

Dec. 3, 1929.

A. DE L. SMITH

1,737,619

METHOD OF FORMING DISK PHONOGRAPH RECORDS

Filed Aug. 21, 1926

3 Sheets-Sheet 2

Fig. 3.

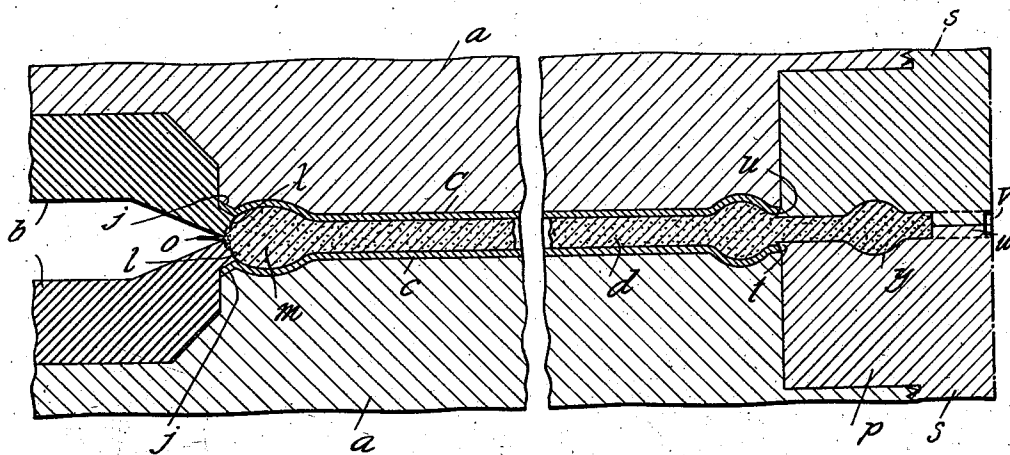


Fig. 4.

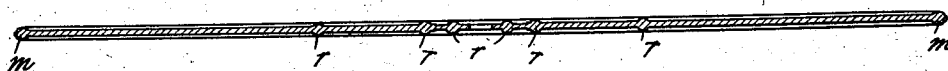


Fig. 5.

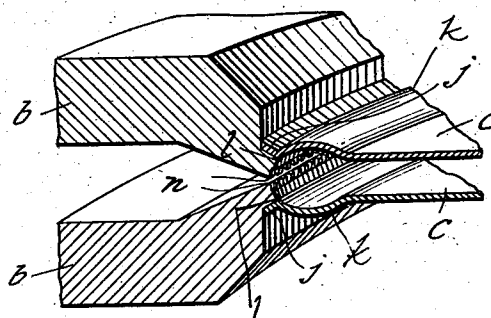


Fig. 7.

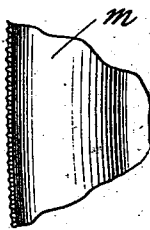


Fig. 6.

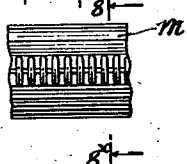


Fig. 8.

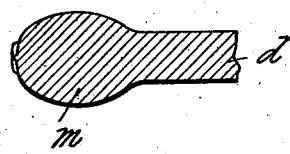
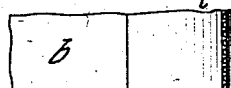


Fig. 9.



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Fig. 10.

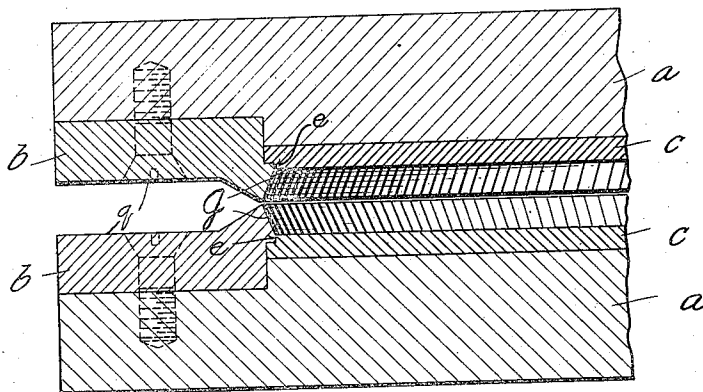
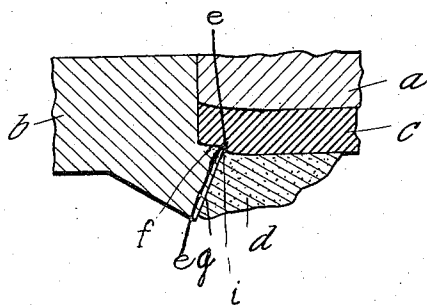


Fig. 11.



