lustrous substance of essence d' Orient" in considerable detail. For present purposes it suffices to emphasize the fact, as brought out in the article mentioned, that "When examined under the microscope this nacreous substance is seen to be composed of various sizes of small blade-like crystals". It is the fact of this crystal or flake-like form that gives rise to the problem of distribution and orientation. For example, if the crystals are so located in the plastic article as to be viewed edgewise in "side elevation" (so to speak), the effect is practically worthless, while if they are so placed as to be viewed flatwise a good effect is obtainable. Also, it appears that the particular direction in which the crystals are viewed flatwise has its influence on the appearance of the plastic.

It is an object of the invention to devise a procedure which, taking account of the various peculiarities of pearl essence and of plastic compositions, gives an imitation mother of pearl of high quality, proper sheen, and deceptively close resemblance to genuine mother of pearl. To this end, and also to improve generally upon procedures and products of the character indicated, the invention consists in the various matters hereinafter described and claimed.

The accompanying drawings illustrate conventionally various steps in the procedure, it being evident, of course, that the sizes of the pearl essence crystals and the thickness of the layers are exaggerated for the sake of clearness, and that the various figures are not to scale either actually or with respect to each other.

In the drawings:—Figure 1 is a fragmental plan view of cast cellulose ester film containing pearl essence, with individual crystals of essence shown, but it will be understood that this showing of individual crystals is but for illustrative purposes, it being the fact that actually the crystals are not individually discernible but are closely distributed throughout the plastic, giving a peculiar sheen to the film; Figure 2 is an edge view of the film; Figure 3 is an elevation of cut films stacked ready for welding into a block; Figure 4 is an elevation of a block, showing a sheeting operation; Figure 5 is a plan of a sheet from the block shown in Figure 4; Figure 6 indicates the cutting of certain of the sheets (Figure 4) into irregular pieces; Figure 7 is an elevation showing the stack for a second blocking and pressing operation; Figure 8 illustrates in plan the laying up of the pieces (Figure 6) in the press; Figure 9 illustrates the sheeting of the block (Figure 7); Figure 10 is a plan or face view of the finished product; and Figure 11 is a view illustrating a modified procedure. In Figures 5, 6 and 8, for the sake of simplicity, the crystals of pearl essence are shown merely by single lines, rather than as in Figures 1 and 10, but it

will be understood that in these figures, as in Figures 1 and 10, the crystals are viewed flatwise, all said figures being plan views.

Briefly stated, procedure in accordance with the invention preferably comprises the following steps: casting a film of cellulose nitrate having pearl essence distributed therethrough; cutting the film into sheets, stacking the sheets, and welding them into a block under heat and pressure as in a standard cake press, and sheeting the block horizontally cutting certain of the sheets into irregular pieces stacking the material for a new block by alternating full sheets and layers made up of the irregular pieces; forming the stack into a block and sheeting it horizontally or cutting it into rods or other desired shapes, to give the product. In this procedure the casting of the film gives the primary orientation of the pearl essence particles, and the use of the irregular pieces and their arrangement gives a secondary orientation, as explained in detail below.

In detail, the procedure outlined above may be as follows:

A colloidal solution of pyroxylin, camphor and volatile solvent is prepared in any of the ways common to the film casting art. Such a solution has the consistency of a syrup, as distinguished from the relatively solid character of the plastic masses usual for use on the rolls in the usual process of making pyroxylin plastic, and is usually called a "dope". To this dope is added the pearl essence and such coloring materials as desired in any particular case, and the mixture stirred until homogeneous. By way of illustration the casting composition may be (parts by weight)—

Pyroxylin	100
Camphor	37
Urea	.5
Pearl essence (dry basis)	.42
Acetone	350
Butyl alcohol	20
Denatured ethyl alcohol	30
Coloring material as desired.	

The ratio of the ingredients can, of course, be considerably varied, for instance, the camphor may be varied from 30 to 50 parts per 100 of pyroxylin as in the ordinary pyroxylin plastic art. The proportion of urea (stabilizer) may be considerably varied, of course. Upon the amount of solvents used depends the viscosity of the dope. The kinds and exact proportions of volatile solvents are not important, for example, methyl alcohol, butyl acetate, and ethyl acetate are all possible ingredients. In fact any suitable composition in the pyroxylin film casting art is satisfactory. The coloring matter may be added to counteract the natural yellow cast which the pyroxylin has and to

impart thereto a blue-white color. The colors should be fast and the amounts and kinds may be varied to give the shade desired. For example, the following may be used per 100 parts of pyroxylin: ultramarine .004 parts, and alizarine purple lake B .006 parts. The proportion of pearl essence may be somewhat varied depending upon the exact effect sought, cost, etc., but the proportion given has been found preferable, all factors considered.

