Sept. 15, 1931. O. WITTEL 1,823,243

METHOD AND APPARATUS FOR LAPPING COLOR FILM EMBOSSING ROLLERS

Filed Oct. 29, 1928

FIG. 1.

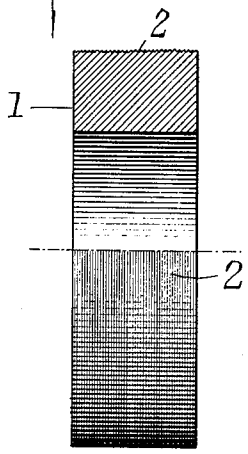


FIG. 2.

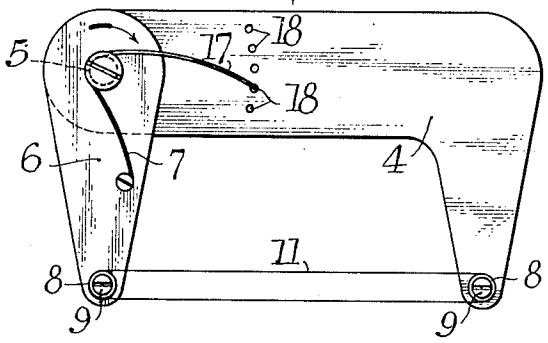


FIG. 3.

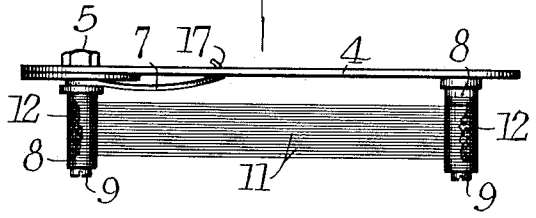


FIG. 4.

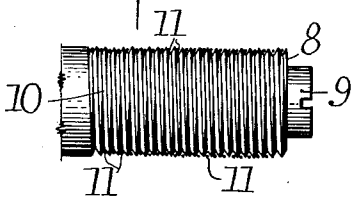


FIG. 5.

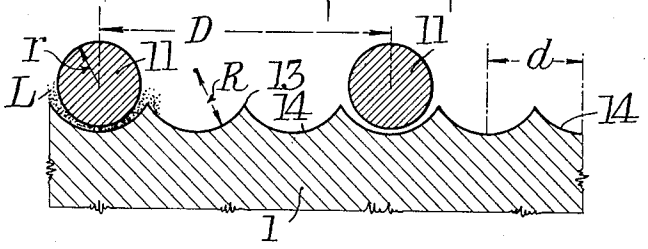


FIG. 6.

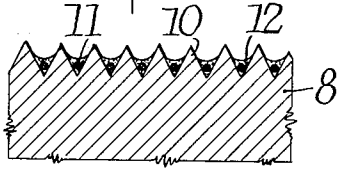


FIG. 7.

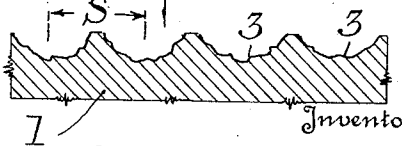
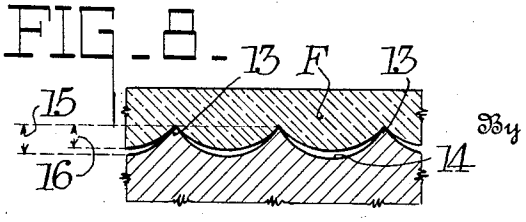


FIG. 8.



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR LAPPING COLOR FILM EMBOSSING ROLLERS

Application filed October 29, 1928. Serial No. 315,771.

This invention relates to lapping minute grooves or serrations on rollers for embossing film for color motion pictures. One object of my invention is to provide a method of obtaining a series of exceedingly small grooves in a roller which are of similar shape, dimensions, and which have a highly polished surface. Another object is to provide a lapping tool with which such grooves may be made. Another object is to provide a wire lapping tool on which wires are provided for the lapping operation and which are held under spring tension. Another object is to provide a wire-holding means which is constructed to hold each wire accurately in a predetermined position, and other objects will appear from the following specification, the novel features being particularly pointed out in the claims at the end thereof.