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METHOD OF FORMING DISK PHONOGRAPH RECORDS

Application filed August 21, 1926. Serial No. 130,597.

My present invention provides certain improvements in disk phonograph records, and also improvements in the method of making such records whereby certain objectionable features in the present manufacturing process will be eliminated.

One of the principal objects of the invention is to provide an improved arrangement of the parts of the stamping dies whereby the making of such records is not only greatly facilitated, but which are so constructed that they resist wear and are therefore capable of being used constantly for long periods.

Heretofore it has been the practice in assembling the elements of the dies to so arrange the ring and stamper that there was present between their meeting faces a small vertical shoulder. When the two complementary dies were compressed some of the plastic material, of which the records are formed, was forced into the crevice between said shoulder and frequently became sealed therein. This often necessitated prying a record from the die, always a time-consuming procedure and sometimes destructive of the record. Eventually the edges of the meeting faces of the elements due to the tremendous pressure imposed upon them became worn and new die elements had to be substituted. This wearing off of the edges was evidenced by a rim or slightly raised edge formed around the periphery of the disk.

By my improved construction and arrangement of the die elements, I have been able to extend the life of the parts greatly beyond their old tenure, and to increase the daily production of records from a given set of dies.

I have found that if the vertical shoulder at the meeting faces of the elements is eliminated and the overlapping of the ring and stamper occurs on a slight incline to the plane of the disk none of the plastic material will enter between the parts. This is explained by the fact that the pressure put upon the die elements brings the faces closely together at each stamping operation, thus opposing any tendency of the plastic material to force the underlying edge of the stamper away from the overlapping edge of the ring.

I have found also that if the faces of the die elements forming the periphery of a record are curved so as to form a bead on the edge of the record, that the record may be stripped from the die much more readily, the enlarged edge thus formed obviating any tendency to create angular corners in the die during its use in which the plastic material may exhibit a tendency to adhere.

It has been the practice heretofore to break off the fin around the disk by hand or otherwise, an operation which leaves a ring of irregular and jagged edges which are buffed off by sandpaper. Sometimes, in breaking off the fin close to the disk, pieces of the record were also chipped off necessitating the discarding of the record. The buffing step is of course time-consuming and expensive in that it requires handling a record several different times, and in order to obviate this and attendant operations I have provided means for perforating the fin at its junction with the disk for the dual purpose of rendering the fin easily separable and also to provide an edge on the finished record which obviates the burnishing operation.

The improved construction above described is illustrated in the accompanying drawings which present one embodiment of my invention, but it is to be understood that the invention is not limited to the specific structure therein shown, since it will occur to anyone in the art that modifications may be made thereof which will not depart from the principles enunciated herein.

In the drawings:

Fig. 1 is a plan view of one of a pair of cooperating dies;

Fig. 2 is a cross-section on the line 2*-2* of Fig. 1 showing two cooperating dies in operative position and a record being molded between them;

Fig. 3 is an enlarged view of part of Fig. 2;

Fig. 4 is a cross-sectional view of a record made according to my invention;

Fig. 5 is a fragmentary view of portions of the edging rings and stampers of two cooperating dies, showing the inclination of their meeting faces and the knurling on the edging faces of the rings;

Figs. 6 and 7 are edge and plan views of fragments of a record illustrating the knurling thereon,

Fig. 8 is a cross section on the line 8*-8* of Fig. 6; and

Fig. 9 is a fragmentary plan view looking down on the serrated edge of the edging ring;

Fig. 10 is a magnified cross-section illustrating the arrangement and construction of the die elements with which the difficulties above mentioned have been experienced, and

Fig. 11 is a view of the die elements of Fig. 10 showing the deformation which occurs with its use.

In order to make clear how the defects occurred in the present practice of making disk phonograph records, reference is first made to Figs. 10 and 11, showing the die block *a*, edging rings *b* and stamper *c*, between which the disk *d* is formed. The edging faces *g* of the rings *b* are beveled slightly and have small shoulders *e* overlying the edges *e'* of the stampers as shown. The rings extend beyond the edges of the stampers *c* and their bottoms are seated in the blocks *a*. In forming these seats a clearance of approximately four thousandths of an inch is provided initially so that when the rings are positioned and are forced into engagement with their seats the overhanging shoulders will compress the edge faces of the stampers forming slight indentations therein and effect a close union therewith.

