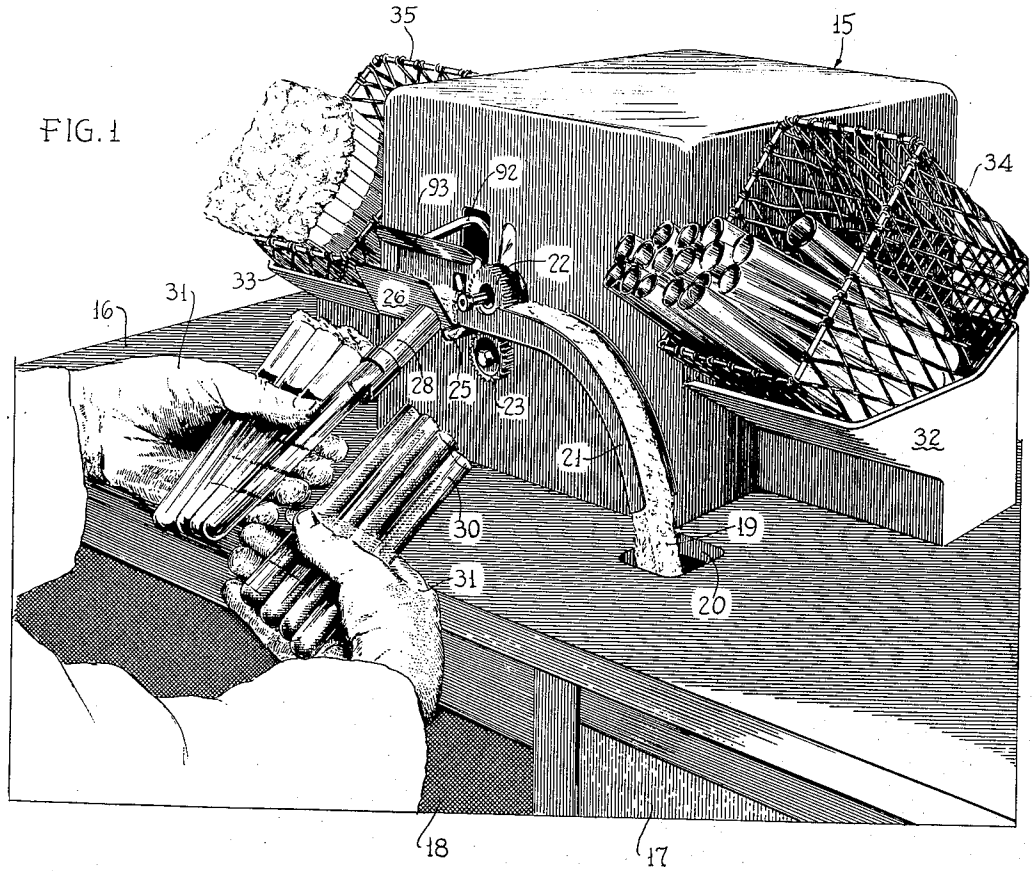
Oct. 2, 1956 J. A. HARRISON ET AL 2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

Filed Feb. 23, 1949

5 Sheets-Sheet 1

FIG. 1



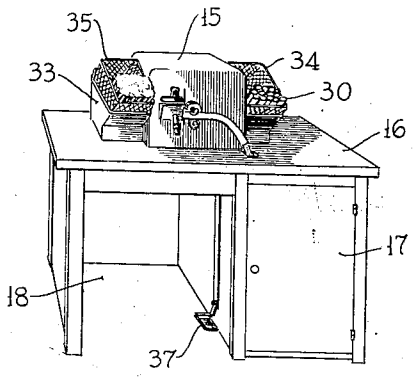


FIG. 2

INVENTORS.
James A. Harrison
Michael Troisi.

BY
Karl L. Schiff
their Agent

Oct. 2, 1956 J. A. HARRISON ET AL 2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

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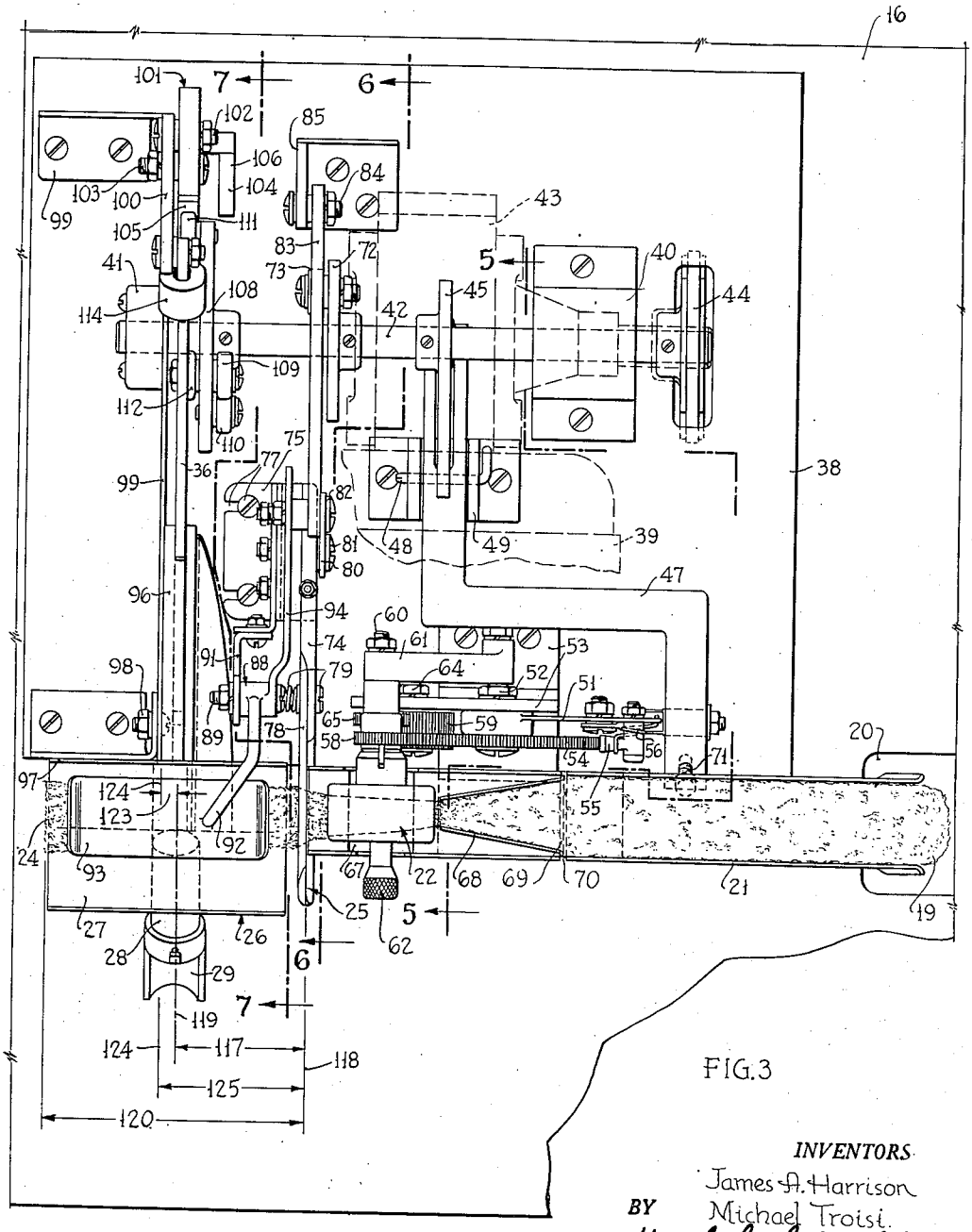


