Nov. 24, 1970 R. SZPUR 3,541,663

SYRINGE NEEDLE ATTACHMENT DEVICE

Filed Aug. 21, 1968 3 Sheets-Sheet 1

FIG-1

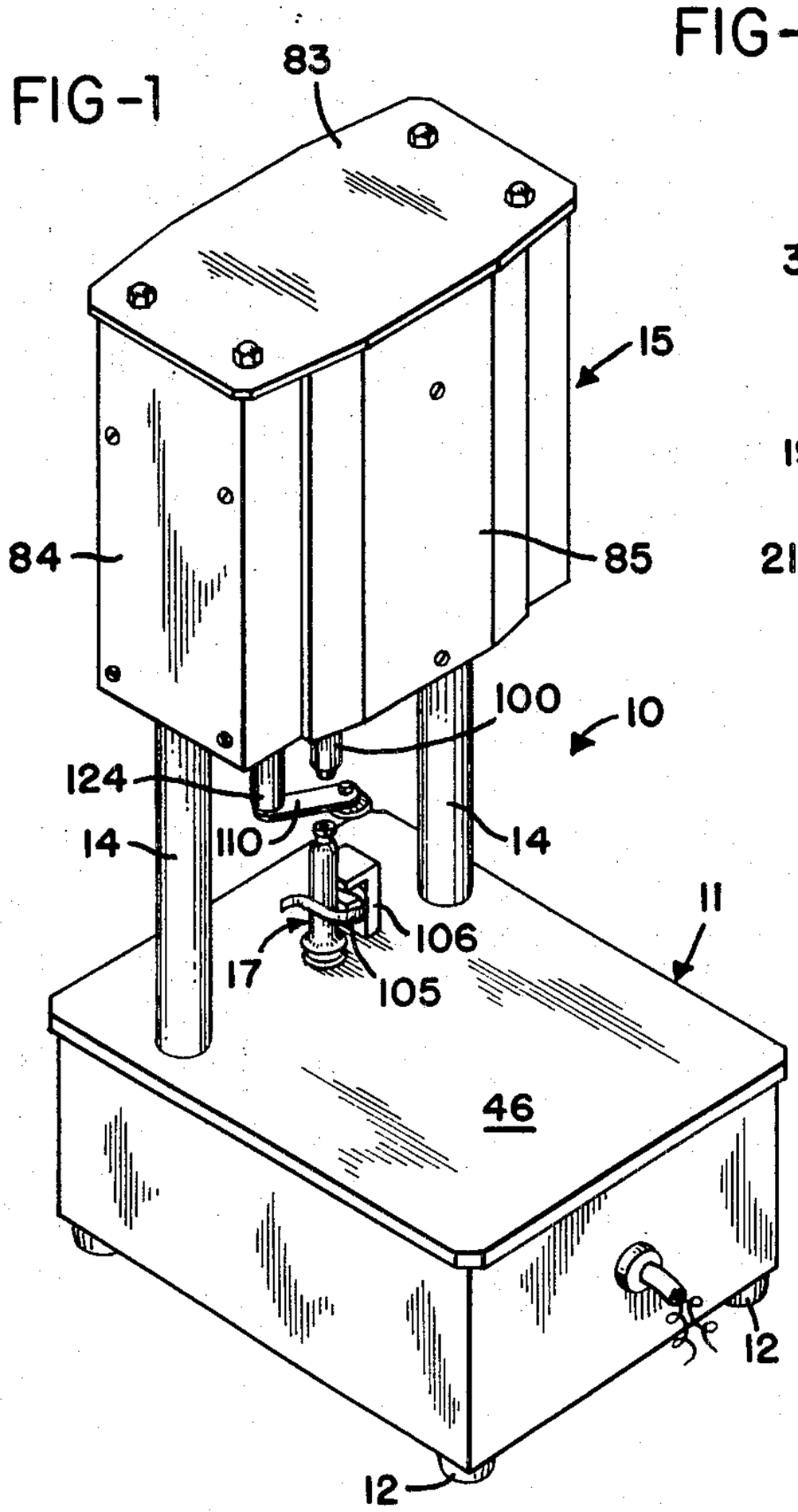


