

Jan. 6, 1953

W. GOLD

2,624,499

APPARATUS FOR PLUGGING TEST TUBES AND THE LIKE

Filed Oct. 22, 1949

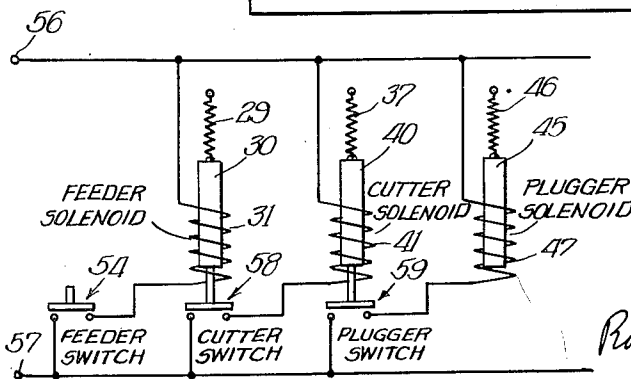
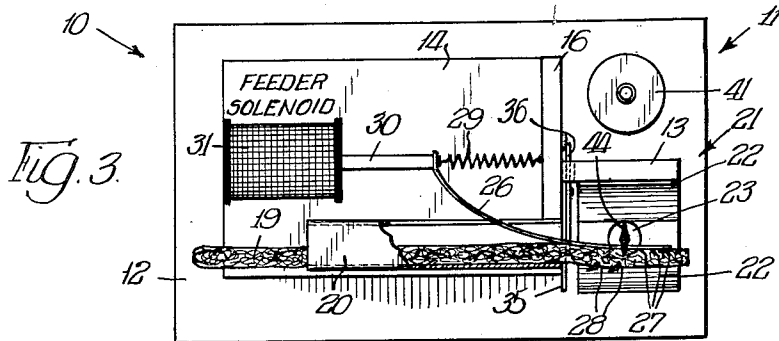
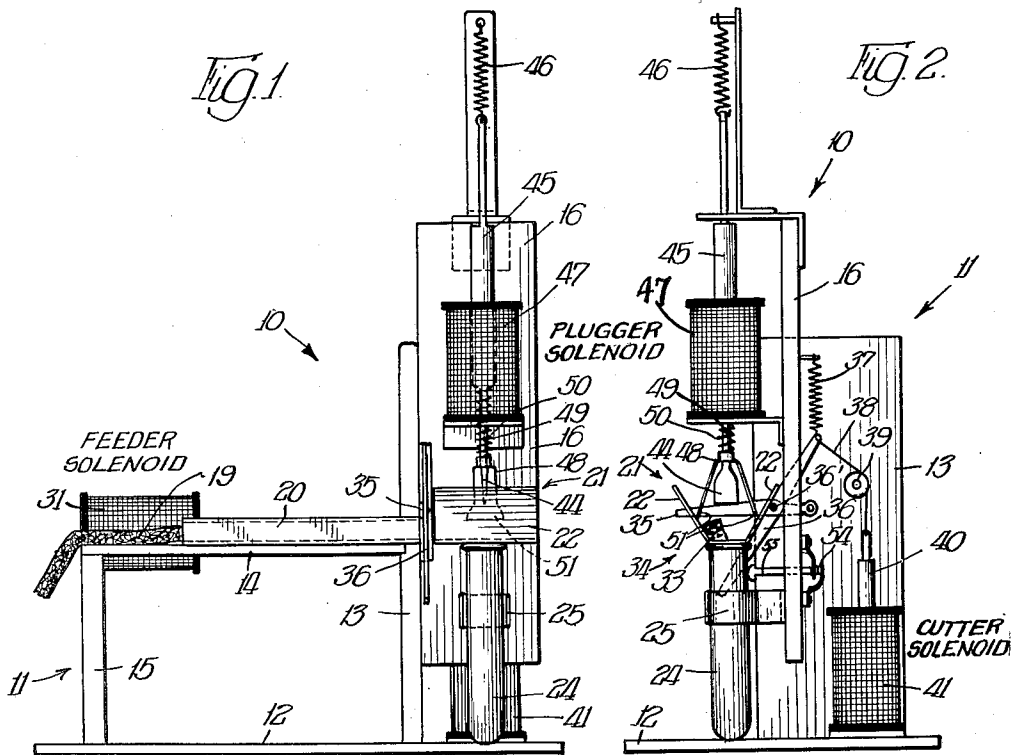


Fig. 4.

