No. 773,978. PATENTED NOV. 1, 1904.

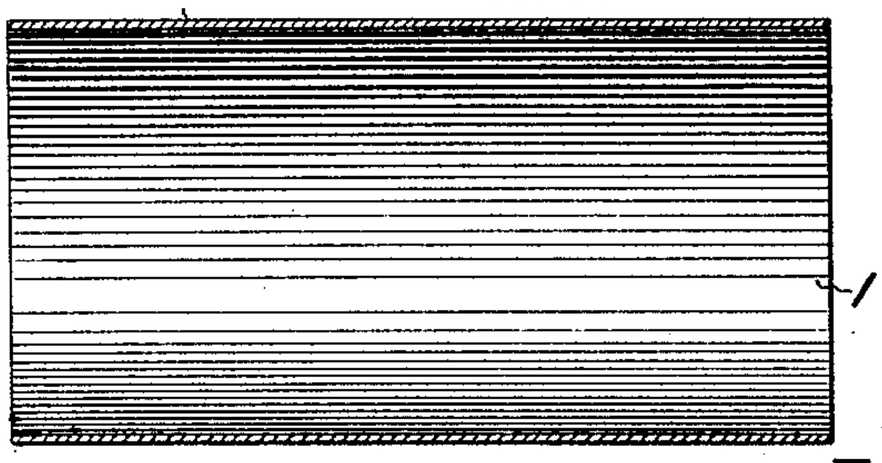
A. N. PETIT.

PROCESS OF MANUFACTURING CELLULOID CYLINDERS FOR RECEIVING PHONOGRAPHIC RECORDS.

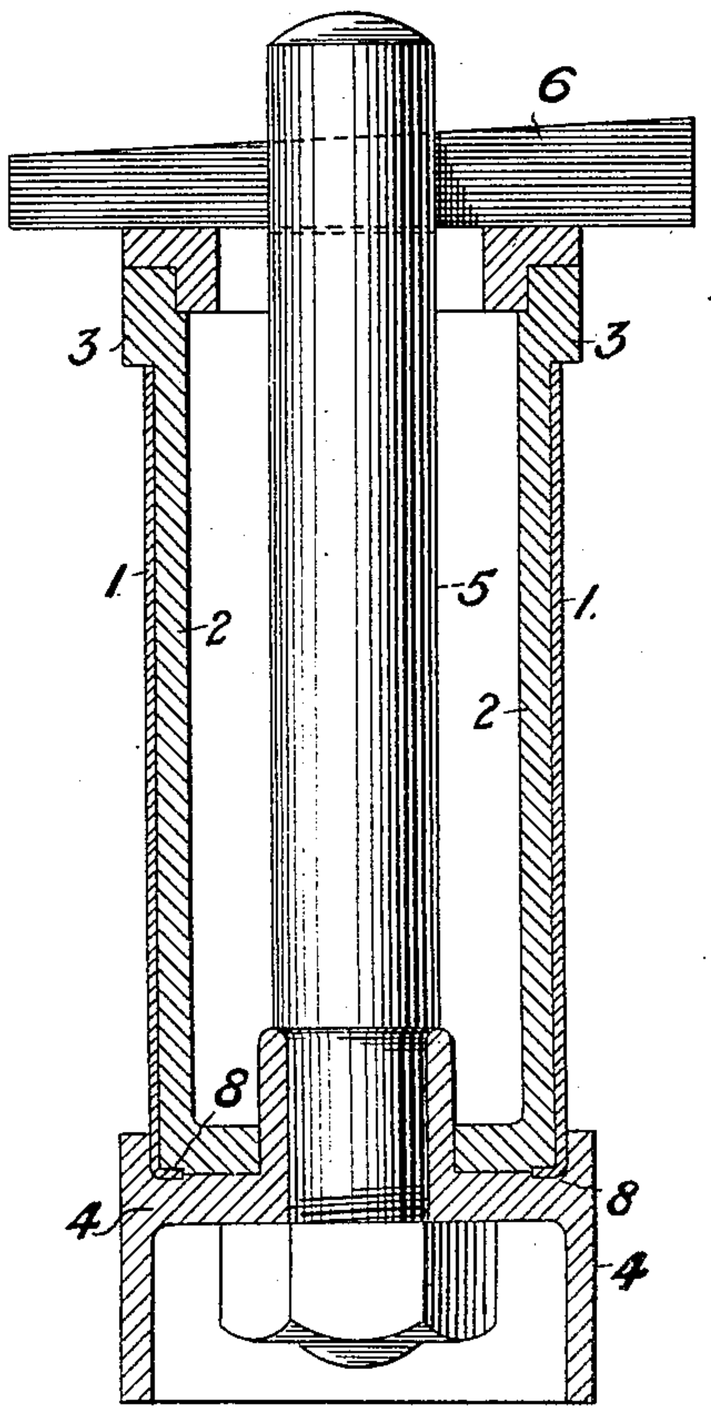
APPLICATION FILED MAR. 25, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