Coming now to the drawings, wherein like reference characters denote like parts through,—

Fig. 1 is a view partly in elevation and partly in section of a film embossing roller constructed by the method and with the apparatus made in accordance with my invention;

Fig. 2 is a side elevation of a lapping tool constructed in accordance with a preferred embodiment of my invention;

Fig. 3 is a top plan view of the lapping tool shown in Fig. 2;

Fig. 4 is an enlarged side elevation of one of the wire-holding posts of the lapping tool;

Fig. 5 is a highly magnified fragmentary sectional detail illustrating the action of the lapping wires upon the embossing roller;

Fig. 6 is an enlarged sectional view through a portion of a wire-holding post;

Fig. 7 is a fragmentary detail showing the surface of a cylinder having the preliminary etched or cut grooves therein; and

Fig. 8 is an enlarged fragmentary detail indicating a possible relation between a film being embossed and an embossing roller constructed in accordance with my invention.

In certain systems of color photography the film is embossed with a plurality of extremely fine lenticular areas and these areas may be made by embossing the film with a roller which has grooved or serrated periphery. The lenticular areas or elements formed in the film are extremely minute as, for instance, in a preferred type of film the distance across these elements may be from .0015 to .002 of an inch. It is to be understood, of course, that these dimensions may vary considerably, but the lenticular elements are always extremely small.

In order to provide an embossing roller for the film, with very sharp points which will press into the film when rolled upon it under pressure, I have provided a method and apparatus which will now be fully described.

It is to be understood that my method and apparatus may be used in making a completed cylinder which may be used directly to roll the lenticular elements into the film, or it may be used for making a tool which is used to transfer an impression to a second tool, which later is used to make a final film embossing roller. It is sometimes preferable to make the roller through a series of steps, because when this is done, in making the two preliminary tools, it is easier to make the first tool comparatively small in width, the second somewhat larger, and the third film embossing roller can readily be made of considerably greater dimensions than either of the tools used in making it. This system forms no part of my invention.

As shown in Figure 1, a grooved embossing cylinder may consist of an annular member 1, having a plurality of very fine grooves 2, formed in its surface. Because of the extremely small size of these grooves, the drawing is nowhere near to scale. A cylinder 1 is first made with a smooth, accurately ground and polished, outside periphery which may be then covered with a resist, such as wax, and a fine line scratched through the wax, after which the cylinder is etched, leaving more or less irregular grooves, as indicated at 3 in Figure 7. Instead of etching, these grooves may be cut upon a lathe, but, in any event, the grooves are not of either the proper size or width. The spacing between the centers of grooves indicated at S in Fig-

ure 7 should be the width which is desired between the final grooves in the roller. This may be, say, .0018 of an inch.

With the roller grooved by etching or cutting, as above described, the grooves are made perfect in shape and the points between the grooves are sharpened by means of a lapping operation and with a lapping tool which will now be described.

As indicated at Figure 2, the lapping tool may comprise an L-shaped member 4, to which there is pivoted at 5 an arm 6, which is pressed about the pivotal point in the direction indicated by the arrow by means of a spring 7. Each of these members,—that is, members 4 and 6, carry wire-holding posts 8. These posts may be held by screws 9 on their respective mounts and, as indicated in Figure 4, are preferably provided with a thread 10 about which the wires 11 are wound. Around portions of the threads 10, after they have been wrapped with wires 11, there is placed a section of shellac or varnish 12 which, as indicated in Figure 6, cements and holds the various wires in the bottom of the threads 10.

The L-shaped member 4 and the hinged member 6, with the posts 8, constitute a spring support for the wires 11. By placing an end 17 of the spring in different apertures 18, the desired tension can be maintained.

Since it is very difficult to cut a thread having as small a pitch as .0018, as would be required for lapping the grooved cylinder of Figure 7, I preferably provide the thread 10 of a pitch considerably greater than .0018, but of a multiple thereof. For instance, there may be one thread 10 for every four grooves on the roller, so that with the lapping wires spaced as shown in Figure 6, each wire would tend to polish every fourth groove in the roller and by moving the lapping tool gradually up and down the surface of the cylinder, all of the grooves will finally be shaped and polished.

The size of the wires relative to the grooves is also important. Referring to Figure 5, if the final spacing of the grooves indicated at *d* is desired to be .0018, the radii of curvature R may be the same dimension as the spacing and if this is so, the radius of the lapping wires *r* should be slightly less than the radius of the grooves, in this case, *r* being .0015. This difference in the radii permits a certain amount of lapping compound L to lie between the lapping wires and the grooves.

The first of the lapping operation is performed with very fine emery water and the final polishing is performed with rouge. The lapping operation with a steel cylinder of comparatively small dimensions, such as, for instance, approximately the width of a 16 mm. motion picture film, may take from eight to sixteen hours.