FIG-2

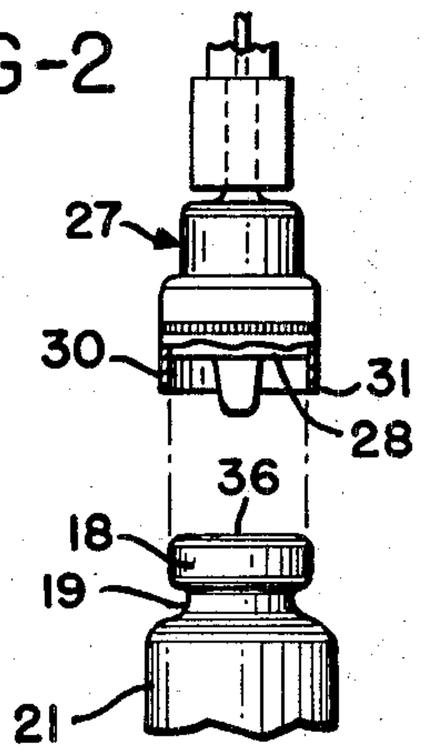


FIG-4

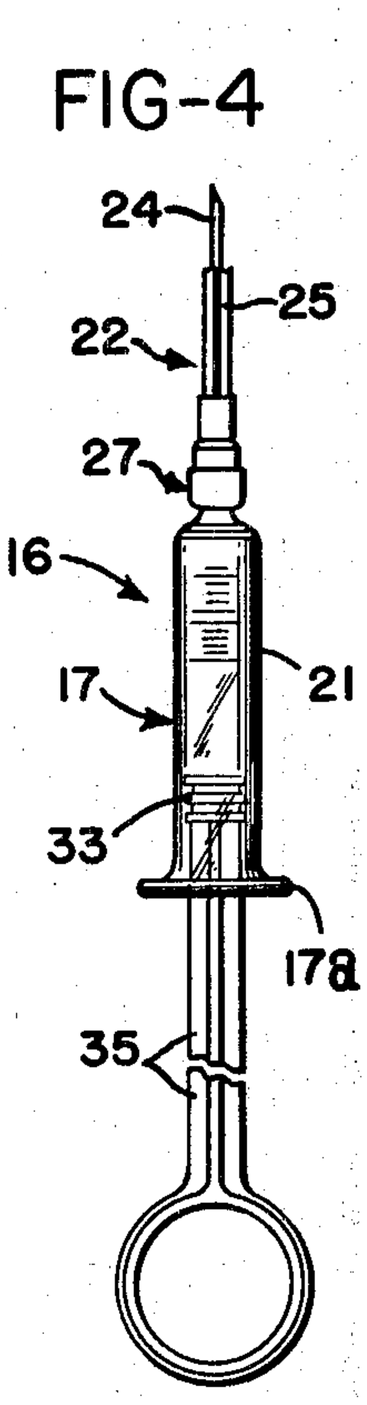


FIG-3

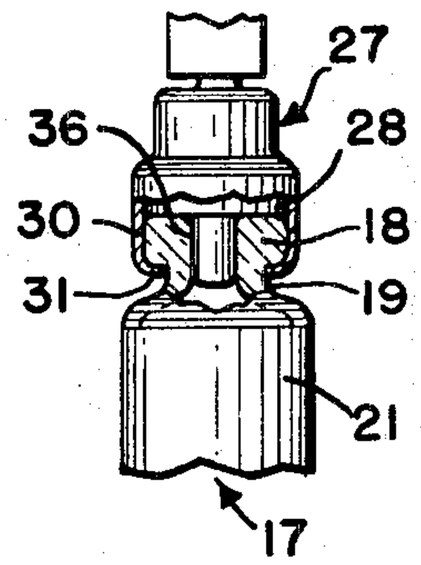