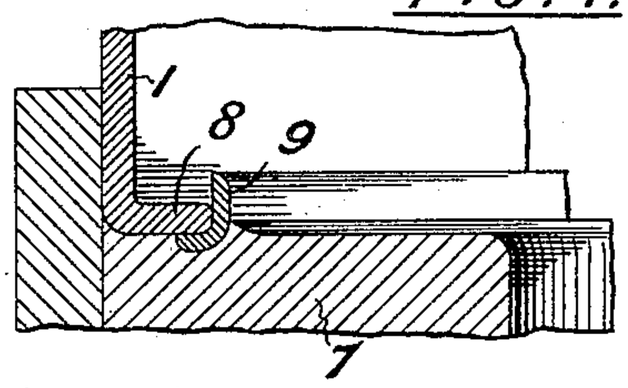
—FIG: 1.—



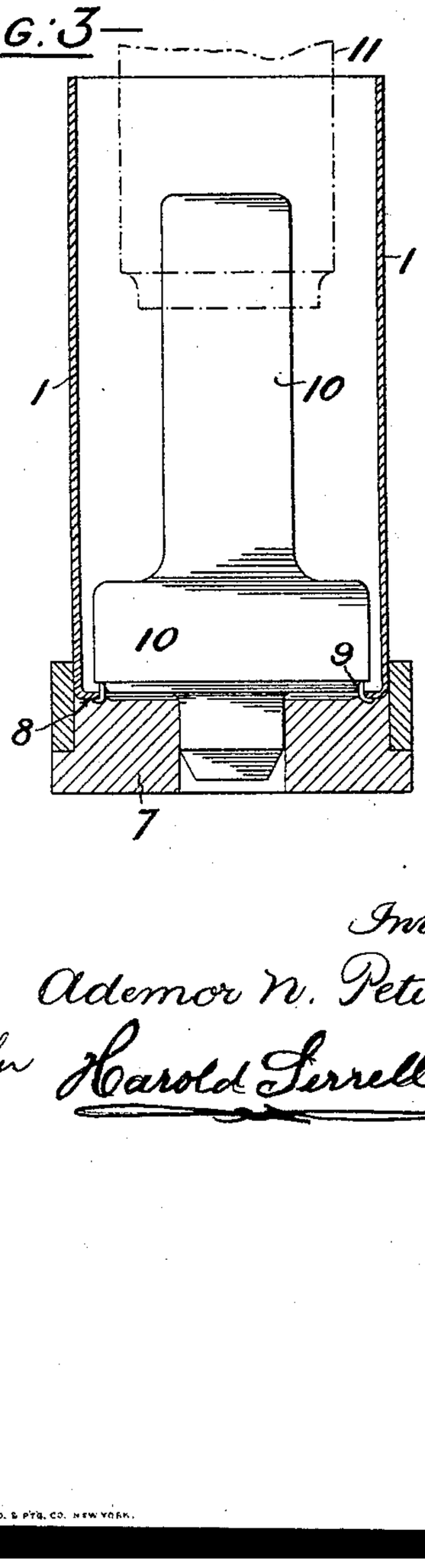
—FIG: 2.—



—FIG: 4.—



—FIG: 3—



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