During this time the wires 11, which, of course, are very small, may wear out and break. A careful operator runs the lapping tool slowly up and down so that different parts of the wires are brought in contact with the rotating cylinder. Should certain wires break, these wires may be pulled off, the shellac 12 holding the remaining wires in place.

After a number of the wires become broken, a new lapping tool may be readily prepared by dissolving off the shellac and wrapping the threads with wire 11 and then applying fresh varnish.

It should be especially noticed that the spring 7 exerts a comparatively light tension upon the wire 11 and this not only tends to hold the wire taut, but it prevents the operator from applying too great pressure upon the wires during the lapping operation.

The method which I have just described for polishing minute grooves in cylinders provides grooves having accurate radii of curvature and is especially useful in that regular sharp points 13, as shown in Figure 5, separate the smooth curved walls 14 from each other.

Attention is directed to the fact that in embossing film it is believed that the film does not entirely touch the surface 14 of the grooves. Obviously, where the dimensions are so small, it is very difficult to say whether or not this is true. But I believe the film acts, as indicated in Figure 8, while being rolled,—that is, the curvature of the film is somewhat less than the curvature of the groove. Measurements under a microscope indicate that where the total depth of the groove, as indicated at 15, is, for instance, .0005 of an inch, the total height indicated at 16 of the film embossings may be .0004 of an inch.

I am not prepared to say that the film does not actually contact with the surface 14 and then after the rolling operation is over spring back the .0001 of an inch of a difference.

However, it is well known that in order to retain a most perfect polish, a cellulosic film can only contact with a highly polished surface, for if it is brought in contact with a slightly matte or roughened surface, this surface will be imparted to the film. With the method and apparatus described in this application, the film lenticular elements have a highly polished, perfectly satisfactory surface for producing the minute images on the emulsion side of the film.

I believe that it is only necessary in order to produce accurate, minute, lenticular elements on a film band to provide a row of sharp projections 13, which are regularly spaced. If these points are sufficiently strong, it is not material how deep the groove 14 lying between the points may be. However, the film is rolled on these projections under considerable pressure and because of

the extremely minute size of the projections, these are liable to break or to become distorted.

With the lapping operation, as above described, the points 13 are sharp and yet the ridges are comparatively thick through the base, so that injury to these ridges is not liable to result. Moreover, as I have lapped and highly polished the entire surface of the grooves 14 with rouge, these rollers have a mirror-like finish which could impart a perfect surface to the film if it is actually pressed into contact with the entire surface of the groove, as may be the case.

The fine wires 11 are preferably of soft copper, since this material readily takes up a certain amount of the lapping compound. However, I do not wish to be limited to any particular metal as obviously other materials would be entirely satisfactory.

The annular member 1 is preferably made of cold-rolled steel, as this metal can be readily worked in the manner described above, and as it is sufficiently hard to stand up under the necessary pressure used in embossing the film. However, it is obvious that other grades of steel or other metal can be used if desired. The periphery of the member 1,—that is, the grooved face 2, can be protected from rusting, if desired, with a very thin layer of plating chromium, but this may be omitted if care is taken in using the roller to prevent rust.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A method of lapping lenticular film embossing rollers which comprises providing a cylinder with a plurality of fine guide lines, turning said cylinder, and lapping with a plurality of wires, a fine lapping compound being used on the cylinder.

2. A method of lapping lenticular film embossing rollers which comprises providing a cylinder with a plurality of fine guide lines, turning said cylinder and moving wires under tension over the rotating cylinder, the wires being positioned by the guide lines, and applying a very fine lapping compound between the wires and cylinder.

3. A method of lapping lenticular film embossing rollers which comprises providing a cylinder with a plurality of fine guide grooves breaking the surface of the cylinder, lapping said grooves with a lapping compound and with wires of slightly less diameter than the grooves to be made in the cylinder, and continuing the lapping operation until the grooves are enlarged to the desired size, said operation also polishing the grooves in the periphery of the cylinder.

4. A method of lapping lenticular film embossing rollers which comprises providing a cylinder with a plurality of fine guiding grooves, and enlarging said grooves by lapping with a plurality of fine wires, said wires being spaced at greater distances from each other than the guiding grooves.

5. A method of lapping lenticular film embossing rollers which comprises providing a cylinder with a plurality of fine guiding grooves, and enlarging said grooves by lapping with a plurality of fine wires, said wires being spaced at greater distances from each other than the guiding grooves, said spacing being multiples of the spacing of the guiding grooves.

Signed at Rochester, New York, this 22nd day of October 1928.

OTTO WITTEL.