

April 15, 1958

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2,830,735

TUBE-COMPRESSING DEVICE

Filed Jan. 13, 1954

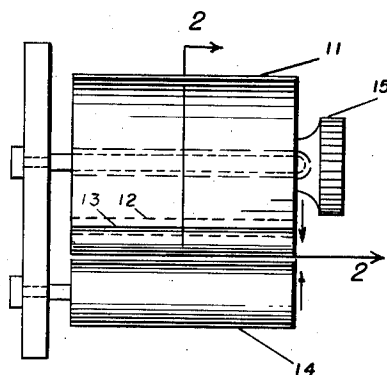


FIG. 1

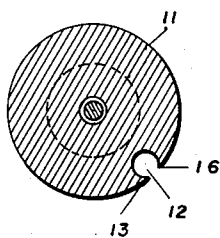


FIG. 2

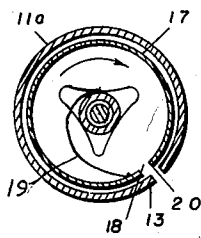


FIG. 3

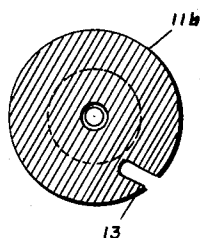


FIG. 4

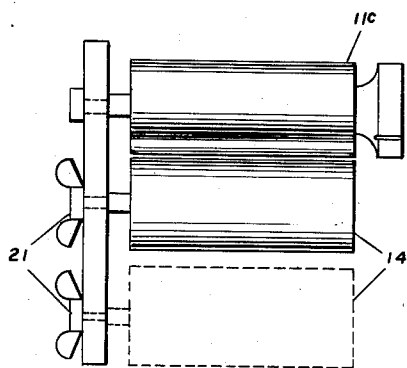


FIG. 5

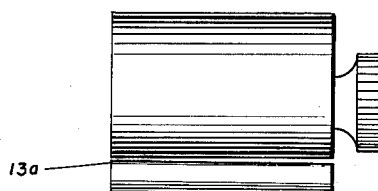


FIG. 6

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TUBE-COMPRESSING DEVICE

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Application January 13, 1954, Serial No. 403,737

1 Claim. (Cl. 222—102)

This invention relates to a new and improved apparatus for expelling the contents of containers of the collapsible tube variety.

Many varied types of apparatus for expelling or removing the contents of such tubes have been described and suggested at various times in the past. While generally operable in more or less satisfactory degrees, the various devices heretofore proposed have suffered from a variety of disadvantages. Among these disadvantages may be mentioned the following typical ones:

In some of the prior art devices the tube has been compressed progressively between a pair of rolls, and driven between the rolls by the force of frictional engagement between the rolls and the walls of the tube. This type is disadvantageous in that the frictional force is not always sufficient to prevent slippage, especially on glossy-painted tubes, or when the pasty contents of the tube is especially viscous and stiff. This difficulty has been overcome in some adaptations by providing a knurled or other uneven surface on the rollers, but this type of roll tends to leave pockets in the tube, so that it is not completely emptied, and more important, has a pronounced tendency to tear the tube open, thus defeating the whole purpose of the operation.

Other prior art devices also provided compression members in the form of rolls or the like, coupled with traction means of various kinds designed to clamp on the bottom end of the tube and pull it between the rolls or other compression members. This class of devices represents an improvement over those of the type first mentioned, but were in general of such construction that the tension created in operation tended to pull the conventional channel-shaped closure member off the bottom of the tube, with generally disastrous consequences. In addition, devices of this type were ordinarily of a construction which made removal of the empty tube a rather inconvenient operation involving the return of the tube at the end of the cycle to its original starting position by reversing the operations used to empty the tube.

A third type of device in common use was the "key" type. This was perhaps the least desirable of all the prior devices, but is noted here because it bears certain superficial similarities to the device of the present invention, and for the purpose of illustrating the distinguishing features, which are hereinafter pointed out.

In the key-type apparatus, a slotted spindle or "key" is provided, which is adapted to receive the bottom end of the tube to be emptied, by inserting said end in the slot provided. The tube is then emptied by winding it up upon itself, using the key as an axis and torsion transmitter. The most serious disadvantages of this apparatus were two; in the first place, each successive revolution of the tube introduced its own share of irregularity and distortion, with the result that the tube was left in a lumpy, twisted condition, and only partially evacuated. In the second place, the whole tube had to

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be unwound and straightened out again before the device could be reused.