FIG. 3

INVENTORS
James A. Harrison
Michael Troisi.
BY
Karl L. Schiff
their Agent

Oct. 2, 1956 J. A. HARRISON ET AL 2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

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FIG. 4

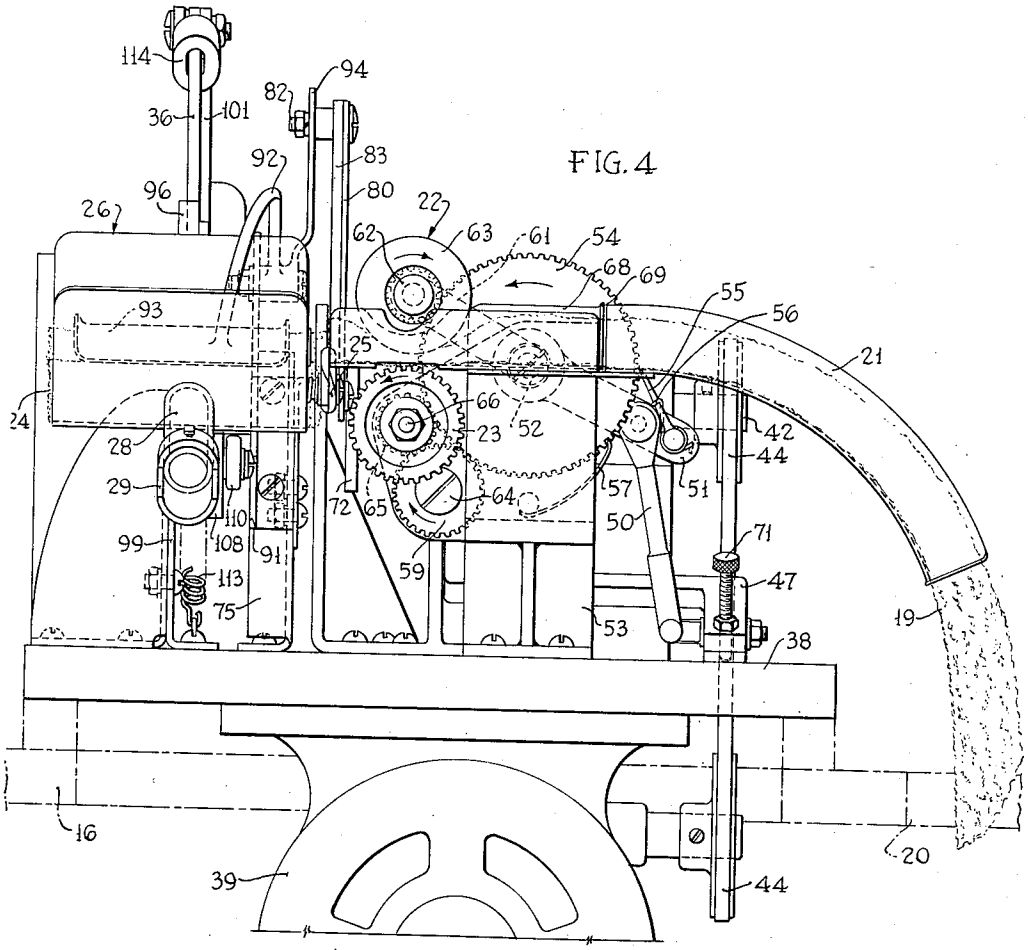
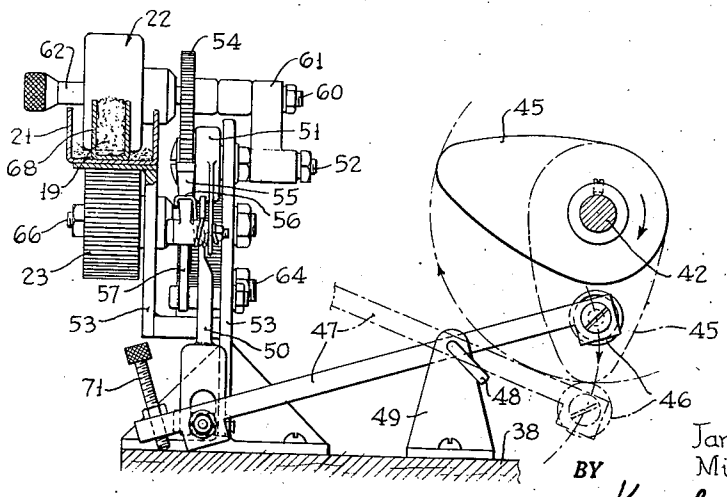