INVENTOR.

William Gold,

BY

Robert R. Lockwood

UNITED STATES PATENT OFFICE

2,624,499

APPARATUS FOR PLUGGING TEST TUBES
AND THE LIKE

William Gold, Madison, Wis., assignor to Wisconsin Alumni Research Foundation, Madison, Wis., a corporation of Wisconsin

Application October 22, 1949, Serial No. 122,957

15 Claims. (Cl. 226—2)

1

This invention relates, generally, to plugging apparatus, and it has particular relation to apparatus for plugging test tubes and the like.

Among the objects of this invention are: To provide for plugging test tubes or the like with short lengths of cotton or like material in a simple, efficient, and economical manner; to employ a strip of material of indefinite length and to cut the same into the required lengths for each plug; to feed the strip automatically into cutting and plugging position; to withdraw the feeding mechanism in response to placing the test tube in position to receive the plug; to cut the strip in response to the withdrawal of the feeding mechanism; to insert the plug into the test tube in response to operation of the cutting mechanism; to hold the plug in the test tube while the plugging mechanism is being withdrawn; and to feed the strip into the cutting and plugging position in response to the removal of the plugged test tube from its plug receiving position.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiment thereof shown in the accompanying drawing, and it comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention reference can be had to the following detailed description, taken together with the accompanying drawing, in which:

Figure 1 is a view, in side elevation, of a device for plugging test tubes and the like;

Figure 2 is a view in front elevation of the apparatus shown in Figure 1;

Figure 3 is a top plan view of the apparatus shown in the preceding figures; and

Figure 4 illustrates diagrammatically the circuit connections which can be employed for energizing the solenoids shown in the preceding figures.

Referring now particularly to Figures 1, 2 and 3 of the drawing, it will be observed that the reference character 10 designates, generally, an automatic test tube plugging machine. The machine 10 includes a frame that is indicated, generally, at 11. The frame 11 includes a base 12 which carries a transverse upright 13 from which a shelf 14 projects rearwardly. The shelf 14 may be supported at its rear end by a support 15. The

2

transverse upright 13 carries a vertical base 16. It will be understood that the frame 11, as described and shown in the drawings, can be modified as desired and that the particular arrangement thereof is shown only for illustrative purposes.

A strip 19 of material such as cotton and having an indefinite length may be fed through a horizontal hollow guide 20 which is positioned along one side of the shelf 14. The forward end of the strip 19 is fed into a trough 21 which has outflared sides 22 and an opening 23 in the bottom under which a test tube 24 or like receiver may be positioned for receiving a plug to close its upper end. If desired, a clip 25 may be carried by the vertical base 16 and arranged to receive the test tube 24 for centering it properly underneath the opening 23.

The strip 19 is fed into the trough 21 by a resilient feeding tongue 26. As shown more clearly in Figure 3, the tongue 26 has forwardly inclined teeth 27 for gripping the forward end of the strip 19 and moving it into the trough 21 along one side of the opening or aperture 23. In order to hold the strip 19 in the position to which it is fed by the tongue 26 forwardly inclined teeth 28 are provided along the side 22 against which the strip 19 is held by the tongue 26. When the tongue 26 is retracted, the teeth 28 serve to hold the strip 19 in the forward position.

The feeding tongue 26 is urged to move the strip 19 into the trough 21 by a coil tension spring 29. The tongue 26 can be retracted by a feeder armature 30 on energization of a cooperating feeder solenoid 31.

With a view to cutting off a plug 33, Figure 2, from the strip 19 for insertion into the upper end of the test tube 24, a cutter, shown generally at 34, is provided and is arranged to operate between the forward end of the hollow guide 20 and the rear end of the trough 21. The cutter 34 comprises a stationary blade 35 which is fastened to the vertical base 16. Cooperating with the stationary blade 35 is a movable blade 36 which is pivoted at 36' to the stationary blade 35. A coil tension spring 37 serves to bias the movable blade 36 to the open position. For operating the movable blade 36 a flexible connection 38 is connected thereto and is trained over a pulley 39. At its other end the flexible connection 38 is secured to a cutter armature 40 which has a cutter solenoid 41 to cooperate therewith. On energization of the cutter solenoid 41, the spring 37 is tensioned and the blade 36 is moved to cut off the plug 33 from the remainder of the strip 19.