These difficulties, or some of them, were formerly of little significance, since the tubes were used in connection with inexpensive materials, or with materials used only on a small scale, or for other reasons complete evacuation of the tube and speed and efficiency of the apparatus were not of particular importance.

In recent years, however, the use of collapsible tubes has undergone considerable development, and one of the most commercially important aspects of this development is the practice of filling the tubes with precisely measured quantities of material. An example of the application of this method is in the paint industry. The paint dealer is now supplied with a base stock of white paint and an assortment of tubes containing measured quantities of oil colors. Upon receipt of an order for a given color, he then is able to select the proper size tube of the appropriate oil color, empty it completely into a specified quantity of the base stock, and mix, to achieve a precise and reproducible colored paint. The advantages of such a system are enormous as to the savings in storage space and inventory investment over the old system of stocking a complete supply of ready-to-use paint in all shades. This development has, however, created a definite need for a simple positively-acting device which will empty the color tube substantially quantitatively.

It is therefore an object of this invention to provide an improved apparatus for emptying collapsible tubes. A further object is to provide a device which will empty such tubes of substantially their entire contents. Another object is to provide such a device, which will not tear or distort the tube in use. An additional object is to provide a tube-collapsing device of improved simplicity and efficiency in operation. These and other objects will become apparent as this invention is hereinafter more fully described and claimed.

In its broader aspects, this invention contemplates a tube-compressing device of the type comprising a traction roll having a slot adapted to receive the bottom closure of a conventional collapsible tube, and a compression roll associated with said traction roll in operative relation to compress said tube between the two said rolls, wherein said slot is provided with an undercut lip operative to hinder the radial egress of said bottom closure from said slot. This invention further contemplates a device of the type just described wherein said traction roll is of such large circumference that said tube may be stretched thereon without substantial overlapping.

In a particularly desirable embodiment, this invention contemplates a tube-compressing device of the type just described wherein said undercut lip cooperates with another lip to define a constricted slot, said constriction being sufficiently narrow to prevent the radial egress of the bottom closure member of the collapsible tube.

Obviously, the roll will vary in size depending on the range of tube sizes contemplated for use therewith, so that the specific dimensions will vary. However, the tubes generally used for containing oil colors for paint-making according to the system above described are typical and may be taken as illustrative. These tubes are in general from 2 to 8 inches long, and from 1 to 4 inches wide when collapsed, and are provided with a channel-shaped clamp serving as a bottom closure member, which is ordinarily from about $\frac{1}{16}$ to $\frac{1}{8}$ inch thick when clamped over the end of the tube.

For tubes of this particular type, therefore, the circumference of the traction roll should be at least 2 and preferably 8 inches, so as to accommodate the various lengths of tube without overlapping on the roll. The traction may be larger of course, if desired, but such is not

ordinarily preferred since it merely adds to the weight and bulk of the device, except where larger tubes than those mentioned are to be employed. Similarly, where the preferred form of this device, embodying the constricted slot, is employed, the constriction must naturally be wide enough to accommodate the double thickness of the collapsed tube (ordinarily only a few thousandths of an inch), but should be narrower than the overall thickness of the bottom closure member, i. e. less than $\frac{1}{8}$ and preferably less than $\frac{1}{16}$ inch.

The compression roll may be of any convenient diameter, but in practice is preferably small compared with the traction roll, simply because this provides a more compact assemblage.

For greatest convenience in operation, it is preferred that the rolls, or at least the traction roll, be axially removable from the spindles on which they are mounted. This makes the device somewhat easier to load, and much easier to unload, since it eliminates the necessity of unwinding the tube from the roll and instead, enables the tube to be removed by simply pulling the traction roll off its spindle, thus releasing the tension on the tube. With the tension relaxed the tube will fall off the traction roll or may easily be removed therefrom by sliding the closure member out of the slot. This construction ordinarily requires that the rolls be supported at one end only, as shown in the drawings.

The preferred clearance between the rolls is ordinarily about from 0.010 to 0.020 inch, since this clearance gives substantially complete evacuation of the tube without creating undue tension, when tubes of conventional wall thickness are used.