FIG. 5



INVENTORS
James A. Harrison
Michael Troisi
BY
Karl L. Schiff
their Agent

Oct. 2, 1956 J. A. HARRISON ET AL 2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

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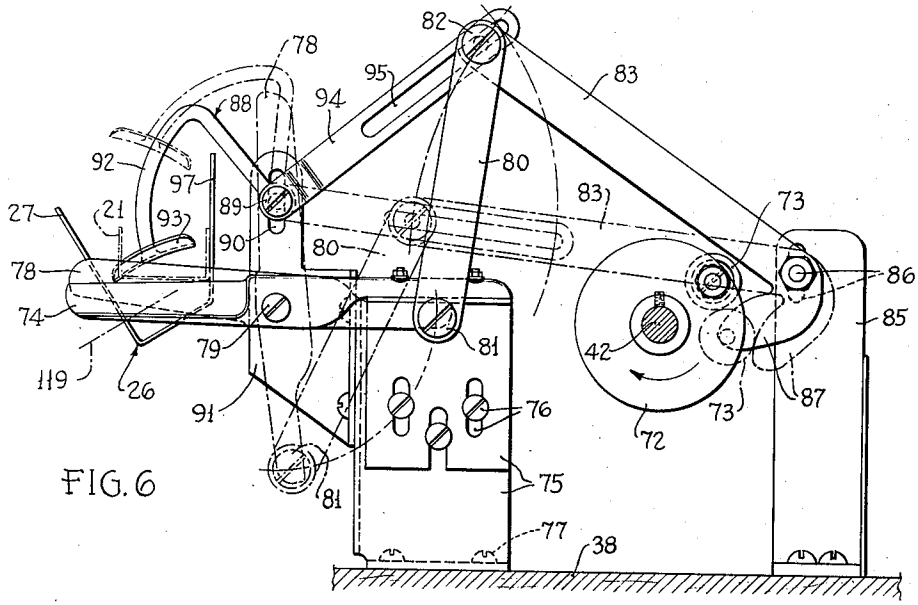


FIG. 6

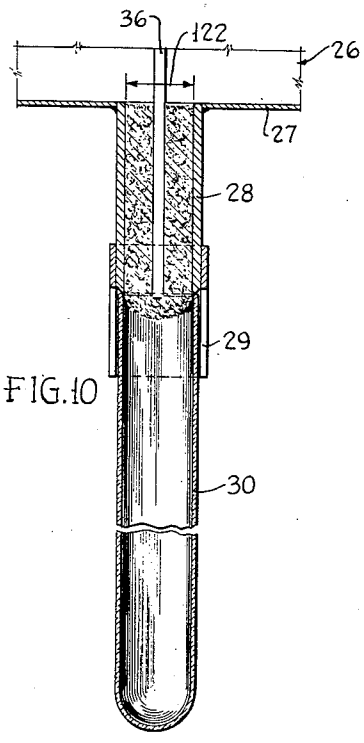


FIG. 10

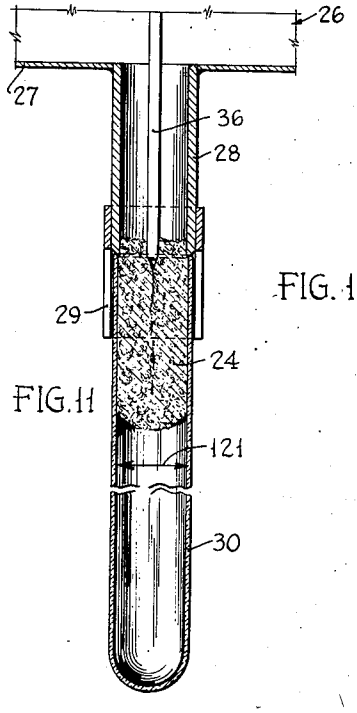


FIG. 11

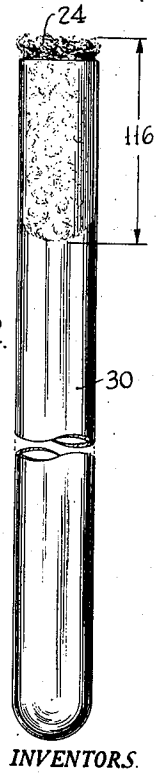


FIG. 12

INVENTORS.
James A. Harrison
Michael Troisi
BY
Karl L. Schiff
their Agent

Oct. 2, 1956 J. A. HARRISON ET AL 2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