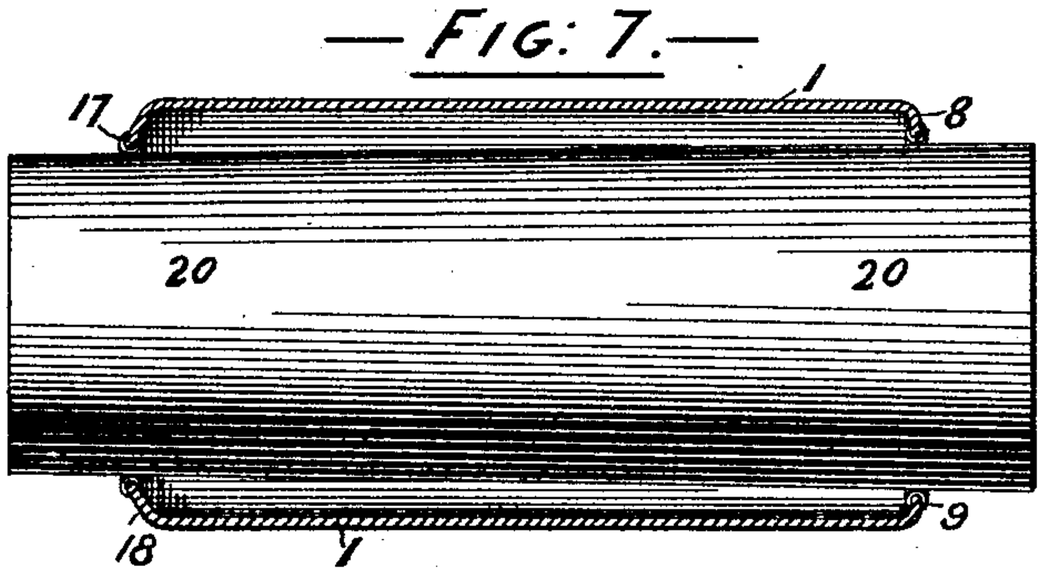
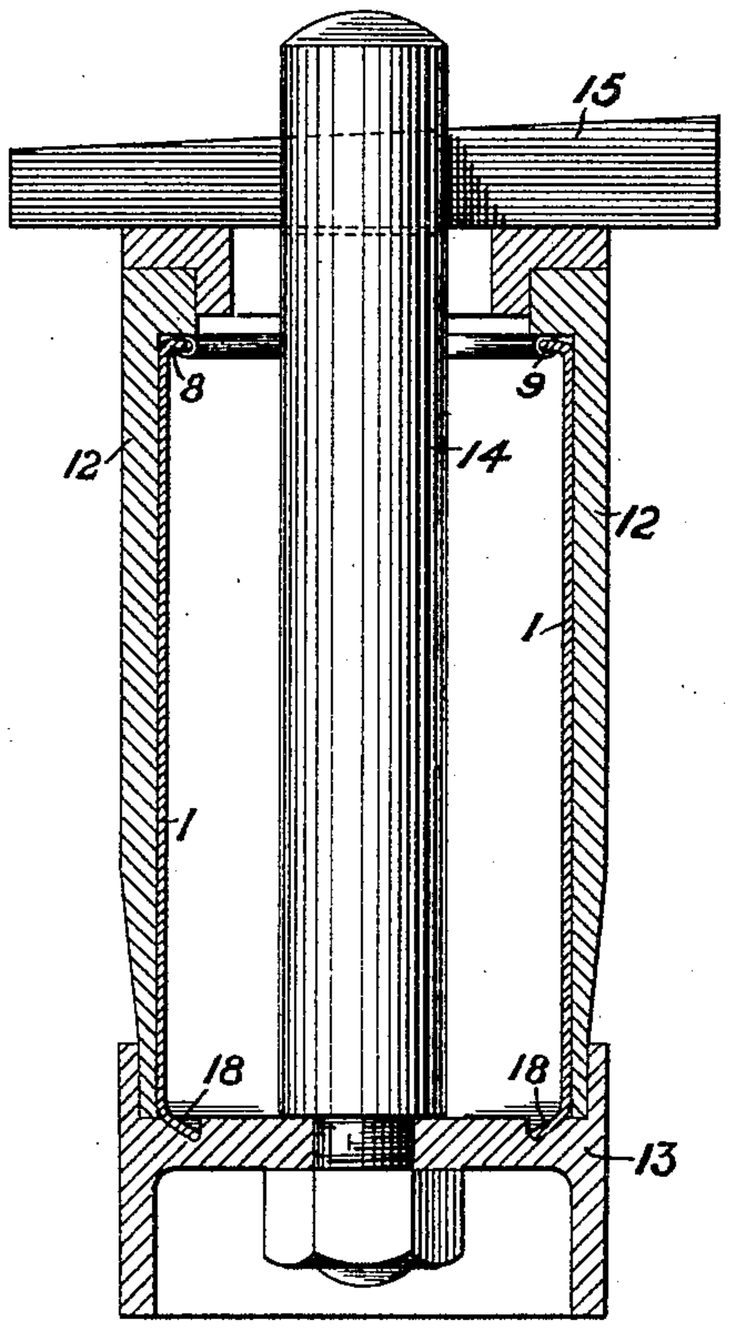
APPLICATION FILED MAR. 25, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