A particularly helpful feature of the present invention, in practice, is the fact that the tube is snubbed or stretched over the undercut lip of the slot and the bottom end of the tube is thus provided with a secondary seal, while a portion of the traction load on the clamp is transferred to that portion of the tube itself which overlies the lip. This overcomes certain disadvantages of many of the prior art devices. Specifically, where a lump of hard material in the tube or outside it, or unevenness in the walls of the tube or of the roller or any similar agency prevented complete evacuation of the tube, leaving pockets of residual material in the theoretically evacuated lower portion, the fluid pressure in the forward end was sometimes transmitted to the rear or bottom end of the tube and to the closure itself, causing leakage. With the device of the present invention, however, this backpressure tends to be absorbed by the snubbed portion of the tube wall, rather than acting on the closure.

Moreover, in many prior devices, the whole traction force on the lower end of the tube was absorbed by clamping means of one form or another acting directly on the closure member, with the result that the closure member was sometimes pulled off the end of the tube, resulting in a thoroughly troublesome state of affairs. In the present invention, a considerable portion of the traction force acts upon the snubbed portion of the tube wall itself, greatly diminishing the likelihood of pulling off the closure member.

Referring now to the figures,

Fig. 1 is a front view of the device of this invention ("front" being understood to mean the direction from which the tube is inserted and toward which the contents thereof are delivered).

Fig. 2 is a cross-section along line 2—2 of Fig. 1, showing the preferred type of slot arrangement.

Fig. 3 shows, in cross-section, an alternative type of slot arrangement comprising two concentric slotted cylinders, with resiliently acting means urging them to a relative position wherein the slots fail to coincide.

Fig. 4 is a cross-section similar to Fig. 2, showing another alternative form of slot arrangement, whereby the tube closure may be removed in a generally radial direction after relaxing the traction force.

Fig. 5 illustrates a variation of the device of Fig. 1, wherein the compression roll axis is adjustable with reference to its distance from the traction roll axis, so that traction rolls of various sizes may be employed.

Fig. 6 is a partial view similar to Fig. 1, showing another modified form of slot.

In operating the device, the bottom closure member of the tube (not shown) is inserted in the slot 12 of traction roll 11, and the traction roll is rotated, for example by means of knurled knob 15, so that the slot, and the tube following it are caused to pass under compression roll 14, as indicated by the arrows in Fig. 1. In Fig. 1, as also in the other figures, 13 is the undercut lip across which the lower portion of the tube wall is snubbed.

Fig. 2 illustrates the preferred form of slot, the distance between lips 13 and 16 being less than the overall thickness of a conventional tube closure.

Fig. 3, the inner concentric roll 17 of this modification has slot 18, and resilient means such as spring 19, to urge the inner cylinder in the direction shown by the arrow, causing lip 20 to snub the tube across lip 13.

In Fig. 5, a smaller interchangeable traction roll is shown as 11c, and compression roll 14 is mounted on adjustable mounting means, such as the wing-nut assembly at 21.

Fig. 6 is a partial view similar to Fig. 1, showing a modified form of traction roll wherein a slot of the constricted type is provided, and the constriction is tapered to permit easier insertion of the tube closure at the less constricted outer end, while still providing adequate constriction, particularly at the more constricted inner end, to control passage of the closure member of the smallest size tube contemplated. The taper is shown here in somewhat exaggerated fashion, the preferred taper being of the order of 0.005 inch difference between the widest and narrowest portions of the constriction.

While this invention has been described with reference to certain embodiments and illustrated in certain specific forms, these are to be understood as illustrative only, and this invention is not to be limited, except as set forth in the appended claim.

I claim:

A tube-compressing device of the type comprising a traction roll having a slot adapted to receive the bottom closure member of a conventional collapsible tube, and a compression roll associated with said traction roll in operative relation to compress said tube between the two said rolls, wherein said slot is provided with an undercut lip operative to hinder radial egress of said bottom closure from said slot, said undercut lip cooperating with another lip to define a constricted slot, said constriction being sufficiently narrow to prevent radial egress of the bottom closure member of said tube, said constricted slot being tapered to provide a greater degree of constriction at one end than at the other end of said slot.

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