This invention relates to dental appliances and more particularly to a method and apparatus for cooling hydrocolloid impression material used by dentists in the preparations of impressions for dental crowns, caps, inlays, bridges and plates.

Dentists make impressions of patient's teeth and/or adjacent mouth structure by placing an impression tray containing a softened impression material in the patient's mouth and the teeth and/or adjacent mouth structures are embedded in the plastic material in the tray. This material had previously been heated to make it soft and pliable and as the material cools it hardens and sets. The tray of material is cooled by water circulation in the tray at normal water temperature or from water jars filled with ice cubes. In addition to being messy, cumbersome and time consuming, the results are not always satisfactory since the timing and rate of cooling is not constant. There is no consistent firmness of texture. Suction created is soft due to insufficient cooling and the impressions become distorted when removed from the patient's mouth. This necessitates retaking the impression, taking more valuable time to the annoyance of both dentist and patient.

In using the hydrocolloid impression cooler comprising the present invention more time can be spent in the preparation of the impression materials and to the patient in the chair. The cooler is completely automatic and stops when the cooling cycle is completed and automatically returns to starting position without additional action by the operator. The impressions are chilled correctly, timed properly, have a firmness and texture not obtainable by any other method, guaranteeing all impressions to be absolutely perfect. This removes the guesswork in knowing when the material has set and hardened. This saves time, and assures consistently better work, faster production and more satisfied customers.

The hydrocolloid impression cooler comprising the present invention progressively cools the water circulated through the impression tray through a series of timed steps such that the material is gradually and uniformly cooled without discomfort to the patient. This is accomplished by sequentially diverting the water through a plurality of temperature controlled paths before circulation through the tray. The proper path is selected by timing the operation of solenoid control valves directing the flow of water through the various paths.

It is therefore an object of this invention to provide a novel method and apparatus for cooling hydrocolloid impression material.

Another object is the provision of a method and apparatus for making dental impressions by controlling the cooling rate of hydrocolloid impression material.

Another object is the provision of a hydrocolloid impression cooler for successively cooling impression material at predetermined temperatures for specific periods of time.
temperature coming into the tank. The cooling coil 43 is connected to a conventional refrigeration unit 47, the compressor motor 48 of which is controlled by thermostat 44. When the water in tank 39 is above a certain temperature, determined by the setting of control 17, the contacts in thermostat 44 close to complete the circuit and refrigerating unit 47 starts its cooling operation. This assures an adequate supply of cold water at all times. Safety switch 20 is in the power circuit and will automatically pop out if for any reason the unit gets too hot, pulls too heavy a load or the line voltage drops too low. This forestalls burning out of the motor. Safety switch 28 remains out until the operator corrects the trouble and re-engages the switch to again complete the power circuit to the motor 48.

Switch 13 completes the power circuit to terminal block 49. When the switch is closed the “power on” light 14 lights up, indicating that the power is on and that the automatic timer unit is ready for operation. Terminal block 49 connects various circuits to the power source as shown. One circuit goes from terminal block 49 to the heat thermostat 36, the heating element 37 and back to the terminal block. Thermostat 36 is set for 85° F. and when the incoming water sprayed over it is below this temperature, its contacts close and the heater element begins heating. This gives the heating element time to start heating before the incoming water reaches it, assuring a continuous heated water supply. Heater pilot light 4 is connected across the heating element 37 and is lighted when the contacts of thermostat 36 closes and element 37 is heating.

Another circuit is connected to timing unit 52. Here one end of relay 66 is connected to terminal block 49. The other end is connected to timer motor M and also is returned to the terminal block through the dentist’s foot operated switch 16. When switch 16 is momentarily depressed by the operator, relay 66 is energized, closing switch 67 and starting the timer motor M. Even though the return path of relay 66 through switch 16 is open, the closing of switch 67 provides a second return path to the terminal block, 49 to complete the circuit. Thus, relay 66 once energized will remain energized until switch 67 is opened.

Motor M sequentially moves cams, 53 to 57, to close contacts 61, 62, 63 and 64 for definite lengths of time and to open switch 67 when the cycle is finished. When contact 61 is closed, the cooling operated valve 38 is operated and cycle light 1 goes on. When contact 62 is closed solenoid operated valve 29 is opened and cycle light 2 goes on. When contact 63 is closed solenoid operated valve 31 is opened and cycle light 3 goes on, and when contact 64 is closed, buzzer 54 buzzes for a few seconds and then stops. Thereafter cam 57 opens the holding switch 67 which stops motor M automatically in start position, ready to start a new timing cycle when switch 67 is again closed by the operation of foot switch 16.