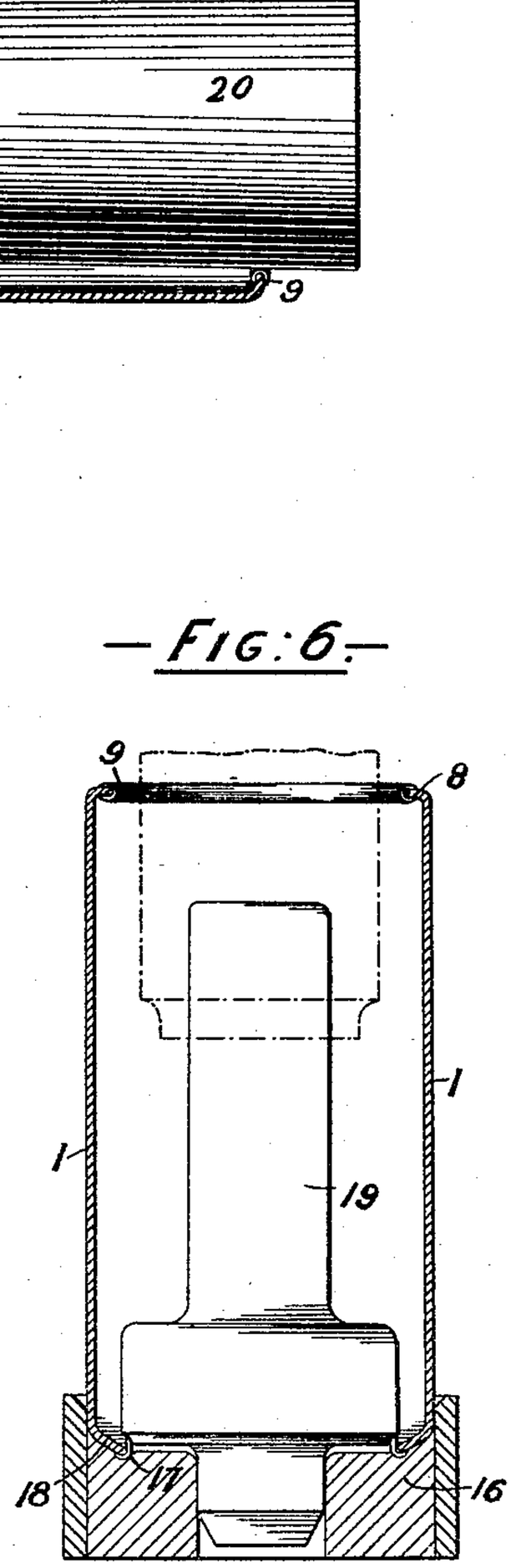
— FIG: 7. —



— FIG: 5. —



— FIG: 6. —



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No. 773,978. Patented November 1, 1904.

