DIE FOR PHONOGRAPH RECORDS.

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To all whom it may concern:

Be it known that we, Louis G. Sylvester and Cyrus B. Wells, citizens of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Dies for Phonograph Records, of which the following is a specification.

This invention relates to improvements in dies for molding flat disks, such as phonograph records, from plastic material containing a binder which softens with heat and is hard at normal temperatures. Dies for molding this material are usually channelled, so that steam may be circulated through them to heat them while they are separated, and cold water may be circulated through them to chill and set the material after it has been compressed between the dies. In order to insure quick and perfect molding of objects having large superficial areas, such as phonograph records, it is desirable to make the channels in the dies comparatively short, so that the heating and cooling fluids may pass freely and quickly through them, and it is important that the channels be so arranged that the heating and cooling effects of the fluids will be evenly distributed throughout the surfaces of the dies.

In carrying out our invention we provide a pair of dies, each having a plurality of relatively short spiral channels extending parallel with one another from the circumference to the central portion of the die, these channels being of substantially the same length and of the same cross sectional area, so that the rate of fluid flow will be the same in each channel; and we provide inlet and outlet passageways for the fluids, each passageway separately connected to the outer end of one spiral channel and to the inner end of an adjacent channel, in order that the heating fluid, or cooling fluid, may flow from the circumference to the center of the die in alternate channels, and from the center to the circumference of the die in the intermediate channels, whereby the heating or cooling effect of the fluid is uniformly distributed throughout the surface of the die. The channel portions of the two dies are alike, but in order further to uniformly heat or chill the plastic material while it is under compression by the dies, we arrange the pipe connections to the two dies so that the inlet passageways of the one will be adjacent the outlet passageways of the other, and with this arrangement the channels are so crossed that the material between the dies will be affected by the temperature of the incoming fluid in one die at points where it is affected by the temperature of the outgoing fluid in the other die, and thus the temperature throughout the body of plastic material is made uniform.

In the accompanying drawings—

Figure 1 is a central vertical section through a pair of dies for molding plastic disks, such as phonograph records, the clamping rings for holding the matrices on the dies being omitted, the section through the dies being taken on the line 1—1 of Fig. 4; the upper die being in section on the line 1—1 of Fig. 5; and the lower die being in section on the line 1—1 of Fig. 6:

Fig. 2 is a face view of the channelled side of one of the die plates;

Fig. 3 is a similar view of one of the die plates, on a smaller scale; showing only one of the spiral channels, for the purpose of illustration;

Fig. 4 is a diagrammatic view showing the pipe connections to the dies;

Fig. 5 is a top plan view of the dies, superposed as shown in Fig. 1, the channels in the upper die being indicated in heavy dotted lines, and the channels in the lower die being indicated in lighter dotted lines;

Fig. 6 is a top plan view of the upper die, the channels being indicated in dotted lines; and

Fig. 7 is a similar view of the lower die.

Referring to Figs. 1 and 2 of the drawings, A, B, indicate upper and lower dies for molding disks of plastic material, each die comprising a metal body 1, having fitted into its face a circular channelled plate 2, these plates in the two dies being the same in all respects and similarly channelled. These dies are adapted to be used in suitable presses, and water and steam are alternately circulated through the channels of the dies, for the purpose of heating and chilling the plastic material. As the mechanism for operating the dies and for automatically controlling the heating and cooling fluids forms no part
of the present invention, it will not be necessary to illustrate or describe the same. It will be understood that for molding a phonograph record, the thin metal matrices for making the impressions in the opposite side of the plastic material will be placed upon the surfaces of the die plates 2, and will be held therein by annular clamping rings (not shown) which fit into recesses 4 in each die and are held therein by screws fitting in the openings 5, (Fig. 7).

Each of the die plates 2 has four spiral channels a, d, e, and f, extending from points adjacent to its circumference to points adjacent the central boss 6 of the die. Each channel, as clearly shown in Fig. 3, makes a turn and three-quarters around the axis of the disk and the terminals of the several channels c, d, e, and f, in succession, spaced a quarter of a turn or 90° apart.