3

With a view to carrying the plug 33 downwardly through the aperture 23 in the bottom of the trough 21 from its position along one side thereof, a plugger 44 is employed. As shown in the drawing, the plugger 44 is in the form of a flat blade and is carried at the lower end of an armature 45. A coil tension spring 46 is connected to the upper end of the armature 45 for retracting it and the plugger 44. The armature 45 and plugger 44 are moved downwardly by a solenoid 47 which is arranged to be energized in a manner to be described.

It is desirable that the plug 33 be held in the test tube 24 after it has been inserted therein by the plugger 44 while the latter is being withdrawn. For this purpose an inverted U-shaped guide and holding member 48 is slidably mounted on a shank portion 49 of the plugger 44 between it and the armature 45. The U-shaped guide and holding member 48 is loosely and slidably mounted on the shank portion 49 and is arranged to be moved downwardly by a coil compression spring 50 which is positioned, as shown more clearly in Figure 1, between the upper end of the guide 48 and the lower end of the armature 45. The guide 48 has lower elongated portions 51 for engaging and gripping more firmly the plug 33 after it has been inserted into the upper end of the test tube 24.

The energization of the feeder solenoid 31 is controlled by a feeder switch 54 which is arranged to be closed by a rod 55 that extends through the vertical base 16 and whose outer end is arranged to be engaged by the test tube 24 when it is positioned in the clip 25 to receive the plug. As shown in Figure 4, the feeder switch 54 is arranged to connect the solenoid 31 for energization across energized terminals 56 which may be connected to a suitable current source as will be understood readily.

Also as illustrated in Figure 4, the cutter solenoid 41 is arranged to be engaged on closure of a cutter switch 58. As illustrated here the cutter switch 58 is arranged to be closed on energization of the feeder solenoid 31 and the movement of the feeder armature 30 to a position where the resilient feeding tongue 26 is retracted out of the path of the movable blade 36 of the cutter 34. The plugger solenoid 47 is arranged to be energized on closure of a plugger switch 59. It will be observed in Figure 4 that the plugger switch 59 is closed on energization of the cutter solenoid 41 and movement of the cutter armature 40 to a position where the movable blade 36 has severed the plug 33 from the strip 19.

In operation it will be assumed that the strip 19 is positioned as shown in Figure 3 of the drawing and that the terminals 56 and 57 are suitably energized. Further, it will be assumed that a test tube 24 to be plugged is placed in the clip 25 in the position shown in Figure 2. As a result of the positioning of the test tube 24 as described, the feeder switch 54 is closed and the feeder solenoid 31 is energized. The armature 30 is drawn into the solenoid 31, the coil tension spring 29 is extended and the resilient feeding tongue 26 is retracted to a position out of the path of the movable blade 36. On completion of this movement by the feeder armature 30, cutter switch 58 is closed and cutter solenoid 41 is energized. The cutter armature 40 is attracted and the movable blade 36 is operated to cooperate with the stationary blade

4

35 and cut off the plug 33 from the strip 19. At the same time the spring 37 is tensioned. At the end of the forward stroke of the cutter armature 40, the plugger switch 59 is closed and the plugger solenoid 47 is energized. The plugger armature 45 is moved downwardly and the spring 46 is extended. The plugger 44 engages the plug 33 intermediate its ends and moves the same through the aperture 23 downwardly into the test tube 24. At the same time the coil compression spring 50 causes the U-shaped guide and holding member 48 to be moved downwardly with the edges of the lower elongated portions 51 riding over the upper surfaces of the outflared sides 22 of the trough 21. Further downward movement of the guide 48 is arrested when these edges engage the bottom of the trough 21. By this time the flat blade plugger 44 has moved downwardly through the aperture 23 and has carried with it the doubled over plug 33. The plugger 44 continues to move downwardly while the guide 48 is held stationary in the trough 21.