UNITED STATES PATENT OFFICE.

ADEMOR N. PETIT, OF WATERLOO, NEAR LIVERPOOL, ENGLAND.

PROCESS OF MANUFACTURING CELLULOID CYLINDERS FOR RECEIVING PHONOGRAPHIC RECORDS.

SPECIFICATION forming part of Letters Patent No. 773,978, dated November 1, 1904.

Application filed March 25, 1903. Serial No. 149,473. (No model.)

To all whom it may concern:

Be it known that I, ADEMOR N. PETIT, a citizen of the United States of America, and a resident of Waterloo, near Liverpool, Lancashire, England, have invented certain new and useful Improvements in Processes of Manufacturing Celluloid Cylinders for Receiving Phonographic Records, of which the following is a specification.

Cylinders for phonograph and the like instruments which are to receive upon their exterior surface the phonographic records have latterly been composed either wholly or partially of celluloid or have consisted of a base provided with a celluloid surface to receive the record, and such cylinders have presented many advantages in use and, owing to their being practically indestructible, have retained a permanent record of the sound-waves. The formation of the record upon the surface of the celluloid cylinder is conveniently effected by inserting the celluloid cylinder within a matrix which is itself an electrotype taken from a wax cylinder in which the records have been cut by the recording-stylus of the phonograph. The celluloid cylinder having been suitably inserted in the matrix is subjected to internal pressure and heat, and thereby expanded against the internal surfaces of the electrotype-matrix, from which it (the celluloid cylinder) receives the requisite impression and reproduction of the record.

Now this invention treats of record-cylinders which are formed wholly of celluloid, the walls of the tube being of sufficient thickness for strength and the internal diameter somewhat greater than the diameter at any point of the mandrel which is to carry the celluloid record-cylinder. In order to adapt such cylinders composed wholly of celluloid to frictionally fit upon the mandrel when slid thereon, so that the outer cylindrical surface is concentric with the axis of the mandrel and so that the celluloid record-cylinder shall occupy its required position in the longitudinal direction of the mandrel, it is necessary that the cylinder should be provided with a collar at each end having different-sized apertures and that the circular apertures of the collars shall accurately fit at all times upon the different diameters of the mandrel with which they are brought into contact, and to this end I have described in my prior United States Patent specification, No. 666,937, a celluloid record-cylinder having one end inwardly bent—viz., that end which is to fit onto the large end of the mandrel—and the other end of the record-cylinder I have shown fitted with a ring of celluloid formed separately and then suitably cemented in its place. In the specification of an earlier United States Patent, No. 657,956, granted to myself, however, I have described as a new article of manufacture a celluloid record-cylinder in which both end parts are formed by inwardly bending a portion of the two ends of the cylinder, so that what I have termed the "collars" are made integral with the body of the record-cylinder. Obviously and as explained in this specification the two inwardly-extending ends must vary in diameters, so that the internal edges of the bent-in ends shall have the proper difference of diameters to fit on the tapering mandrel which is to carry the cylinder and grip that mandrel frictionally in such a manner that the external surface of the cylinder shall be concentric throughout with the axis of the mandrel, an air-space shall be left between the outer surface of the tapering mandrel and the inner surface of the record-cylder, while the latter shall occupy when these conditions are satisfied its correct position longitudinally upon the mandrel. Now I have found this latter construction of cylinder with integrally-bent ends is adapted for the purposes of its use; but I have since found in practice that record-cylinders so constructed with integrally-bent ends do not always properly fit on the tapering mandrels of reproducing-machines, because they are very liable to slight variations in size, the coefficient of expansion of celluloid being large, and that this slight variation is sufficient to prejudicially affect the fit of the cylinder when in the proper position upon the mandrel.

