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METHOD OF CONSTRUCTION OF THREE DIMENSIONAL
BLADING OF ARBITRARY SHAPE
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2,985,952

FIG. 1

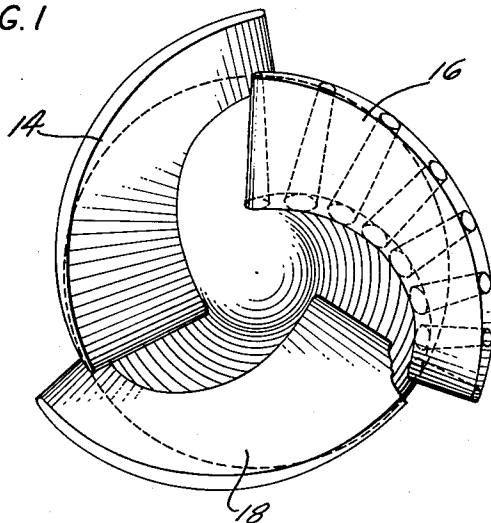


FIG. 2

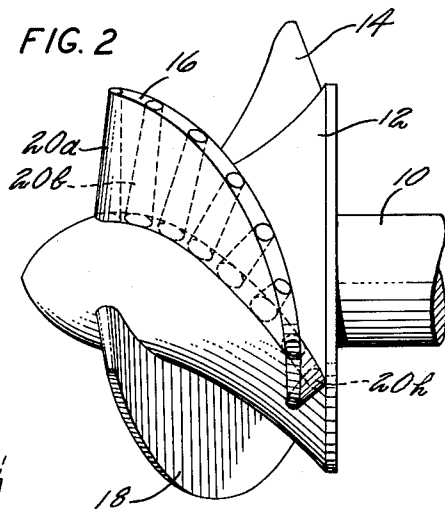
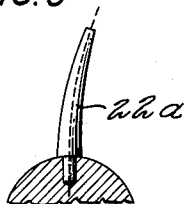


FIG. 3



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METHOD OF CONSTRUCTION OF THREE DIMENSIONAL BLADING OF ARBITRARY SHAPE

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7 Claims. (Cl. 29—156.8)

This invention relates to bladed impellers and has as its object an improved method of making a master impeller for a pump or the like of the type having three-dimensional blading. By three-dimensional blading is meant—an impeller having the geometry of its blades so curved or tapered in all dimensions that measurements must be taken from three planes each at right angles to the other two in order to locate any point on a blade.

The construction of the master impellers for pumps and turbines which serve as the model for machining or casting operations has been a time consuming and painstaking job requiring much hand shaping of the blades.

It is another object of the invention to provide a simplified method for making these master impellers with greater accuracy.

Still another object of this invention is to provide an improved method of making the master impeller for pump or turbine impellers having blading which is very difficult to shape by usual methods in use.

A further object of the invention is generally to improve the method of making pump and turbine impellers having blading of compound curvature.

These and other objects and advantages of the invention will be evident or will be pointed out in connection with the following detailed description of the preferred embodiment of the invention illustrated in the accompanying drawing.

In this drawing:

Fig. 1 is a front view and Fig. 2 a side view of a master impeller, or pattern, made in accordance with this invention;

Fig. 3 is a detailed view showing a curved pin.

Figs. 1 and 2 show a master impeller on a shaft 10 including a hub 12 and three identical impeller blades 14, 16 and 18.

In making the master impeller the hub 12 is turned to the desired shape having the required fore and aft curvature shown best in Fig. 2. This is a simple turning operation which can be performed on a lathe. The hub is made of suitable material which can be turned and bored easily. A plurality of stations is next established on the hub surface along the length of each blade which defines the mean camber line of the blade at its hub end. For purposes of illustration, eight stations have been shown in the drawing for each blade. In the master impeller construction shown in Figs. 1 and 2, straight conical pins 20a, 20b, 20c, 20d, 20e, 20f, 20g and 20h are inserted at the eight stations for each blade with their longitudinal center lines intersecting the mean camber lines of the several impeller blades, here three in number, from the hub to the tip thereof. These pins are also turned from any suitable material and are of correct thickness and taper to correspond to the tip to hub thickness distribution along the pin center line at each station along the blades. It will be understood that each conical pin is inserted at the proper station corresponding to computed station locations along the blade from the leading edge to the trailing edge thereof.