Hydraulic pressure is used in pressing the dies together, varying from fifty to seventy-five tons, which is exerted on the enclosed plastic material *d* and as this must in volume be slightly in excess of the space enclosed, in order to assure that the die will be completely filled, it follows that a considerable pressure will be directed laterally against the projecting inclined surfaces *g* of the rings as these approach each other and the excess material is forced outwardly between them. This pressure repeatedly applied tends to spring the rings in places tending to open the joint between the shoulder and its point of engagement with the edge of the stamper. Likewise the repeated pressure on the rings tending to crowd them against the stampers and to force the latter against the blocks *a* results in time in a tendency to crush down the edge of the block *a* immediately under the edge of the stamper, so that the latter will in time be separated an appreciable distance from the overlying shoulder of the ring. The last mentioned effect may also result if there is a slight variation in forming the depths of the ring seats, or in the accuracy of the rings themselves, or it may be due to inequalities occurring in the loss of temper in the rings. Irrespective of the immediate cause of the separation of the ring shoulder and the edge of the stamper it will be seen that at the

point or points where the crevice (*f* Fig. 11) occurs, the plastic material will be forced in and repeated operations will serve to aggravate or increase the amount of separation. A comparatively slight crevice will hold enough of the plastic material to render removal of a disk impossible without rupturing it. Under such conditions when a record is removed, the crevice is filled with the plastic material which hardens and renders the corner edges of succeeding records rough. As more and more records are made the wear upon these edges of the rings and stampers increases until they become worn to such an extent that the record comes off the die with a slightly raised edge *i*. Eventually, of course, the edging rings and stampers must be discarded and replaced with new elements. This is wasteful, since the original stampers, so far as their face portions are concerned, are quite capable of further use.

By a reconstruction and rearrangement of the elements, I have been able to overcome this objectionable feature and to increase the output by a very large figure. This reconstruction is clearly illustrated in Fig. 5, which bears identifying characters corresponding to the parts indicated in Figs. 10 and 11.

In this improved form of die, the outer edge of the stamper *c* has an inclined flange *j* and a curved bead *k* adjoining it. The edging ring is similarly curved at its inner face *l* to form with the bead an arc of a circle. When these elements are assembled they will impart to the edge of the disk a bead *m* which is substantially circular in cross-section.

Curving the edging faces of the rings and the stampers has more than esthetic value. In addition to diminishing the tendency of the record to stick to the die, it directs some of the lines of pressure tangentially to the curvature of the bead and thus assists in causing the plastic material to flow outwardly between the edging rings. Theoretically, the cutting surfaces of the edging dies close together in the press, but in practice the mass of material under compression prevents them from actually uniting throughout the circumference of the record, the slight space then provided leaving a circular slit between the opposed surfaces of the rings through which the excess material under compression exudes forming a fin or web, which is removed by hand after the record is removed from the dies.

To facilitate this operation and leave the edge of the record sufficiently smooth so that it need not be subsequently burnished at its edge, the dies are formed in such a manner that as the last of the extruded material passes through the constantly narrowing slit between the dies it will be rendered into a thin sheet or fin possessing irregularities in its contour. To this end I provide the inner surfaces of the edging rings with a continu-

ous row of alternate ridges or depressions by knurling, etching or otherwise treating the said faces. Similar markings, it will be seen are formed on the edge of the completed record disk.

5 In practice I have found that the ring surface *l* may be conveniently formed by using a fine knurling tool, the exact form of the depressions thus caused being immaterial. 70
10 The pressure caused by the knurling operation displaces a portion of the metal, forming alternate depressions and lands, and this displacement causes corresponding points to be struck upon the cutting edge *n* of the ring 75
15 so that this is correspondingly roughened or provided with a series of very fine needle points. In other words, the material as it is extravasated will, at alternate points along the edge of the record, pile up in minute 80
20 ridges and minute depressions effecting the fracturing margin which facilitates the removal of the fin.

In the formation of a record disk by means of the instrumentalities described, it will be 25
seen that as the similarly formed upper and lower dies approach each other, that the major portion of any excess plastic molding material will be forced outwardly between the cooperating edges of the ring dies and 30
that the final portion of such excess which is extruded under the heavy hydraulic pressure to which the dies are subjected as they approach each other, and which material is immediately adjacent the edge of the record, 35
will be forced between the aforementioned needle points. Therefore the line of attachment between the extended fin and the comparatively thick edge of the disk will be more or less wavy in appearance. These small 40
waves or wrinkles occur at both sides of the fin and at some places the bottoms of certain waves at one side will nearly if not quite meet the bottom of the waves formed at the other side. It has been found in practice that the 45
resulting formation of the fin at its point of juncture with the record greatly facilitates the removal of the fin when the record is removed from the dies, whether this operation is performed while the fin and record is still 50
heated or if the parts are allowed to cool. The increased ease with which the fin is removed while still warm, I attribute to a change in temperature occurring immediately upon the opening of the dies which occurs 55
in the thinner area where the wavy formation occurs.