In Fig. 2, the outer end of the channel c is shown at c' and the inner end of this channel is shown at c' ; the outer end of the channel d is indicated at d' and the inner end of this channel is indicated at d' ; the outer end of channel e is indicated at e' and its inner end is indicated at e' ; and the outer and inner ends of the channel f are indicated at f' and f' respectively.

The body portion of the upper die is provided with four passageways extending from its sides in nearly radial directions toward the central part of the die, these passageways being indicated at i, i', j, and j', in the drawings, and being arranged 90° apart about the axis of the channelled plate. The lower die is provided with a similar number of similarly arranged passageways i, i', j, and j', respectively.

The passageway o in the upper die has a lateral opening indicated at 7 (Fig. 6) connecting said passageway with the outer end of the spiral channel c and it also has an opening 8 connecting said passageway with the inner end of the adjacent channel d.

The passageway 7 has a lateral opening 9 connecting it with the outer end of the channel d and it has a similar opening 10 connecting it with the inner end of the channel e.

The passageway o' has an opening 11 connecting it with the outer end of the channel e and it has an opening 12 connecting it with the inner end of the channel f. The passageway 4 has an opening 13 connecting it with the outer end of the channel f and it has an opening 14 connecting it with the inner end of the channel c.

It will be seen from this construction that if the heating or cooling fluid is admitted through the passageway i, in Fig. 6, it will flow through the channel d from the circumference of the die to the central part and will then pass out through the passageway o and at the same time fluid will flow from the passageway i through the adjacent channel e from its inner end to its outer end and will flow out through the passageway o'. If fluid is admitted through the channel i' it will enter the outer end of the channel f and the inner end of the channel e and will flow in opposite directions through these adjacent channels, the fluid from the channel f passing out through the passageway o', and the fluid from the channel e passing out through the passageway o. The passageways o and o' may be considered the outlet passageways and the passageways i and i' may be considered the inlet passageways. As hereinafter explained the inlet passageways are to be connected together by pipes extending to a controlling valve for admitting fluid to these passageways simultaneously while the outlet passageways will be connected to a common outlet pipe.

The connections between the passageways and the channels are the same in the lower die as in the upper die, each passageway being connected to the inner end of one channel and the outer end of an adjacent channel, but the pipe connections to the fluid controlling valves are arranged so that fluid will be admitted to the channels through two of the passageways i, j in the lower die, which are adjacent the outlet passageways o, o' of the upper die, and fluid will exhaust from the passageways o, o' in the upper die, which are adjacent the inlet passageways i, j in the upper die. In the lower die (Fig. 7), the fluid will flow through passageway i' inwardly through the channel c to the outlet passageway o, and outwardly from the center of the die through channel d to outlet passageway o'. From passageway i the fluid will flow toward the center of the die through channel e and thence out through passageway o', and it will also flow from passageway i to the inner end of channel f and thence through the latter channel to the outlet passageway o.

In Fig. 4 we have shown diagrammatically the connections for admitting the fluid to the dies and in Fig. 5 the dies are shown superposed, as arranged in a press. In Fig. 4 the valve for admitting steam and water alternately to the dies is indicated conventionally at 7. This valve, it will be understood, is operated automatically by the press to admit steam from the pipe v to the dies while the latter are separated and to cut off the steam and admit cold water from the pipe w to the dies while the latter are together. The courses of the fluid are indicated by the arrows in Figs. 4 and 5. From the valve v fluid flows through pipe 15 to branch pipes 16 and 17, and thence into the passageways i, i' of the upper die, and after passing through these channels it flows out through passageways o, o' of said upper die to the branch pipes 18 and 19 and thence to the common exhaust pipe 20.
fluid flows from the pipe 15 through pipes 21 and 22 to the inlet passageways i, i' of the lower die, thence through the channels in said die to the outlet passageways o, o' and thence through pipes 23 and 24 to the exhaust pipe 20. The inlet and outlet passageways are not quite radial but are tangent to the axis of the die plates so that when the dies are superposed the outlet ends of the channels in the one die overlap the inlet ends of the channels in the other die, as indicated by the dotted lines in Fig. 5. From the foregoing it will be seen that in each die the fluid is admitted to the outer ends of alternate channels and to the inner ends of the intermediate channels simultaneously and flows in opposite directions through adjacent channels to the outlet passageways, thus effecting an even distribution of the heating or cooling medium throughout the die. It will also be seen that by arranging the pipe connections so that the inlet passageways in the one die will be adjacent the outlet passageways in the other die, with the ends of the corresponding channels of the two dies overlapping, as shown in Fig. 5, the plastic material between the dies will be affected by the temperature of the incoming fluid in the one die at points where it is affected by the outgoing fluid in the other die. This, with the channeled arrangement described, permits of quick and uniform heating and chilling of the plastic material, which is essential for large production and a perfect product.