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FIG. 7

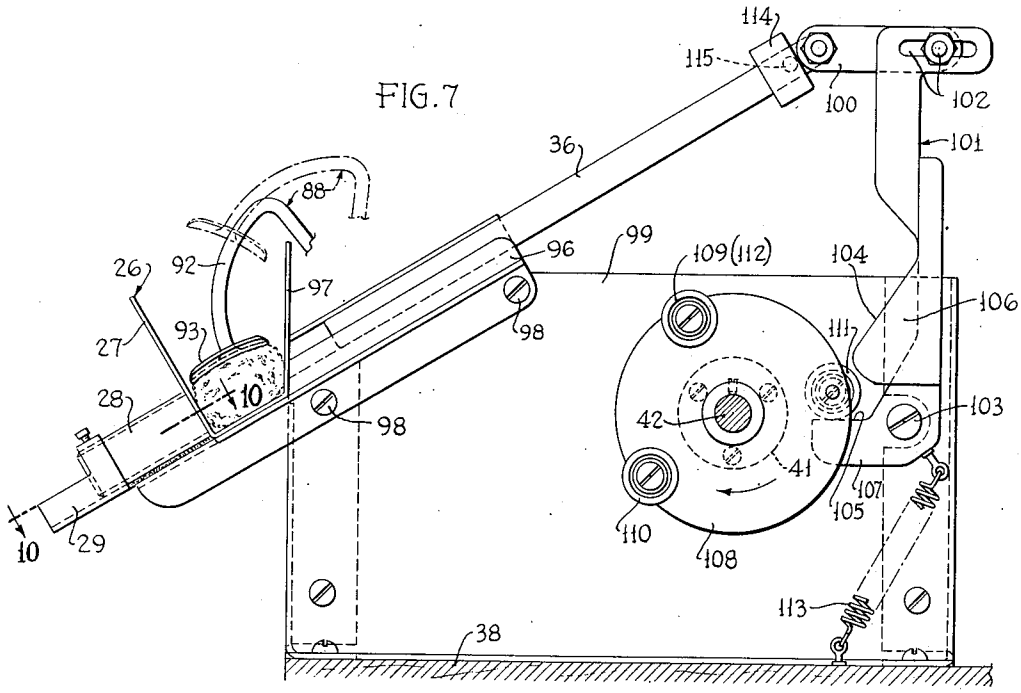


FIG. 9

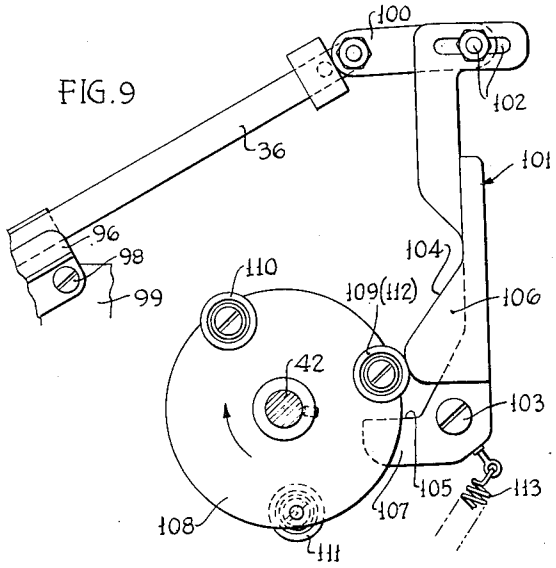
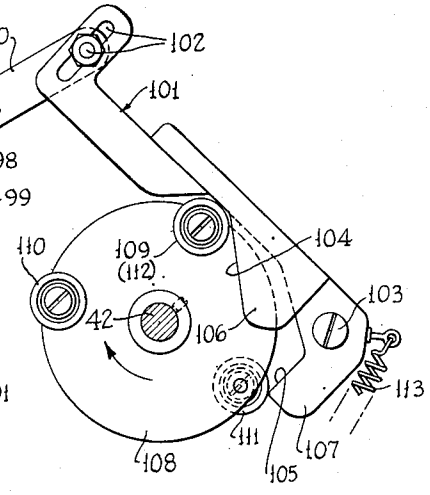


FIG. 8



INVENTORS
James A. Harrison
Michael Troisi
BY Karl L. Schiff
their Agent

United States Patent Office 2,764,860 Patented Oct. 2, 1956

2,764,860

PLUG FOR TEST TUBES AND THE LIKE, AND METHOD AND MACHINE FOR MAKING AND INSERTING PLUGS

James A. Harrison and Michael Troisi, Philadelphia, Pa.

Application February 23, 1949, Serial No. 77,884

9 Claims. (Cl. 53—41)

The invention relates to the art of closing vessels by plugs or stoppers which are held in and partly project outwardly beyond the outlet of the vessel. The invention relates more particularly to the closing by fibrous stoppers of test tubes and other analogous vessels used in large numbers for clinical examinations, scientific research and other purposes.

The object of the invention is to overcome the inadequacies of the known fibrous stoppers or plugs and of the known method of making such stoppers and inserting them into vessels.

The closing of test tubes and the like by fibrous plugs is customarily done by cutting or tearing an about rectangular strip out of a wide thin sheet of absorbent cotton, by doubling the strip through folding its longer marginal portions toward each other, by rolling the double-layer strip rather tightly into a cylindrical plug, and by pushing the plug into the open end of a test tube or other vessel. It requires great skill, dexterity and experience for obtaining by this manual procedure plugs that fit with the right pressure into the ends of vessels of a given type. Even exceptionally well trained and fast workers cannot overcome the limitations of this inherently slow procedure. Manual closing of 400 to 500 test tubes per hour by one person may be considered about top speed, while an ordinary laboratory technician will only accomplish the closing of about 300 to 350 tubes per hour. In short, the customary method of closing test tubes with fibrous plugs is expensive and takes much valuable time of scientists and their helpers.

This situation is greatly improved by the invention, which provides a novel type of fibrous plug and a novel method and means of making and inserting plugs, whereby even an unskilled person may satisfactorily plug test tubes and the like at a speed many times greater than the top speed attainable with the manual system.

The new plug or stopper is formed by folding a piece of sliver, such as cotton roving, rayon or other sliver of a weight per yard and a density adapted to the inner diameter of the outlet of the vessel to be closed. As sliver is obtainable of great uniformity in texture and dimension throughout its length, the new plugs are very uniform too, irrespective of the skill and care of the person making and inserting them.

It should be kept in mind that the plugs in question should be held with such resilient pressure in a test tube that the latter with its contents may be lifted gently by gripping the projecting end of the plug. On the other hand, the plug should be loose enough that the tube will slide off when it is lifted by the plug and lightly shaken up and down. This loose fit, as well as the ability of the plug to maintain its shape, is important for the often necessary, subsequent removal and reinsertion of the plug. The new plug has all these necessary qualities.

A preferred form of the new plug has two longitudinally adjoining halves of a short length of sliver folded upon each other. The plug so formed is inserted with the bent portion first so that its major portion is within

the prismatic, mostly cylindrical outlet or neck of the vessel while a short portion projects outwardly to permit the convenient withdrawal of the plug.

The new method of closing comprises the steps of folding a piece of sliver or the like over one end of a rod, of pushing said piece by means of the rod into the vessel to be closed or into a form tube in front of the vessel, and of pulling the rod out of the plug so formed.