The tip surface of the blade is generated by varying the length of the tapered pins. A workable filler material is then inserted between the pins and is shaped until all tangent points between adjacent pins are faired in. This material may be a low melting point metal or a hardenable material, such as plastic wood, which can be worked after hardening.

Each of the blades of the impeller is made as above-described, all the blades of a given impeller being identical.

In Fig. 3 a pin 22a has been shown which is curved from hub to tip as would be required to make an impeller blade in which a line joining the mean camber lines of the blade from tip to hub is a curved line.

The method above-outlined would completely describe a hub shape and blade geometry of arbitrary design which can serve as a model for subsequent machining and casting operations of the impeller.

It will be evident that the method above-described for making three-dimensional blade impellers is greatly simplified over previous methods and eliminates much of the tedious hand shaping of the blades previously required.

We claim:

1. The method of making a master impeller for pumps or the like having three-dimensional blading which consists in turning an annular hub to the desired fore and aft curvature, inserting into the surface of said hub at prescribed stations along each blade location a set of tapered pins of predetermined thickness conforming to the thickness distribution of the blade from tip to hub at said stations, and producing the full vane geometry of the blades by inserting a workable filler material between the pins and shaping the material to fair in tangent to the pin surfaces.
2. The method of making a master impeller for pumps or the like having three-dimensional blading which consists in, turning an annular hub having a fore and aft curvature to produce the desired flow surface, inserting sets of tapered pins of the required thickness to define the tip to hub dimensions of the blades into the surface of said hub at the proper stations along the blades from the leading edge to the trailing edge of the several blades, inserting a workable filler material between the pins, shaping said material until all tangent points between adjacent pins are faired in, and generating the tip surface of the blades by varying the length of said pins.
3. The method of making a master impeller for pumps and the like having three-dimensional blading which consists in first generating the hub surface to the desired fore and aft curvature, forming sets of tapered pins for the several blades having the proper thickness along their individual lengths to correspond to the tip to hub thickness distribution at the various points along the blades, inserting the formed pins into the hub at the proper stations corresponding to computed positions along the blades from the leading edge to the trailing edge of each blade, generating the desired tip surface of the several blades by cutting off said pins at their free ends, inserting a workable filler material between the pins, and shaping said material until all tangent points between adjacent pins are faired in.
4. The method of making a master impeller for a pump or the like which consists in shaping the hub of the impeller to the desired fore and aft curvature, selecting a plurality of stations along the length of a curved impeller blade each represented by a line joining the mean camber lines from tip to hub of the blade, turning a plurality of tapered pins, one for each of said stations, of the proper thickness along their length to correspond to the variable tip to hub thickness distribution of the blade at each station, inserting said pins into said hub at said prescribed stations, generating the tip surface of the blades by cutting off the free ends of said pins, and

inserting a workable filler material between said pins until all tangent points between adjacent pins are faired in.

5 5. The method of making a master impeller for a pump or the like which consists in shaping the hub of the impeller to the desired fore and aft curvature, selecting a plurality of stations along the length of each of a plurality of curved blades, turning a set of straight conical pins for each blade of the proper thickness along their length to correspond to the variable tip to hub thickness distribution at each station, inserting the hub ends of said pins into said hub at the prescribed stations for each of said blades, generating the tip surfaces of each blade by trimming off the pins at their free ends, and inserting a workable filler material between said pins until all tangent points between adjacent pins of each set are faired in.

10 6. The method of making a master impeller for pumps or the like having three-dimensional blading which consists in turning an annular hub to the desired fore and aft curvature, locating a plurality of stations on said hub along a curved mean camber line of each blade at the hub end of the blades, determining the proper thickness distribution along a hub to tip line of the blades at each station, forming tapered pins having the desired thickness distribution along the hub to tip lines at the selected stations, inserting said pins into said hub at the appropriate stations along each blade from the leading to the trailing edge of the blades, molding a workable filler material between said pins, and shaping said material until all tangent points between adjacent pins are faired in.

7. The method of making a master impeller for a pump or the like having three-dimensional blading, all surfaces of which are curved which consists in generating the hub of the impeller to provide the desired fore and aft curvature, forming a set of longitudinally curved and tapered pins for each blade of the impeller having the proper thickness along their lengths to correspond to the tip to hub distribution at various stations along the blade from leading to trailing edge of the blade, inserting said pins into said hub with the center lines of the several pins of each set joining the mean camber lines from the tip to the hub of the blade, generating the tip surface of the blades by trimming the free ends of said pins, molding a workable filler material between the pins, and shaping said filler material until all tangent points between adjacent pins are faired in.

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