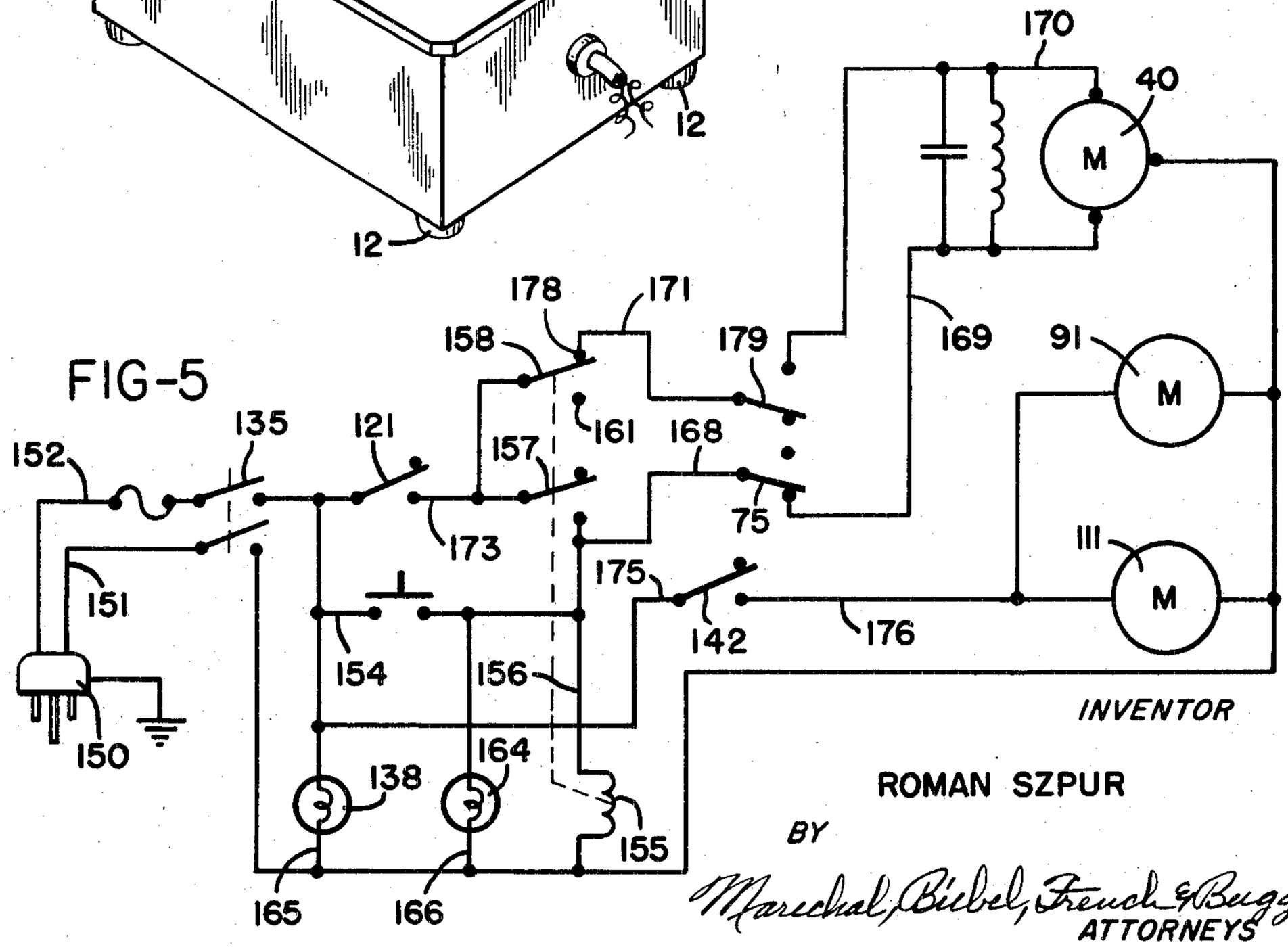


FIG-5



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SYRINGE NEEDLE ATTACHMENT DEVICE