The new device comprises means, such as the rod and form tube described in the preceding paragraph, for folding the sliver and for introducing it into the vessels. The new device comprises preferably also means for advancing and severing predetermined lengths of sliver, and means for operating in proper synchronism the advancing, severing, folding and inserting means.

A complete understanding of all the objects, features and advantages of the invention, of which so far only a brief general outline has been given, will be gained from the example illustrated in the attached drawing and described hereinafter.

In the drawings:

Figure 1 is a fragmentary perspective and somewhat diagrammatic picture of the machine partly enclosed by a cover, the top of a cabinet supporting it, the hands of a person operating the machine, and of supplies of closed and unclosed test tubes;

Figure 2 is a complete perspective, likewise somewhat diagrammatic, three-quarter front elevation of the same machine and its supporting cabinet, on a smaller scale;

Figure 3 is a plan view of the machine without the cover shown in Figures 1 and 2, at a larger scale;

Figure 4 is the front elevation to Figure 3;

Figure 5 is a sectional view and side elevation of the sliver-advancing mechanism, the section being taken along line 5—5 of Figure 3;

Figure 6 is a side elevation and sectional view of the sliver-severing and hold-down device, the section being taken substantially along line 6—6 of Figure 3;

Figure 7 is a sectional view and side elevation of the forming and inserting mechanism for the plugs, the section being taken along line 7—7 of Figure 3;

Figures 8 and 9 are fragmentary views corresponding to the right upper part of Figure 7 showing the mechanism in different typical positions;

Figure 10 is a fragmentary section in the plane of line 10—10 of Figure 7 through the form tube of the machine and through a test tube in front of the form tube showing the forming and inserting tool and a plug in the position corresponding to the position of the driving mechanism illustrated in Figure 8;

Figure 11 is a section corresponding to Figure 10 but showing the positions of the parts at the completion of the insertion of the plug; and

Figure 12 is a picture of a test tube with a plug inserted therein.

The understanding of the details of the machine will be facilitated by preceding their description with a brief outline of the most important elements and functions of the machine.

Figures 1 and 2 show the hood-encased machine proper 15 supported on the top 16 of a desk having a compartment 17 and a kneehole 18. Compartment 17 houses a supply of sliver (not shown). The leading end 19 of the sliver passes through hole 20 in top 16 into a channel 21 and is gripped between a pair of metering pinch rolls 22, 23 which intermittently advance equal, short lengths or pieces 24 of the sliver. The pieces 24 are cut off by scissors or other severing means 25 and dropped into a short channel 26. Front wall 27 of channel 26 carries a short downwardly inclined form tube 28 opening into the interior of the channel and having on its outer end a support 29 for a test tube 30 to be closed.

The operator of the machine holds in each hand 31 a number of test tubes 30, Figure 1, and places one tube at a time on support 29 of form tube 28. The relative arrangement of form tube 28 and top 16 of the desk as well as the height of the latter are such as to allow the operator to rest his hands 31 on top 16. On each side of the machine 15 is an easel 32, 33 for carrying a container, such as a wire basket 34, 35, the one basket 34 for the reception of test tubes to be closed, and the other 35 for tubes that were just closed by the machine.

A rod 36 guided for reciprocating movement in the axial direction of form tube 28 pushes a severed sliver piece 24 into form tube 28 while folding it over the end of the rod, as shown in Figure 10. Rod 36 is then retracted, leaving the doubled-up piece 24 in form tube 28, and is at once moved outwardly again whereby it pushes piece 24, which may now be called a plug, out of form tube 28 into a test tube 30, as shown in Figure 11. This completes the plugging of a tube 30 which now with its plug 24 is taken off and presents the appearance shown in Figure 12.

As will become apparent from the following description of the details of the machine and of its operation, the entire briefly outlined procedure is automatic, except for the handling of the test tubes, and the cycle of steps is repeated as long as the operator depresses control switch 37 with his foot.

All elements of the machine are mounted on a chassis plate 38 which is supported at appropriate height on top 16 of the cabinet. Plate 38 carries on its underside an electric motor 39 and on its top in bearings 40, 41 a main shaft 42 driven by the motor over speed reduction gear 43 and belt drive 44. The directions of rotation of the shaft and of the parts driven thereby and now to be described, are indicated by arrows throughout the drawing.

The metering rolls 22, 23 for advancing sliver 19 are driven by a cam 45 which is secured to shaft 42. Once during each revolution of shaft 42, cam 45 engages a roller 46 carried on the inner end of a double-armed lever 47 which is fulcrumed at 48 on bracket 49. A link 50 has its ends journalled respectively to the outer end of lever 47 and to a second lever 51 which is supported rotatably about a pivot pin 52 on bracket 53. Pin 52 also carries a spur gear 54 which is engaged by a pawl or ratchet 55, the latter mounted on the end of lever 51 and biased by spring 56 so as to be held against gear 54. Upward movement of lever 51 causes counterclockwise rotation of gear 54 while, during downward movement of lever 51, pawl 55 merely ratches over the teeth of gear 54, the clockwise rotation of gear 54 being prevented by a spring ratchet 57 mounted on bracket 53.

Gear 54 meshes with pinions 58, 59. Pinion 58 is rotatable about pivot pin 60 carried on one end of a lever 61 the other end of which is swingably supported by pivot pin 52 of gear 54. Pinion 58 is coupled with the beforementioned pinch roll 22. A handle 62 at the end of pin 60 permits roll 22 with its pinion 58 to be swung upwardly about pin 52 for the purpose of inserting or removing the sliver 19. The weight of roll 22, pinion 58, pin 60 and lever 61 holds these members in the position shown in Figures 1, 3, 4 and 5, in which roll 22 operatively engages sliver 19. Roll 22 is shown as being covered with a sleeve 63 of rubber or other material for frictional engagement with the sliver 19.

