Feb. 3, 1942. A. F. LARABEE 2,272,090

SPHERE-SMOOTHING APPARATUS

Filed May 23, 1940 2 Sheets-Sheet 1

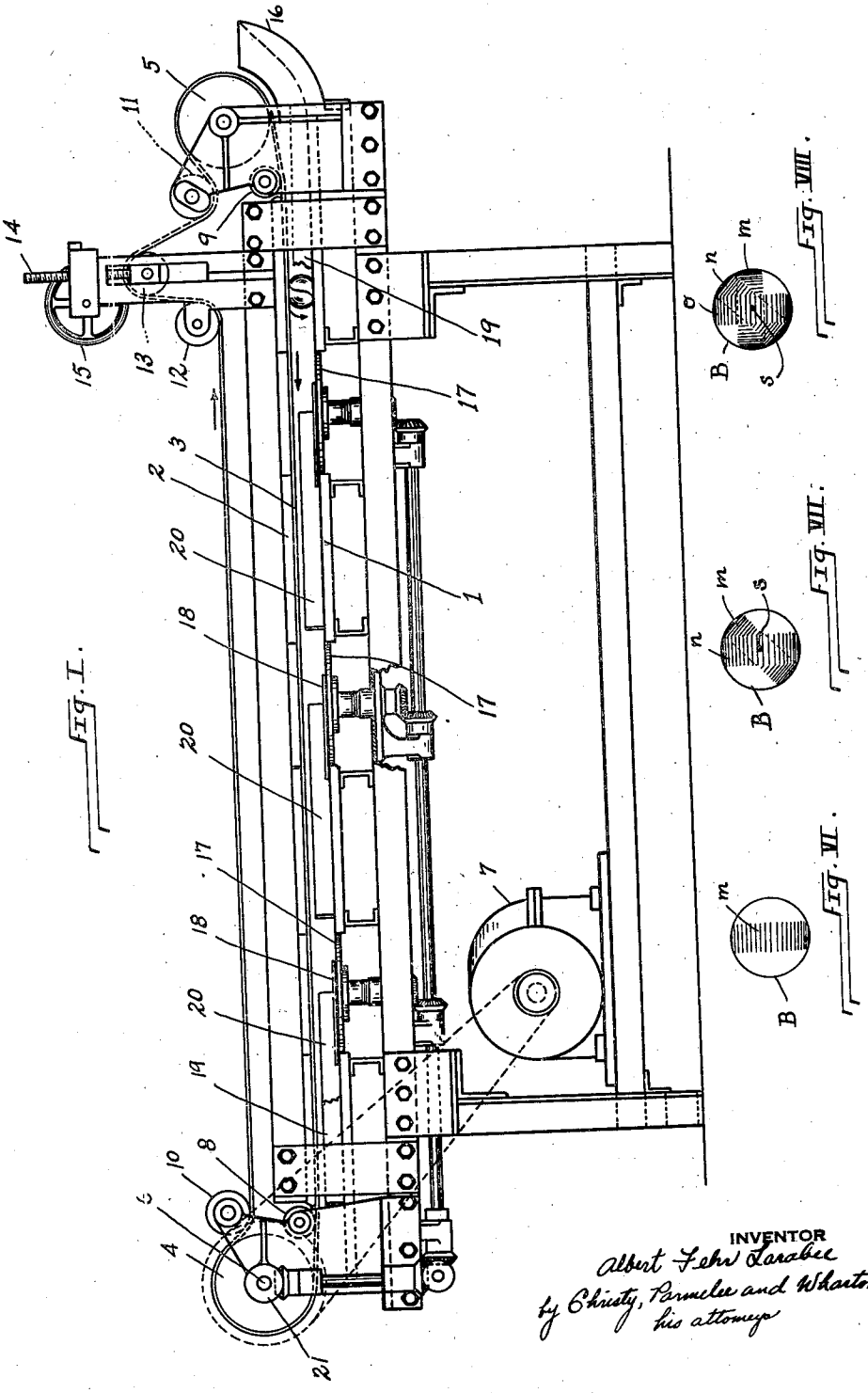


Fig. I.

Fig. VIII.

Fig. VIII.

Fig. VII.