Operation

Hydrocolloid impression material must be cooled gradually and uniformly to obtain the best results in the finished impressions. This is done by circulating water of preselected, and progressively cooler temperatures through the impression tray for predetermined amounts of time. At the end of the complete timing cycle the dentist is assured that the impression material is set and hardened enough for removal from the patient’s mouth. The hydrocolloid impression material is placed in the patient’s mouth at a temperature of 120° F. The power supply switch 13 is turned on and the cooler is ready for operation. The dentist holds the tray firmly in the patient’s mouth, touches his foot to the foot switch 16 and the automatic starter starts the timing cycle by arm 53 contacting terminal 61. This opens valve 28 and water passes through the hot water path to the tray. An 85° F. temperature is maintained throughout the first period which lasts two minutes. By this time the impression material has been cooled to 85°. At the end of two minutes the timer motor M has moved the cam holding contact 61 and it again opens. The hot water electrical circuit is broken and the solenoid valve 28 closes, stopping the flow of heated water. Five seconds after valve 28 closes the automatic timer engages contact 62 and the valve 29 in the normal water temperature 70° F. now flows through the impression tray. After two minutes the impression material has cooled to that temperature and the automatic timer permits contact 62 to open, valve 29 closes and water of normal temperature ceases flowing through the tray. In another six seconds the cold water electrical circuit is closed at contact 63, solenoid valve 31 is opened, and water of 42° F. is circulated for two minutes through the impression tray. Through this uniform gradual cooling the hydrocolloid impression material sets with slight shrinking to a perfect form and fit. At the end of the last two minute periods the motor cams open contact 63 and closes contact 64. This contact causes buzzer 54 to sound for three seconds to signify the nurse that the cooling cycle is completed so that she may care for the patient. The automatic timer then moves the cams of their starting position ready for the next cooling cycle. One of the cams open switch 67 and breaks the motor circuit. The impression is now ready to be removed, perfect in shape, firmness and texture. Not only is the dentist assured against failure through controlled and timed reduction of temperature of the impression material, but he is able to perform faster and more efficiently, to the greater satisfaction of the patient.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

1. Apparatus for progressively and uniformly cooling hydrocolloid impression material in a dental impression tray comprising a first fluid path connected to said tray, parallel paths including a heated fluid path, a normal temperature fluid path, and a cooled fluid path all connected to said first path and to a fluid source, control means for regulating fluid flow in each of said parallel paths, timing means for sequentially passing fluid from each of said parallel paths to said first path for a predetermined period of time, fluid from said heated path being passed first, fluid from said normal temperature path being passed second and fluid from said cooled path being passed last.

2. Apparatus for gradually and uniformly cooling hydrocolloid impression material in a dental impression tray comprising a plurality of fluid paths connected to said tray, each of said paths having fluid therein of different predetermined temperatures, valve means in each of said paths for controlling fluid flow therein, electrical means for opening and closing said valve means, an electrical energy source, timing means for sequentially connecting said energy source to each of said electrical means, and a starting switch connecting said timing means to said energy source.

3. A hydrocolloid impression cooler comprising at least two paths for circulating cooling fluids of various temperatures through an impression tray having a soft pliable impression material therein, means for sequentially connecting said paths to said tray for circulating fluid therethrough from paths of highest temperature successively to paths of lowest temperature thereby gradually cooling said material to a cool hardened state.

4. Apparatus for gradually cooling hydrocolloid impression material in a dental impression tray of the fluid cooling type comprising a first fluid path adapted for connection to a fluid supply, a pressure control valve in
5. Apparatus for cooling impression material as in claim 4, said means maintaining a fluid temperature of approximately 85° F., comprising a heating tank in said path, having an inlet and an outlet, a heating element in said tank for heating fluid in said tank, a thermostat near said inlet for sensing the temperature of fluid coming therefrom, said thermostat operable to complete an electrical circuit to said heating element to cause actuation thereof when incoming fluid to said tank is below 85° F.

6. Apparatus for cooling impression material as in claim 4, said means maintaining a fluid temperature of approximately 42° F., comprising a cooling tank in said path having an inlet and an outlet, refrigerant cooling coils in said tank between said inlet and said outlet, a thermostat in the path of fluid from said inlet to sense the temperature thereof, means operable by said thermostat for cooling said coils to inductively cool fluid in said cooling tank when said fluid from said inlet exceeds approximately 42° F.

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