My present invention therefore refers to a method for overcoming this defect and difficulty without changing the character of construction of the cylinders—that is to say, while on the one hand still retaining the use of a cylinder constructed wholly of celluloid

with inturned ends, yet on the other hand providing that the variations in size of the ends of such a cylinder shall not affect the proper fit of the cylinder upon the mandrel. To this end I provide each edge of the inturned ends with a ring of metal secured to the said edges, and these rings having a much smaller coefficient of expansion than the celluloid I have found will always fit upon the mandrel in the required position, and in a patent application by myself, Serial No. 149,475, filed simultaneously with the present patent application and patented January 19, 1904, No. 750,119, I have described as a new article of manufacture a phonograph-record cylinder so constructed.

My present invention refers to the process of manufacture of such celluloid record-cylinders having inturned ends with metal edges, and I will now describe my invention with reference to the accompanying drawings.

Figure 1 shows in longitudinal section a plain tube of celluloid which is to be subjected to the process hereinafter described. Fig. 2 is a longitudinal vertical section of a "core-press" for inwardly turning one end of the cylinder which is to fit onto the larger end of the mandrel. Fig. 3 shows in vertical section a base-mold and press for applying the metal edge, and Fig. 4 is a vertical section of a portion of the press shown at Fig. 3 and drawn to a greatly-increased scale. Fig. 5 is a vertical section of a case-mold in which the opposite end of the cylinder is inwardly turned to fit upon the smaller end of the mandrel, and Fig. 6 is a vertical section of a press for applying the metal edging to the inwardly-turned end of the cylinder which is of the smaller diameter. Fig. 7 is a sectional view showing a mandrel with the record-cylinder in section constructed according to this invention fitted thereon.

In carrying out the process according to my present invention I first take a plain cylindrical tube of celluloid, such as is shown at Fig. 1 and marked 1, and I first turn in that end of the cylinder 1 which is to have the larger aperture and which is to fit onto the larger end of the mandrel, and to do this I place in the celluloid cylinder 1 a hollow metal core 2, which is not heated, this part of the apparatus being shown at Fig. 2. The end of the cylinder 1 fits up against a shoulder 3 on the core 2, and the lower end projects beyond the end of such core 2. I provide a base 4, of metal, with an upstanding edge, and before application this metal base 4 is heated by, for instance, immersing it in hot water, and when so heated the base 4 is applied to the base of the cylinder 1 and the core 2. The heat of the base 4 sufficiently softens the outstanding end of the cylinder 1 so as to cause that end to be easily bent inward by the base 4, which forms a bottom mold, and between the end of the core 2 and the upper surface of the base 4 a recess is formed in the metal to receive the end of the cylinder which is so turned inward. Pressure is then applied to force and hold the lower end of the core 2 against the base-mold 4. This is effected in the construction shown by a bolt 5 passing through the bottom mold 4 and the core 2, the upper end of the bolt being held by a cotter 6. The end of the cylinder 1 having been thus inturned and become cool it is removed from the core 2 and placed upon a base-mold 7, as shown by the vertical section at Fig. 3. This base-mold 7 is formed with an annular recess to receive a ring of metal. This ring 9 is shown also at Fig. 4, and it is first placed in position in the annular recess of the base-mold, as shown. The cylinder 1 is then placed in position on the base-mold 7, so that its inturned edge 8 lies upon the outwardly-turned lower edge of the ring 9, and an upstanding flange of the mold 7 reaches for a short distance up the exterior of the cylinder 1 at its lower end. A pressure-die 10, attached to the ram 11 of a hydraulic or other press, is then brought down through the opening of the cylinder 1 upon the upstanding edge of the metal ring 9, and the external lower edges of that die 10 are so formed that the edge of the ring 9 is turned over onto the inner surface of the end 8 of the cylinder 1, and said ring 9 firmly holds that inturned edge by pressure. The cylinder is now removed from the device shown at Fig. 3, having one end completely formed with an inturned metal ring 9 upon that edge which is adapted to fit the larger end of the mandrel, and the internal diameter of the end of that cylinder so fitted with the metal ring 9 will not appreciably vary, and consequently will always fit the mandrel when the cylinder 1 is located in the desired position thereon. The opposite end of the cylinder is now to be operated upon, and in this case where a greater length of the end is to be turned inward in order to make the internal diameter smaller than the end 8, already described, I prefer to make such inturning at an angle to the body of the cylinder. The mode adopted for turning in this end is to fit the cylinder 1 into a cylindrical casing 12, (shown in section at Fig. 5,) so that the already-formed end of the cylinder fits up against an end shoulder on the casing 12, and this latter casing is made of metal and is not heated. The casing 12, with the end of the cylinder 1 projecting, is then applied to a base-mold 13, which has been previously heated, say, to nearly the temperature of boiling water. When applied, the mold 13 has a softening effect upon the projecting end of the cylinder 1, and that end 18 adapts itself by pressure to the formation of a circular groove made in the upper face of the mold 13. In the drawings, Fig. 5, the base-mold 13 and the casing 12 are drawn together by means of a bolt 14 and a cotter 15. When the end 18 of the cylinder has been thus formed, it is removed from the appara-