The other pinion 59 engaged by gear 54 is supported by a stationary pivot pin 64 and meshes with a second pinion 65 carried by a stationary pin 66. Pinion 65 is connected with lower pinch roll 23 which projects through a hole 67 in the bottom of channel 21.

Upon each upward movement of lever 51 with its pawl 55, the pinch rolls 22, 23 are rotated by gear 54 and pinions 58 and 59, 65, respectively, thereby feeding a sliver piece 24 of predetermined length toward the left of Figures 1 to 4. A funnel-like channel insert 68 serves for compressing the incoming sliver and for leading it to the mid region of the pinch rolls 22, 23. This insert 68 is removably held by flanges 69 in slots 70 of the walls of channel 21. For different types of sliver, different sizes of inserts 68 are preferably employed.

The amount of each sliver advance and, consequently, the length of each piece 24, is adjustable by screw 71 threaded into the forward end of lever 47 and engaging the top of plate 38. This screw limits the return movement of lever 47 and thereby the amount of movement imparted to the lever by cam 45 which in turn determines the angle of rotation of gear 54 and of the pinions driving the pinch or metering rolls 22, 23.

The scissors 25 for severing sliver piece 24 are operated by a disc 72 secured to the motor-driven shaft 42 and carrying a cam roller 73. The one, lower blade 74 of the scissors is horizontally mounted on a bracket 75 which by slot and screw connections 76, 77 is adjustable in vertical and transverse direction relative to chassis plate 38 and, consequently, relative to the delivery end of channel 21. Incidentally, channel 21 is immovably carried by the stationary bracket 53. The other, upper scissor blade 78 is journalled to and pressed against the first blade 74 by a bolt and spring connection 79. A link 80 has its one end journalled at 81 to the inner end of blade 78 and its other end journalled by bolt 81 to a lever 83. Lever 83 is swingable about pivot pin 84. A bracket 85 carries pin 84 vertically adjustably in a slot 86. A short second arm 87 is formed on and includes an acute angle with lever 83.

Upon rotation of shaft 42 with disc 72, the cam roller 73 first engages the underside of lever 83 thereby swinging it upwardly together with link 80 and inner end of scissor blade 78 so that the scissor blades cut off a piece 24 of sliver fed between them previously by the pinch rolls 22, 23. Upon further rotation, roller 73 disengages lever 83 and then engages the top surface of arm 87 thereby swinging lever 83 in the opposite direction; this causes downward movement of link 80 and the opening of scissors 25, as shown in dot-and-dash lines in Figure 9.

Attached to and operated by the severing mechanism is a device for temporarily holding down a piece 24 of sliver in channel 26. This mechanism comprises a bell crank lever 88 swingable about a bolt 89 which is secured vertically adjustably in slot 90 to an extension 91 of bracket 75. The forward arm 92 of lever 88 is curved and angled and carries a holddown plate 93. Plate 93 in operative position, shown in full and dotted lines in Figures 3, 4, 6 and 7, engages from the top a piece of sliver 24 in channel 26. The ends of plate 93 are curved upwardly so as not to restrain the sliding of the sliver toward the form tube 28, as will be explained later on. The other arm 94 of lever 88 has a long slot 95 through which an extension of bolt 82, connecting link 80 and lever 83 passes for sliding movement in the longitudinal direction of the slot.

Upward movement of lever 83 swings lever 88 into the position where plate 93 engages sliver 24, see the full- and dotted-line showing in Figures 4, 6 and 7, thereby insuring that the sliver is held to the bottom of channel 26 during and shortly after its severance by the scissors 25 until it is firmly engaged by rod 36. The subsequent downward movement of lever 83 swings lever 88 into the position shown in dot-and-dash lines in Figures 6 and 7, thereby leaving the passage free for the feeding of another piece 24 of sliver into the channel 26.

The spring biased connection 79 between the blades 74, 78 of the scissors causes enough friction for holding the scissors and the mechanisms connected therewith in the inoperative position during the time roller 73 is out of contact with lever 83. Of course, other well known means might be provided so as to prevent undesired movement.

The severing and hold-down mechanism is followed by the mechanism for moving the push rod 36 which is slidable in a guide 96. The guide 96 opens into channel

26 and extends inwardly and upwardly from the rear wall 97 thereof. Guide 96, channel 26, and form tube 28 are connected with each other and are as one unit removably secured by bolts or screws 98 to a supporting structure 99 of chassis plate 38. The purpose of this removability will be explained later on.

The inner upper end of rod 36 is journalled by a short link 100 to the upper end of a lever 101. The connection between link 100 and lever 101 is adjustable by a slot and bolt connection 102 so as to adjust the position of rod 36. Lever 101 is journalled at 103 to structure 99 and is provided with two cam surfaces 104 and 105, the one above and the other at about the level of journal 103. The cam surfaces 104, 105 are formed on the branches 106, 107, respectively, of a bifurcation of lever 101. Branch 106 is arranged on the one side and branch 107 on the other side of a disc 108 secured to drive shaft 42. Disc 108 carries near its circumference four cam rollers 109, 110, 111 and 112. The rollers 109 and 110 are arranged on one side of disc 108 for engagement with the upper cam surface 104, and the other two rollers 111 and 112 are arranged on the other side of disc 108 for engagement with the lower cam surface 105. Rollers 109 and 112 are coaxially supported. The location of the rollers on disc 108 and the arrangement and shape of the cam surfaces 104 and 105 are determined by the required operation of rod 36 which will become apparent from the following.

Rod 36 is held in the retracted position shown in Figures 3, 4 and 7 by appropriate means, such as by spring 113 inserted between lever 101 and plate 38, by a releasable catch, or other suitable means. A resilient ring 114 serves for stopping the forward movement of rod 36. One or more extra holes 115 at the upper end of rod 36 may serve also for adjusting the position of the rod.