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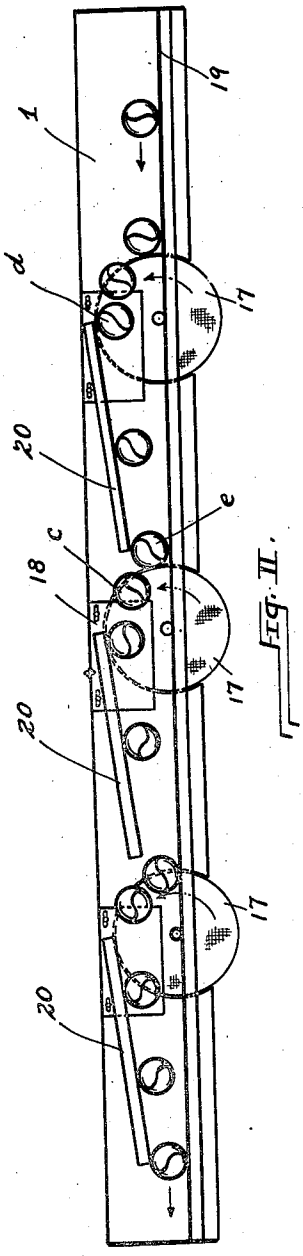


Fig. II.

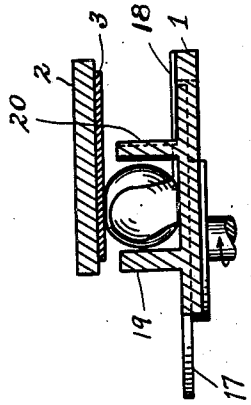


Fig. III.

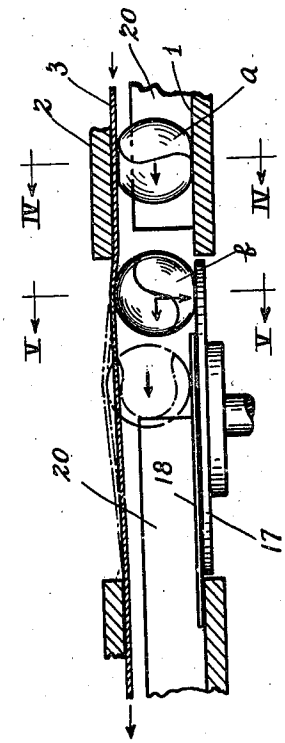


Fig. III.

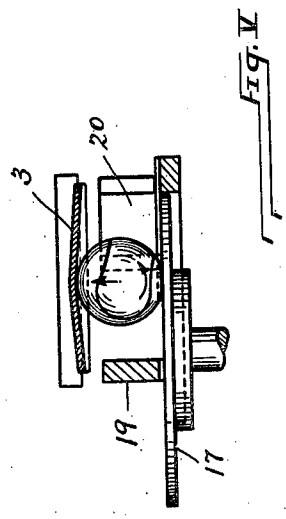


Fig. X.

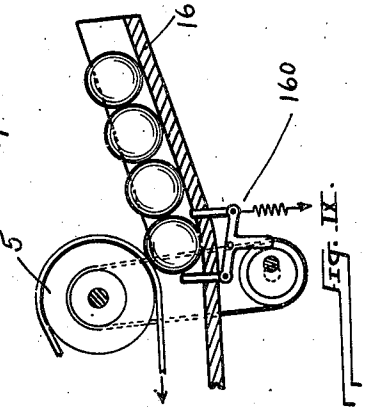


Fig. IX.

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UNITED STATES PATENT OFFICE

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SPHERE-SMOOTHING APPARATUS

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Application May 23, 1940, Serial No. 336,760

4 Claims. (Cl. 154—16)

This invention relates to the smoothing of the surface of a spherical article, and finds practical application in the smoothing and pressing of the felt cloth cover upon tennis balls, and in the closing of the seams at the meeting edges of the applied cover, before the covered ball is vulcanized. An ultimate vulcanizing step is taken, to accomplish the vulcanization particularly of the intercalated film of rubber cement by which the cover is caused initially to adhere to the rubber shell, and to integrate the whole. Invention is found both in apparatus and in the method performed in its operation.

In the accompanying drawings Fig. I is a view, partly in side elevation and partly in vertical section, of the apparatus of the invention as I have built and used it; Fig. II is a fragmentary view showing in plan from above the table top that forms part of the apparatus; Figs. III, IV, and V are fragmentary views to larger scale. Fig. III is a view in vertical and longitudinal section, and shows both the table top and the co-operating parts that are arranged above the table top. Figs. IV and V are views in vertical section, on the transverse planes indicated at IV—IV and V—V, Fig. III. Figs. VI, VII and VIII are diagrammatic views of a tennis ball, illustrating successive circumferential bands upon which the ball is in the practice of the invention compressed. Fig. IX is a view in vertical section of the work-receiving end of the machine, illustrating diagrammatically a modification or elaboration in ball-controlling structure.