Now the pressure on the test tube 24 is relieved and the feeder switch 54 is opened. As a result the feeder solenoid 31 is deenergized and the spring 29 retracts the feeder armature 30 and, at the same time, the teeth 27 grip the forward end of the strip 19 and move it into the trough 21 preparatory to the next plugging operation. On deenergization of the feeder solenoid 31 and retraction of the feeder armature 30, the cutter switch 58 is opened and the cutter solenoid 41 is deenergized. The spring 37 promptly swings the movable blade 36 back to the position shown in Figure 2. Also the plugger switch 59 is opened and the plugger solenoid 47 is deenergized. The spring 46 retracts the armature 45 and the plugger 44 is withdrawn from the test tube 24. The U-shaped guide and holding member 48 is held in its lowermost position by the coil compression spring 50 while the plugger 44 is being withdrawn by the spring 46 from the test tube 24. In this manner the plug 33 is held in the plugged position and is prevented from being withdrawn together with the plugger 44. After the lower end of the plugger 44 has cleared the aperture 23, the guide 48 is picked up and moved to the position shown in Figure 2 in advance of the movement of the strip 19 into the trough 21.

Since certain changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawing and set forth hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. A plugging machine for test tubes or the like comprising, in combination, a stationary feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, a feeding tongue movable endwise in said trough for feeding the strip into the same and across said aperture, means for plugging the strip intermediate its ends through said aperture into the test tube, and means for sequentially operating said feeding tongue and plugging means.

2. A plugging machine for test tubes or the like comprising, in combination, a stationary

5

feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, a feeding tongue movable endwise in said trough for feeding the strip into the same and across said aperture, means for cutting the strip to the required length, means for plugging the cut off portion of the strip intermediate its ends through said aperture into the test tube, and means for sequentially operating said feeding tongue and said cutting and plugging means.

3. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube, means for feeding the strip into said trough, means for plugging the strip through said aperture into the test tube, means cooperating with said plugging means for holding the plugging material in the test tube while said plugging means is being withdrawn therefrom, and means for sequentially operating said feeding and plugging means.

4. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, means for feeding the strip into said trough and across said aperture, means in said trough for gripping the strip to hold the same along one side of said aperture in position to be fed therethrough, means for plugging the strip intermediate its ends through said aperture into the test tube, and means for sequentially operating said feeding and plugging means.

5. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, means for feeding the strip into said trough and across said aperture, means for plugging the strip intermediate its ends through said aperture into the test tube, and means responsive to the placing of a test tube in position to be plugged for sequentially operating said feeding and plugging means.

6. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, means for feeding the strip into said trough and across said aperture, means for cutting the strip to the required length, means for plugging the cut off portion of the strip intermediate its ends through said aperture into the test tube, and means responsive to the placing of a test tube in position to be plugged for sequentially operating said feeding, cutting and plugging means.

7. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, means for feeding the strip into said trough and across said aperture, means for plugging the strip intermediate its ends through said aperture into the test tube, means responsive to the placing

6

of a test tube in position to be plugged for operating said feeding means, and means responsive to the operation of said feeding means for operating said plugging means.

8. A plugging machine for test tubes or the like comprising, in combination, a feeder trough having an aperture in the bottom through which a strip of plugging material can be fed into a test tube positioned generally normal to said trough and in register with said aperture, means for feeding the strip into said trough and across said aperture, means for cutting the strip to the required length, means for plugging the cut off portion of the strip intermediate its ends through said aperture into the test tube, means responsive to the placing of a test tube in position to be plugged for operating said feeding means, means responsive to the operation of said feeding means for operating said cutting means, and means responsive to the operation of said cutting means for operating said plugging means.

9. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube, a feeding tongue movable endwise of said guide, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plunger switch operated to closed position by said cutter armature on energization of its solenoid, a plunger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube, a spring connected to said plunger for retracting the same, a plunger armature connected to said plunger, and a plunger solenoid for said plunger armature arranged to be energized on closure of said plunger switch to operate said plunger.

10. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed by placing a test tube in position to be plugged, a horizontally extending guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube therebelow, a feeding tongue movable endwise of said guide and having teeth for engaging the strip to grip the same, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue, a cutter switch oper-

ated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube therebelow, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, and a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger.

11. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube, teeth extending inwardly from said guide near said one end for engaging the strip to prevent backward movement thereof, a feeding tongue movable endwise of said guide and having teeth for engaging the strip to grip the same, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue while the strip is held stationary by said teeth in said guide, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, and a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger.

12. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a horizontally extending guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube, said guide being provided with outwardly and upwardly inclined sides at said one end, a feeding tongue movable endwise of said guide, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to

said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger, and guide and holding means carried by said plugger and cooperating with said outwardly inclined sides of said guide for directing the cut off portion of the strip of plugging material through said aperture and for holding the same in the plugged position thereof while said plugger is being retracted by its spring.

13. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a horizontally extending guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube, said guide being provided with outwardly and upwardly inclined sides at said one end, a feeding tongue movable endwise of said guide, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger, an inverted U-shaped guide and holding member slidably mounted on said plugger and biased toward its operating end and having outwardly biased arms the extremities of which engage and slide over said outwardly inclined sides of said guide for directing the cut off portion of the strip of plugging material through said aperture and for holding the same in the plugged

position thereof while said plugger is being retracted by its spring.

14. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a horizontally extending guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into a test tube therebelow, said guide being provided with outwardly and upwardly inclined sides at said one end, teeth extending inwardly from said guide near said one end for engaging the strip to prevent backward movement thereof, a resilient feeding tongue movable endwise of said guide and having teeth for engaging the strip to grip the same, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue while the strip is held stationary by said teeth in said guide, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube therebelow, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger, and guide and holding means carried by said plugger and cooperating with said outwardly inclined sides of said guide for directing the cut off portion of the strip of plugging material through said aperture and for holding the same in the plugged position thereof while said plugger is being retracted by its spring.

15. A machine for plugging test tubes or the like with material such as cotton comprising, in combination, a feeder switch arranged to be closed on placing a test tube in position to be plugged, a horizontally extending guide for receiving a strip of plugging material and having an aperture in the bottom at one end through which a short length of the strip can be fed into

a test tube therebelow, said guide being provided with outwardly and upwardly inclined sides at said one end, teeth extending inwardly from said guide near said one end for engaging the strip to prevent backward movement thereof, a resilient feeding tongue movable endwise of said guide and having teeth for engaging the strip to grip the same, a spring connected to said feeding tongue for moving the same along said guide to feed the strip forwardly, a feeder armature connected to said feeding tongue, a feeder solenoid for said feeder armature arranged to be energized on closure of said feeder switch to tension said spring and retract said feeding tongue while the strip is held stationary by said teeth in said guide, a cutter switch operated to closed position by said feeder armature on energization of its solenoid, a cutter arranged to cut off a predetermined length of the strip of plugging material near said one end of said guide, a spring connected to said cutter for retracting the same, a cutter armature connected to said cutter, a cutter solenoid for said cutter armature arranged to be energized on closure of said cutter switch to operate said cutter, a plugger switch operated to closed position by said cutter armature on energization of its solenoid, a plugger reciprocable through said aperture in said guide for moving the cut off portion of the strip of plugging material therethrough into the test tube therebelow, a spring connected to said plugger for retracting the same, a plugger armature connected to said plugger, a plugger solenoid for said plugger armature arranged to be energized on closure of said plugger switch to operate said plugger, and an inverted U-shaped guide and holding member slidably mounted on said plugger and biased toward its operating end and having outwardly biased arms the extremities of which engage and slide over said outwardly inclined sides of said guide for directing the cut off portion of the strip of plugging material through said aperture and for holding the same in the plugged position thereof while said plugger is being retracted by its spring.

WILLIAM GOLD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,171,572	Kelley	Sept. 5, 1939
2,269,722	Lakso	Jan. 13, 1942
2,304,932	Lakso	Dec. 15, 1942
2,412,089	Kelley	Dec. 3, 1946

FOREIGN PATENTS

Number	Country	Date
334,107	Great Britain	Aug. 28, 1930