Figure 7 shows rod 36 and the mechanism for moving it in the position when a piece 24 of sliver has just been fed into channel 26 and cut off by scissors 25 and is ready to be pushed by the forward end of rod 36 into the form tube 28. In this position, roller 111 has just made contact with cam surface 105. Further rotation of shaft 42 with disc 108 forces cam surface 105 on the branch 107 down and swings lever 101 forwardly until the position shown in Figure 8 is reached, which causes movement of rod 36 forwardly into the position where its forward end is in the interior of form tube 28, as shown in Figure 10. The forward end of rod 36 engages during its forward movement the severed piece 24 of sliver held down in channel 26 by plate 93 and draws this piece 24 into the form tube 28 while simultaneously doubling it up until the position shown in Figure 10 is reached. Immediately thereafter, roller 109 engages cam surface 104 on the branch 106 swinging lever 101 back and retracting rod 36, as shown in Figure 9. The doubled-up sliver piece 24 is retained by friction in form tube 28 when rod 36 is withdrawn.

As soon as roller 109 has left cam surface 104, the coaxial roller 112 on the other side of disc 108 engages cam surface 105 swinging lever 101 once again into the position shown in Figure 8 and moving rod 36 forwardly. During this forward movement, the end of rod 36 engages the inner surface of the doubled-up plug 24 retained in form tube 28 and pushes it into the test tube 30. The completion of this inserting step is illustrated in Figure 11. It merely remains to take off test tube 30, which is closed by a plug, and to present the machine with a new test tube.

While the machine might be started, manually or automatically, each time a test tube or other vessel is held in front of the feeding tube 28 on the support 29, it was found satisfactory to let the machine run continuously while the operator presents it with one tube after another, as pictured in Figure 1. The time required by the machine after the plugging of one tube is finished, for advancing and severing a new piece 24 of sliver and pushing it into form tube 28, as shown in Figure 10, is sufficient to allow the operator to remove a plugged tube and present another tube held in his hand to the delivery outlet of the machine.

The length 116 of the plug 24 is determined by the adjustment of the feeding mechanism. As the branches of the plug are to be of equal length, the adjustment of the feeding mechanism should be such that the distance 117, Figure 3, between the cutting plane 118 of scissors 25 to the middle line 119 of form tube 28, which coincides with the location of rod 36, about equals one-half of the length 120 of sliver piece 24 before it is doubled up. It will now be understood that scissor bracket 75 is adjustable in the feeding direction of the sliver 19 for taking care of changes in the form of the scissors and for bringing the cutting plane 118 to the desired location. The vertical adjustment of bracket 75 is for bringing the cutting edge to the proper height relative to the bottom of feed channel 21.

For different types of tubes or vessels, different lengths of plugs and different weights per yard of sliver are desired or necessary. For 10 to 12 mm. (millimeter) test tubes, cotton sliver of 50 to 60 grains per yard and sliver pieces of 2" lengths are desirable. For 16 and 17 mm. tubes, the weight should be 100 to 110 grains and the lengths 3", and for 25 mm. tubes, 200 to 220 grains weight and 4" lengths are required.

So as to accommodate these different lengths and weights of sliver, it is not only necessary to have form tubes 28 of different inner diameter but it is also necessary to change the distance 117. From the above given lengths follows that distance 117 should be 1" for 10 to 12 mm. tubes, 1½" for 16 and 17 mm. tubes, and 2" for 25 mm. tubes. Of course, there may be other sizes of tubes or vessels to be plugged which require still other weights and lengths.

For the plugging of 10 to 12 mm. test tubes, which have an inner diameter 121 of 8 to 10 mm., a form tube 28 with an inner diameter 122 of 7 mm. was found suitable. It will be noted that the inner diameter 122 of form tube 28 is smaller than that of the vessel to be plugged. This insures that the plug is retained in the form tube when rod 36 is withdrawn from the position shown in Figure 10; it also insures the unimpeded transfer of the plug from the form tube into the test tube; and it prevents the pushing back of the test tube by the advancing plug. For 16 and 17 mm. test tubes, the appropriate inner diameter 122 of the form tube is 13 mm., and for 25 mm. test tubes it is 21 mm.

The following cross sectional dimensions for rod 36 were found satisfactory: for 10 to 12 mm. tubes ⅛ x ¼", for 16 and 17 mm. tubes ⅛ x ⅜", and for 25 mm. tubes ⅛ x ½". The diameter of form tube 28 should not be too small and the dimensions of rod 36 should not be too great for each size of vessel and sliver so as to avoid excessive compression of the sliver, which would adversely affect the quality of the plug.

The machine is adaptable to the different sizes of vessels and to the different outlined requirements by the adjustability of the length of the feed, by the provision of several units each comprising a channel 26, a form tube 28 with its adapter 29, a pushing rod 36 and a guide 96, and by the exchangeable securement of the units to the remainder of the machine. All that is necessary for changing the machine from the plugging of one size to the plugging of another size of vessel is to disconnect rod 36 from link 100, to remove said unit from the supporting structure 99 by taking off the bolts 98, to replace it by another unit having the desired dimensions and the appropriate distance 123 between axis 119 and attachment plane 124, to adjust the forward position of the end of the rod by the slot and bolt connection 102 between link 100 and lever 101 or by holes 115, and to adjust the length of feed by means of screw 71. The distance 125 between the cutting plane 118 and the attachment face

of structure 99 is constant, save for the previously described fine adjustment of scissors 25.

The described interchangeability of the plugging unit means, of course, different distances between rod 36 and link 100 or lever 101. These differences can be taken care of either by appropriate different length connecting bolts or by offsetting the upper end of rod 36. No change of holddown plate 93 is usually required as the plate will cover the important region in which piece 24 of sliver is engaged by the rod 36.

It was found that even an entirely inexperienced person may plug without special effort 2000 and even more test tubes per hour.

So so to obtain for certain purposes an encased type of plugs, a strip of gauze may be fed into channel 21 along with the sliver so that the gauze surrounds the front half of the sliver. The middle line of the gauze will then be positioned about at the level of the axis of form tube 28 after having been cut together with the sliver by scissors 25. Upon doubling up the sliver together with the gauze, the gauze will practically completely encase the plug in the form tube and later in the test tube or the like.