Detachment of the fin is actually accomplished by the operator drawing a finger around the edge of the disk, and so uniform 60
is the contour that no buffing is subsequently required. The finished disk has a serrated edge (Fig. 7) which is very attractive to the eye, and increases the safety with which the record may be handled, the fingers being able 65
to get a firmer grasp on the record because of

the knurled or serrated edge than heretofore where the record was buffed smooth.

It will be seen that by arranging the meeting shoulders of the die elements at an inclination so as to overlap one another in their 70
assembly any tendency for the plastic material to enter the joint between the rings and the stamper will be opposed by the force imposed upon the flange *j*, which force is almost at right angles to the inclination of the face *l*. 75

In addition to the parts described each of the molding dies comprises a central locking bolt *p*, which is circular in cross-section and is provided with a screw *s* which is received in a threaded aperture in the die block *a*. 80
The top of the bolt is flared at *t* and rests upon the beveled internal periphery *u* of the stamper *c*. Provision is made in the way of a polygonal aperture *v* in the center of the bolt for receiving a tool by which the bolt is to be screwed into and out of the die. The bolts have raised portions *w* which meet to form a central aperture at the center of the record. 85

In addition to the outer bead *m* each 90
stamper may also be provided with a circular concentric ridge or ridges *r*, *r*, and the center bolts may also have similar grooves *y*. The disks, it will be seen, are consequently formed with a plurality of circular ridges or elevations which, being spaced alike on all disks, will form bearing points when one disk is superimposed upon another, thereby preventing the inscribed surfaces from contacting. Preferably, there are at least two central off- 95
setting rings on each record, one of which is formed by a groove *y* in the bolt *p*. 100

A disk record formed in the manner described possesses several advantages. By reason of the thickened or beaded edge and the other elevated rings, the music lines are protected against injury when the disk is laid upon a flat surface and in handling the disks, particularly during the periods of inspection and packing and after they are taken 105
off the press. For instance, in the latter operation it is not necessary to separate successive disks with sheets of paper. The internal beads or elevated rings cooperate with the enlarged rim to keep the centers of the disks from sagging when a number of them are stacked together. The knurled or serrated edge which is curved in cross-section facilitates picking up the record and from a manufacturing viewpoint contributes to a 110
reduction in cost, as it is accepted as a finished product by the purchaser and minute particles adhering to the record that may be overlooked during inspection either pass unnoticed or are easily brushed off or wiped 115
off by the fingers. 120

In accordance with the provisions of the patent statutes the principle of the invention has been described, and illustrated by the portrayal of a structure which in practice 125
130

has proved to be a satisfactory embodiment thereof, but it is desired to have it understood that the structure shown is merely illustrative, and the invention may be carried out in other ways.

5 Having described my invention, what I claim is:

1. The method of forming disk phonograph records consisting in compressing a mass of molding material between dies having edges which substantially meet to form the periphery of the record and are serrated to give the edge of the record between its two faces indentations, the points formed by the serrations in one die cooperating with similar points formed on the other die, and forming in the extruded web successively weakened points of attachment between it and the record proper.

2. The method of molding disk phonograph records consisting in compressing a mass of molding material between dies having knurled areal borders, the resulting rough cutting edges of which when substantially meeting to form the periphery of the record create weakened points of attachment of the extruded web to the record.

3. The method of forming disk phonograph records consisting in compressing a mass of molding material between dies having edges which substantially meet to form the periphery of the record and are serrated to give the circumferential edge of the record small indentations, the points between the latter serving to form an area of weakness between the web of material extruded and the edge of the molded disk.

4. The method of molding disk phonograph records consisting in compressing a mass of molding material between dies having knurled areal borders which form alternate depressions and lands in the two half edges of the periphery of the molded record, and the serrated edges of which when substantially meeting form areas of weakness in the excess material extruded between said dies.

5. The method of forming disk phonograph records consisting in compressing a mass of molding material between die surfaces one of which at least has a raised surrounding edge formed with spaced depressions forming intervening points which cooperate with the other side to form areas of weakness in the material extruded between said dies.

This specification signed and witnessed this 10th day of August, 1926.

ANNESLEY DE LOS SMITH.