Pearl essence is always supplied to the trade mixed with a liquid, and since the essence is added to the dope while the essence is in this condition it is important that the liquid be compatible with the pyroxylin and the solvents. Practically any liquid that is a solvent for pyroxylin and is compatible with the essence will serve. The essence appears in the trade suspended in straight acetone, while other solvents as ethyl acetate, denatured ethyl alcohol, etc., and thin pyroxylin solution having amyl acetate and acetone are practicable liquids. In the market the essence itself may vary between 2 and 25% of the essence d' Orient suspension. Preferably a mixture containing greater than 10% essence is thinned to about 10% before adding to the dope, but this is not essential. Also, I have found a mixture of amyl acetate and acetone preferable as a suspension medium, and also prefer to have a little pyroxylin dissolved in the liquid. In conforming to the above formula, it will be understood that if the solvents and pyroxylin to be added as suspending liquid are to be of any substantial amount they can be taken account of when making up the dope.

The casting dope, having been thus prepared and having been evacuated (as in a suitably equipped tank) to remove air bubbles, is now cast into a film of indefinite length and any desired width. The thickness of the film may be varied at will without affecting the result; I prefer a thickness of .005 to .020 inch. In casting, the dope is flowed out, as by gravity, through the narrow slit of a casting hopper on to a suitable casting surface, say the periphery of a polished nickel casting wheel or drum, the wheel moving under the hopper during casting, as will be fully understood by those familiar with the film casting art. The major feature of this casting step in the present connection is that the thin flat crystals of pearl essence become oriented as the dope flows through the narrow slot-like orifice on to the casting surface, and as the dope lies in liquid condition on the surface before the solvent evaporates.

The freshly cast film is dried to a point where it can be stripped (e. g. 12 to 20% liquid solvent) and is then stripped from the casting surface. The thus resulting

film 1 is conventionally indicated in Figures 1 and 2, the particles of oriented essence therein being indicated as 2. This film possesses a pearly lustre but this is flat and lacks the contour and mottling which are necessary to a proper resemblance to true mother of pearl. While almost perfect orientation has been accomplished, proper sheen, contour and mottling have not yet been attained.

The cast film or sheeting, still containing 12 to 20% of liquid solvents (acetone and alcohol), is now cut into suitable size sheets for making a stack 3 of sheets for a cake press, the sheets are wiped with some suitable solvent, such as ethyl acetate, and stacked sheet on sheet in the press, as indicated in Figure 3 wherein the various sheets are designated as 1^a. In the press the stack is subjected to sufficient heat and pressure to weld the sheets into a single block 4, the welding entailing no particular difficulties, and the usual practice of the art being satisfactory. The resulting homogeneous and unitary block is then sheeted horizontally into sheets 4^a, 4^b between, say, .040 and .125 inch thick, preferably .06 inch, as indicated in Figure 4. Figure 5 shows conventionally one of the resulting sheets, it being there indicated that the original primary orientation of the crystals, with the crystals 2 lying substantially horizontal and facing all in substantially the same direction, has been substantially preserved. Some of these sheets, as sheets 4^a, sufficient for the operation next described are cut up into small pieces D, preferably of regular-polygon contour, say diamond-shape, as indicated in Figure 6. The pieces may be of any desired size, and I have found desirable diamonds about 2x2½ inches, giving approximately 25 pieces per square foot in the layer mentioned below.

Another stack 5 (Figure 7) is now made up preparatory to another blocking operation, the purpose of which is to give the changeable effect that is characteristic of true mother of pearl. Pearl essence particles show all their lustre in one plane, that is, they are lustrous on their broad surfaces, but they are without lustre on a plane at right angles to this one plane, that is, they are dull upon their edges. The sheets 4^a, etc., since they have substantially all their particles lying flat and horizontal in the sheet, have a sheen which, although high, is not so changeable as I desire.

In making up the new stack (Figure 7) alternate layers of full sheets, as sheets 4^a, and polygonal pieces D are laid up, the stack desirably beginning at the bottom with a layer of pieces D. In laying up the pieces D, a sufficient number may be used in a layer to give an amount of material substantially equal to a full-sheet layer, but