What we claim is:

1. A die for molding disks of plastic material, having a plurality of parallel spiral channels and having passageways for admitting fluid simultaneously to the inner and outer ends of different channels and for permitting the fluid to exhaust from the opposite ends of said channels.

2. A die for molding disks of plastic material having a plurality of parallel spiral channels of substantially equal length extending from the circumference to the central part of the die and having passageways for admitting fluid simultaneously to the outer ends of certain channels and to the inner ends of other channels.

3. A die for molding disks of plastic material having a plurality of parallel spiral channels of substantially equal length and cross-sectional area extending from the circumference to the central part of the die and having passageways for admitting fluid simultaneously to the outer ends of certain channels and to the inner ends of other channels.

4. A die for molding disks of plastic material, having a plurality of spiral channels commencing at different points about the circumference of the die and extending to its central portion and having a plurality of inlet and outlet passageways, each passageway communicating with the outer end of one channel and the inner end of another channel.

5. A die for molding disks of plastic material having a plurality of parallel spiral channels of substantially equal length commencing at different points about the circumference of the die and extending to its central portion and having a plurality of inlet and outlet passageways, each passageway communicating with the outer end of one channel and the inner end of another channel.

6. A die for molding disks of plastic material having a plurality of parallel spiral channels, each channel extending more than one turn and less than two turns about the axis of the die, and having passageways for permitting fluid to flow from the outer ends of certain of said channels inwardly and from the inner ends of other channels outwardly.

7. A die for molding disks of plastic material having four parallel spiral channels each extending approximately a turn and three quarters about the axis of the die and having four approximately radial passageways arranged approximately ninety degrees apart, each passageway communicating with the outer end of one channel and the inner end of another channel.

8. A die for molding disks of plastic material having a plurality of parallel spiral channels extending from the circumference to the central part of the die and having two inlet passageways, at opposite sides of the die, each connected to the outer and inner ends of separate channels, and two outlet passageways at opposite sides of the die, each connected to the inner end of a channel leading from one inlet passageway and to the outer end of a channel leading from the other inlet passageway.

9. A die for molding disks of plastic material comprising a circular plate having a plurality of independent spiral channels of substantially equal length extending from its circumference to its central part, and a die body having a plurality of inlet and outlet passageways, each connected to the inner end of one channel and the outer end of a separate channel.

10. A pair of similar dies for molding disks of plastic material, each having a plurality of spiral channels extending from its circumference to its central part, each die having opposed inlet passageways and opposed outlet passageways, each passageway connected to the outer end of one channel and the inner end of another channel, and the inlet passageways of the one die being adjacent the outlet passageways of the other die.

11. A pair of similar dies for molding
1,582,704 disks of plastic material, each having a plurality of spiral channels extending from its circumference to its central part, each die having opposed inlet passageways tangent to the axis of the die and opposed outlet passageways tangent to the axis of the die and at right angles to the inlet passageways, each passageway connected to the outer end of one channel and the inner end of another channel, and the inlet passageways of the one die being adjacent the outlet passageways of the other die.

In testimony whereof we hereunto affix our signatures.

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