The machine illustrated in the attached drawing and described hereinbefore should be considered as an example of the invention, and it should be understood that the invention is susceptible of many modifications. Those skilled in the art may, for instance, design different types of sliver-advancing or -severing means and of mechanisms by which the different devices are driven in proper timed relation. The forming of the plug and its insertion into the tube, to give another example, may be done by separate pushers working side-by-side though the illustrated and described double-movement of one rod for performing these two functions was found satisfactory. A further example of a conceivable modification is that the silver need not be the most commonly used roving cotton sliver but other continuous strips of loose resilient material, such as rayon or nylon sliver, may be employed.

What is claimed is:

1. Method of closing vessels, such as test tubes, provided with an opening and a tubular portion adjoining the opening, the steps of holding the opening of a vessel in front of one end of a tubular member, of folding a strip of a compressible fibrous material over one end of a flat rod and of pushing the rod with said strip into said tubular member from the other end of the latter, of withdrawing said rod while leaving said folded strip in said tubular member, and of pushing said strip from said tube into the opening of said vessel.

2. A device for closing vessels having a tubular portion adjacent and including their opening, the device comprising a tube, means on one end of said tube for aligning the tubular portion of a vessel with said tube, a support for holding a strip of fibrous material transversely across the other end of said tube, a blade-like pushing rod, a guide for reciprocating movement of said rod coaxially with said tube from a position in which its one edge is spaced from said other end of said tube to a position in which part of the rod is inside said tube, said rod serving for drawing a piece of said strip of fibrous material held on said support into said tube while doubling it up and for pushing the doubled-up strip through said tube and into the tubular portion of a vessel held against said first-named end of said tube by said aligning means.

3. In a machine for closing vessels, such as test tubes and the like provided with an opening adjoined by a tubular portion; a feeding device for receiving and longitudinally advancing step-by-step predetermined lengths of a continuous strip of fibrous material such as a sliver; a conduit for the reception of said strip on the discharge side of said device; a severing device between said feeding device and said conduit for severing pieces of said strip as it is advanced by said feeding device; a tube member extending transversely to, adjoining, and having its one end in open communication with said conduit; a pusher having at least one end formed as a narrow elongated blade of a width less than the inner diameter of said tube and the tubular portion of the type of vessel to be closed; means attached to the other end of said pusher for guiding and reciprocating said pusher coaxially with said tube from a position where the pusher is spaced from said first end of said tube and the opening in the conduit to a position where the blade of the pusher extends into said tube; and means for sequentially operating said feeding device, said severing device and said pusher.

4. In a machine according to claim 3, in which said pusher operating means are constructed for a sequence of two reciprocations between the operation of the severing device and the next operation of the feeding device.

5. In a machine for closing vessels, such as test tubes and the like having their opening adjoined by a tubular portion: a feeding mechanism for receiving and longitudinally advancing step-by-step pieces of predetermined length of a continuous strip of fibrous material such as a sliver; a cutting mechanism on the discharge side of said feeding mechanism for severing said pieces; a channel for receiving said pieces; an opening in one wall of said channel adapted for alignment with the opening and tubular portion of a vessel; a pusher rod; means attached to one end of said rod for guiding and reciprocating the other end thereof coaxially with and in and out of said opening in the channel wall; a device engaging a piece of said strip in said channel for holding it in front of said opening in the channel; and means for sequentially operating said feeding device, said cutting device, said engaging device and said pusher rod.

6. In a machine according to claim 5: said device for engaging a piece of said strip comprising a plate and means for alternately moving said plate away from and toward a second wall of said channel adjacent said first-named wall with said opening to bring said plate into engagement with a piece of fibrous material located in the channel and permitting advancing a new piece of material into said channel, respectively.

7. In a machine for closing vessels, such as test tubes and the like provided with a tubular outlet; a supporting structure; a feeding device for receiving and longitudinally advancing step-by-step predetermined lengths of a continuous strip of fibrous material such as a sliver; means for adjusting the length of the advance; a conduit for the reception of said strip on the discharge side of said device; a severing device between said feeding device and said conduit for severing pieces of said strip as it is advanced by said feeding device; an opening in a wall of and extending transversely to said conduit for alignment with the tubular outlet of a vessel; a pusher having one end adapted for movement into and out of said opening and said outlet; means attached to the other end of said pusher for guiding and reciprocating said pusher coaxially with said opening for pushing one of said pieces into the outlet of a vessel; means for sequentially operating said feeding device, said severing device and said pusher; said feeding device, severing device, conduit, aligning means, guiding means and operating means being supported at fixed relative locations on said supporting structure; said conduit, guiding means and pusher being formed as one subassembly unit; mating attachment means being provided on said subassembly unit and on said supporting structure for removably securing said unit to said structure in predetermined location of its opening and its guiding means relative to said supporting structure and said severing device; and easily removable connecting means between said pusher and said operating means; the removability of said subassembly unit permitting the exchange of one such unit dimensioned for closing vessels requiring certain dimensions of said pieces

of fibrous material against another unit dimensioned for the closing of vessels requiring different dimensions of said pieces.

8. In a machine for closing vessels by a plug formed of fibrous sliver, a pair of rolls arranged for gripping and advancing the sliver between them, a channel for leading the sliver to said rolls, a removable insert in said channel having walls converging toward said rolls for directing the sliver toward the middle of the length of the rolls, the removability of said insert serving for the exchange of an insert for one size sliver against an insert for another size of sliver.

9. A device for closing vessels having a tubular portion adjacent and including their opening, the device comprising a tube having one end designed for alignment with the tubular portion of a vessel, a support for holding a strip of fibrous material transversely across the other end of said tube, a pushing blade, a guide for reciprocating movement of said blade coaxially with said tube from a position in which its one edge is spaced from said other end of said tube to a position in which part of the blade is inside said tube, said blade serving for drawing a piece of said strip of fibrous material held

on said support into said tube while doubling it up and for pushing the doubled-up strip through said tube and into the tubular portion of a vessel held against said first-named end of said tube.

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