as indicated in Figures 7 and 8, this condition need not be strictly adhered to. It is desirable that a layer be of such thickness that, as indicated in Figure 7, there are substantially merely enough pieces in a layer to approximately cover the full-sheet layer beneath. (It will be understood that, actually, the pieces may not necessarily lie in straight layers, as shown in Figure 7, but that certain of them may be tipped due to members of an upper sub-layer of pieces partially falling into spaces between pieces of the lower sub-layer, as will be evident from a consideration of Figure 8 and from the fact that, as before stated, the pieces are merely promiscuously laid in.) When placing the pieces they are desirably spaced a small distance apart at their edges as indicated at 6 in Figures 7 and 8. Also the pieces are turned so that the pearl essence crystals of the various pieces face in different directions. It will be understood that this latter condition is provided for by merely laying in the pieces promiscuously, it, of course, not being feasible to actually determine the direction in which the crystals lie in particular pieces. The stack is now welded as before into a block 7 (Figure 9) and sheeted into sheets 8 (Figure 9), giving the product (Figure 10). The finished sheets have not only the mottled changeable effect desired but also bear the outlines of the irregular-shaped pieces. When, as generally occurs, the pieces of one layer are not in register with the pieces of another, the result is particularly pleasing: the effect of one layer of diamond-shaped pieces is noticeably carried through several layers and blends with the effects of others, and gives a "watered" appearance.

In the above welding operation under heat and pressure, the material of course flows somewhat. In this flowing or shifting, the pieces D, while coalescing and joining, depart somewhat from the simple horizontal position in which they were originally placed, which results in certain of the pearl essence crystals having a position in the block which departs somewhat from the horizontal, so that as the final sheet 8 (Figure 9) is viewed from above—the normal position from which it is viewed in use—some of the crystals will be seen other than flatwise. (Possible positions of some of these angularly placed crystals are indicated at 2^a in Figure 8, and some of the normally placed ones at 2^b.) This tipping of some of the crystals gives the changeable effect I desire. Furthermore, since even those crystals which lie in the same plane extend in different directions, as indicated in Figure 10, an additional desirable effect is obtained in this way. It will be understood that a certain amount of shifting of the crystals is obtained in any case in the repeated heating and pressing;

but I have found it highly preferable to take particular steps, as indicated, to promote and induce the shifting

Referring to Figure 11, as another method
5 of promoting shifting of the crystals, I, instead of using all flat sheets of cast film in making up the stack 3, Figure 3, may use crinkled sheets 9. These sheets are preferably made from plastic masses which have
10 had a suitable quantity of pearl essence mixed into them on the rolls, the sheets 9 being portions of thin sheets from the rolls and which have been crinkled, as by manipulating by hand or passing through crimping
15 gears, as will be understood by those familiar with the usual ways of making up crude plastic sheets. Or, if desired the crinkled sheets may be cast film sheets which have been crinkled by passing through embossing
20 rollers or crimping gears. In making the stack it is preferable to interlay crinkled and flat sheets, alternating, with all containing pearl essence, but it will be obvious that all crinkled sheets could be used, and also that
25 all sheets need not contain essence. Certain of the sheets sliced from a block 4 made from the stack shown in Figure 11 are desirably cut into diamond-shaped pieces for making up the block 5, as above described;
30 but if desired this cutting into diamond-shaped pieces may be dispensed with for the crinkly sheets themselves promote, to a considerable extent, the flowing, etc., promoted by the separate diamond-shaped pieces.
35 While particular reference has been made to the use of alternate layers of full sheets and irregular pieces in the laying up of the final stack, it will be understood that, if for any reason it be desired, more than one
40 layer of pieces or more than one full layer may be used in place of a single layer. Similarly, in using crinkly sheets, every alternate sheet may not be crinkly, or a plurality of crinkly sheets may be used immediately together between plain sheets.
45

I claim:

1. The process of making cellulose ester plastic pigmented with flake-like particles which comprises mixing said particles into a casting dope, casting the dope into film, making a stack comprising sheets of said film interlaid with crinkled sheets of plastic, and welding the stack into a block. 50

2. The process of making cellulose ester plastic pigmented with flake-like particles which comprises mixing said particles into a casting dope, casting the dope into film, making a stack comprising sheets of said film interlaid with crinkled sheets of cast-film plastic, and welding the stack into a block. 55 60

3. The process of making cellulose ester plastic pigmented with flake-like particles which comprises mixing said particles into a casting dope, casting the dope into film, making a stack comprising sheets of said film interlaid with crinkled sheets of rolled plastic, and welding the stack into a block. 65

4. The process of making cellulose ester plastic pigmented with flake-like particles which comprises mixing said particles into a casting dope, casting the dope into film, making a stack comprising sheets of said film interlaid with crinkled sheets of particle-containing plastic, and welding the stack into a block. 70 75

5. The process of making factitious mother of pearl which comprises mixing pearl essence into a pyroxylin-plastic casting dope, casting the dope into film, forming a stack comprising sheets of said film and crinkled sheets of plastic interlaid therewith, welding the stack into a block, sheeting the block and forming certain of the sheets into relatively smaller pieces, forming a stack comprising certain of the sheets interlaid with said pieces, and welding such stack into a block. 80 85

In testimony whereof I affix my signature.
JOHN H. CLEWELL.