tus shown at Fig. 5 and placed upon a base-mold 16, which is not heated. (Shown in section at Fig. 6.) Previous to placing the end 18 of the cylinder in this mold 16 a metal ring 17, such as has been described with reference to the other end of the cylinder 1, but whose interior diameter is smaller than the ring 9, is placed in position in the mold 16, so that the inturned end 18 of the cylinder rests upon that ring. A die 19 is then brought down through the end 8 of the cylinder and is caused to press upon the upstanding edge of the metal ring 17 and to turn that edge outward onto the interior of the end 18 of the cylinder to cause the metal ring to grip, and thus the inturned edge 18 is fitted with the metal ring 17, which fits accurately upon the smaller end of the mandrel when the ring 9 fits upon the larger end. The cylinder 1 is then removed from the device shown at Fig. 6 in a finished condition, and when thus provided with metallic rings gripped onto the inturned edges of the cylinder the fitting of the cylinder onto the mandrel 20 (shown at Fig. 7) is not subject to those variations in size which hitherto presented a very considerable difficulty and objection to the employment of such cylinders wholly formed of celluloid having comparatively thin walls.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The herein-described process of manufacturing blank phonograph-record cylinders of celluloid, the same consisting in inturning that end of a plain cylindrical tube of celluloid, which is to have the largest aperture by the application of heat and pressure, and thereafter placing around the edge of said end a ring of metal, then inturning the other end of the cylinder which is to have the smaller diameter by the application of heat and pressure, and thereafter placing around the edge of said end a ring of metal.

2. The herein-described process of manufacturing blank phonograph-record cylinders of celluloid, the same consisting in inturning one end of a plain cylindrical tube of celluloid to the aperture of maximum diameter by the application of heat and pressure, forming a ring of metal of L shape in cross-section, applying the inturned end of the cylinder upon the said ring of metal and overturning the opposite edge of the ring around the edge of said inturned end of the cylinder so as to strengthen and protect the inturned end of larger aperture, reversing the position of the cylinder, then inturning the other end of the tube of celluloid to an aperture of minimum diameter by the application of heat and pressure, forming a second ring of metal of L shape in cross-section and placing the latter inturned end upon the ring and overturning the opposite edge of the ring around the edge of said inturned end so as to protect the inturned end of smaller aperture.

3. The herein-described process of manufacturing blank phonograph-record cylinders of celluloid, the same consisting in taking a plain cylindrical tube of celluloid, inturning one end by the application of heat and pressure to the aperture of maximum diameter, forming a ring of metal of L shape in cross-section, applying the inturned end of the cylinder upon the said ring of metal and overturning the opposite edge of the ring around the edge of said inturned end of the cylinder so as to strengthen and protect the inturned end of larger aperture, then inturning the other end of the tube of celluloid by the application of heat and pressure, to an aperture of minimum diameter, forming a second ring of metal of L shape in cross-section and placing the latter inturned end upon the ring and overturning the opposite edge of the ring around the edge of said inturned end so as to protect the inturned end of smaller aperture.

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