Above a smooth and rigid table top 1, advantageously formed of hard maple plank, and extending in horizontal plane, is arranged the parallel surface of an opposed and rigid wall 2, advantageously formed of hard maple also. Beneath this opposed upper surface a web 3 of cotton belting advances in the direction of the length of the table. The web is advantageously an endless belt, organized as shown in Fig. I. It is mounted on two drums 4 and 5, arranged beyond the ends of the wall 2; and one of the drums (4) is mounted on a shaft 6 that is rotated from a source of power 7. Thus the endless belt is driven. Suitable guide rollers 8 and 9 are provided, accurately to define the position of the work-engaging reach of the belt. Rollers 10 and 11, beneath which the belt advances, co-operate with drums 4 and 5 to increase the extent of the engagement of the belt with the drums; and a belt-tightening device is provided that consists of a roller 12 set adjacent roll 11 beneath which also the belt advances and a roller 13 that forms with the rollers 11 and 12 a bight in the belt. The roller 13 is mounted in bearings that are adjustable in a direction transversely of the line of advance of the belt. Fig. I shows a screw 14 and a handwheel 15, which will be recognized to be parts of conventional belt-tightening means.

Through a chute 16 at the right-hand end of the table the articles to be treated are brought, one by one, to the space between the table top and the belt-faced wall above. The direction of travel of the reach of belt that faces the wall 2 is from right to left, and the spacing of the belt-faced wall 2 from the table top is such that an in-fed ball, engaged from above by the belt is rolled over the table top from end to end and under compression sufficient to reduce eminences, to obliterate irregularities, and to shape the cover to snugger and smoother fit upon the rubber shell. The compression of a ball that is two and five eighths of an inch in diameter may be of the order of three eighths of an inch, and the contact of the level surfaces above and below upon the slightly flattened sphere may be in a band an inch wide.

By the means thus far described the ball will be rolled over the table top on a single circumferential band. My invention further consists in the provision of means for shifting the ball in its position, so that in the course of its advance it will roll successively on a plurality of circumferential bands. These successive circumferential bands will at two polar points coincide and on the equatorial circle between such polar points will extend edge to edge and cover the entire circumference. Thus over the entire surface the cover is pressed upon the ball, and the seams at the meeting edges of the applied cover closed throughout all their extent.

The continuity of the table top 1 is interrupted by a succession of turn-tables 17 whose surfaces are flush with the surface of the table top 1 and whose centres of turning are arranged to one side of the runway for the balls, and conveniently at one edge of the table. Upon these turn-tables successively the ball, advancing under the driving impulse of the traveling belt, is rolled; and, by the rotation of the table, the ball is rolled in transverse direction. The continuity of the upper wall 2 is interrupted (Fig. III) through space intervals that correspond to the extent of the turn-tables. In these intervals the belt 3 yields. It still holds the ball firmly to contact with the surface of the turn-table;

it still is effective to roll the ball forward; but, at the same time, the turning of the table 17 effects a rolling of the ball transversely in its contact with the belt 3. The organization is such that the extent of such transverse rolling is substantially equal to the width of the band of contact between the ball and the table top 1 below and the belt 3 above in the other portions of its course. Referring to Figs. II and III, a ball advancing from right to left is, by the impulsion of belt 3, carried from the position *a* on table top 1 across the periphery of the turn-table 17 to the approximate position *b* upon the top of and near the periphery of the turn-table. Here the compression of the ball is relieved, while the impulsion of the table 17 (turning counter-clockwise, Fig. II) rolls the ball transversely, and brings it to position *c*.

The speed of turning of the turn-tables 17 is correlated with the speed of advance of the belt 3; and, to that end, Fig. I shows the tables to be rotated from a bevel-gear 21 borne by the shaft 6 that drives the belt.

A thin plate 18, conveniently of metal, adjustable in its position, overlies a portion of the turn-table 17 and a portion of the table top 1 on the delivery side (i. e. to the left of) the turn-table. The turn-table brings the ball at *c* to the edge of plate 18; and there, in response to the constant advance of belt 3, the ball is rolled from the turn-table 17 over the edge of plate 18 and caused to advance upon plate 18. It is manifest that, by adjustment of the plate 18, the extent of the transverse rolling that turn-table 17 effects may be varied and brought to the desired value.

The longitudinal extent of the table top in the intervals between successive turn-tables is precisely determined, so that the ball as it is taken up by each turn-table is properly oriented and is by the action of the successive turn-tables rolled on the same axis.

A sufficient number of turn-tables is provided, that the successive bands of contact characterized above shall cover the entire surface of the ball, and every point in the surface made subject to the smoothing compression. By way of example, Fig. II shows three turn-tables, dividing the table top 1 into four intervals of rolling under compression. These intervals are equal in length and each in length exceeds the circumference of the ball. As has been said, the diameter of a tennis ball of standard size is two inches and five eighths and its circumference about eight inches. The transverse rollings that the turn-tables 17 successively effect are through equal intervals, and the interval may be an interval of an inch, measured circumferentially of the ball. If then the bands of compression through the intervals of compression be an inch wide, it is manifest that in the course of the ball through the apparatus the bands will cover the entire surface of the ball.

This is illustrated in Figs. VI, VII, and VIII. The ball B is shown diagrammatically in Fig. VI to have been compressed and rolled over a single circumferential band *m*. In such condition it comes to position on the first turn-table. The first turn-table effects rotation on the axis of which the point *s* in one pole through an angular range that corresponds to the width of band *m*. In the advance between the first and second turn-tables the ball is compressed and rolled over a second circumferential band *n*. The second turn-table effects rotation again on the same axis and again through a range that corresponds to the width of the compression bands. Between the second turn-table and the third the ball is compressed and rolled over a third circumferential band *o*, and so on.

Provision is advantageously made that the table may be of small dimensions, occupying a minimum of floor-space. The width of the table top 1 slightly exceeds the radius of the turn-tables. Along one edge extends a ball-limiting rail 19; and this rail is continuous, across the intervals in which the turn-tables 17 are set. (The centres of turning of these tables lie immediately within the boundary of the rail 19.) On the opposite side of the table guide rails 20 are arranged. Each of these overlies a plate 18, and the adjacent portion of table-top 1, and extends from a point near the remote edge of the table top, where it may receive a ball advancing upon plate 18 (the upper edge, Fig. II), obliquely over the surface of table top 1, toward the next succeeding turn-table, remote at its termination from rail 19 at an interval sufficient to allow a ball to pass freely. The rail 20 cooperates with the advancing belt, to bring a ball from the position *d*, Fig. II, to the position of transfer to the next turn-table—the position *e* (substantially the position *a*, Fig. III, already mentioned). The rails 19 and 20 are smooth-surfaced and the balls under compression and under the impulsion given by belt 3 slide upon these surfaces, suffering no appreciable rotation by contact therewith.

In order that the balls advancing in succession through the machine shall not be so close together as to rub one upon another, I organize with the feeding chute 16 an escapement mechanism 160 (Fig. IX) of conventional structure and organization.

I claim as my invention:

1. Apparatus for smoothing the surfaces of compressible spherical articles, which consists of a succession of table-top areas extending in a common plane, a turn-table whose surface extends in the same plane, means for rolling the articles in continuity over a table-top area, a turn-table area, and a second table-top area, and means for defining vertically the space interval above the table-top areas through which the articles advance.

2. Apparatus for smoothing a newly applied cover upon a playing ball which includes a discontinuous table top, a correspondingly discontinuous downward facing wall extending above and in parallelism to the table top and spaced at an interval therefrom, a belt adapted to advance adjacent and beneath such downwardly facing wall, and a turn-table completing the continuity of the table top and adapted to roll a ball transversely while it is in course of rolling longitudinally upon the table top under the impulsion of the advancing belt.

3. Apparatus for smoothing a newly applied cover upon a compressible playing ball which includes a discontinuous table top, a correspondingly discontinuous downward facing wall extending above and in parallelism to the table top and spaced at an interval therefrom, a belt adapted to advance adjacent and beneath such downwardly facing wall, a plurality of turn-tables completing at successive portions of its longitudinal extent the continuity of the table top and adapted to roll a ball transversely upon said belt, and a rail arranged above the table top and between the turn-tables and adapted to

effect a shifting transversely without rotation of a ball rolled under compression by the advancing belt longitudinally upon the table top.

4. The method herein described of smoothing a newly applied cover upon a compressible playing ball which consists in rolling the covered ball when under compression along successive circumferential bands of compression, the successive bands coming to coincidence at two polar points, and at the equatorial line between such polar points extending edge to edge and covering the entire circumference.

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