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FIG-6

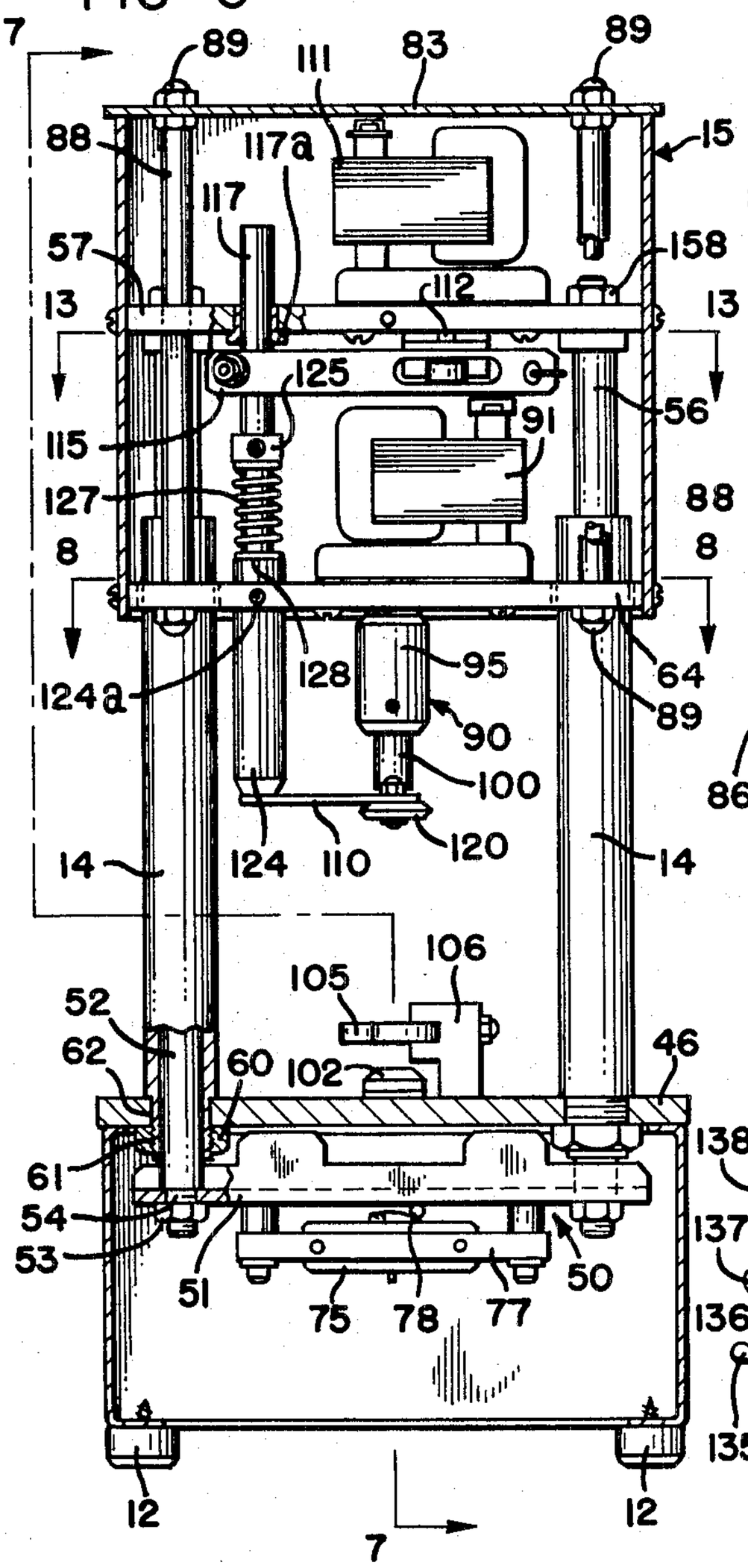


FIG-7

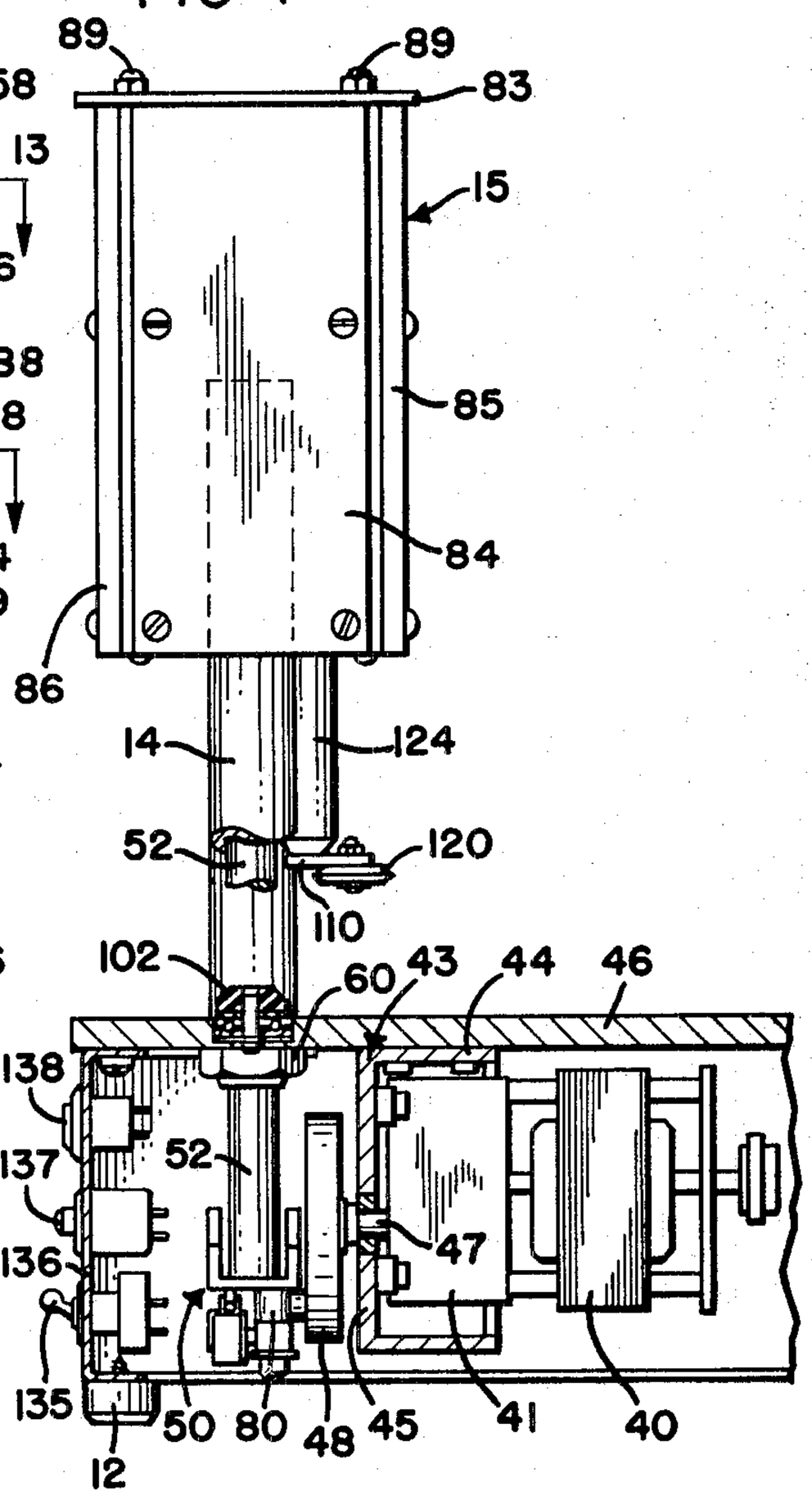
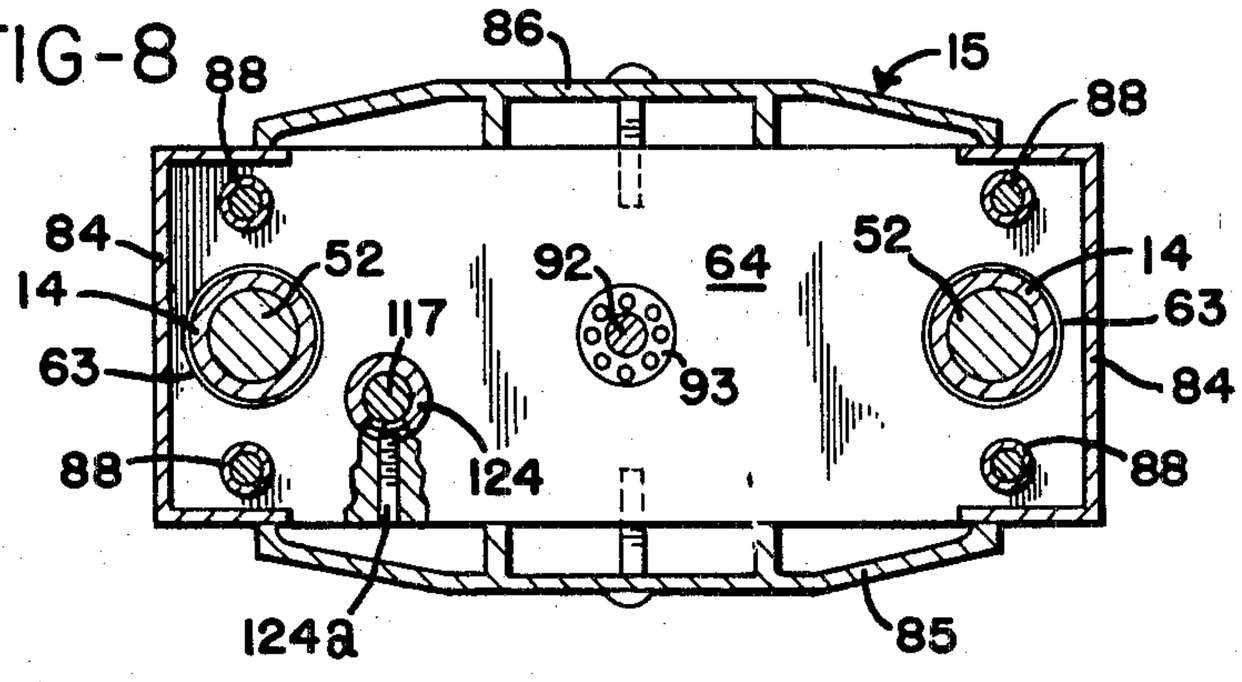


FIG-8



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SYRINGE NEEDLE ATTACHMENT DEVICE

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FIG-9

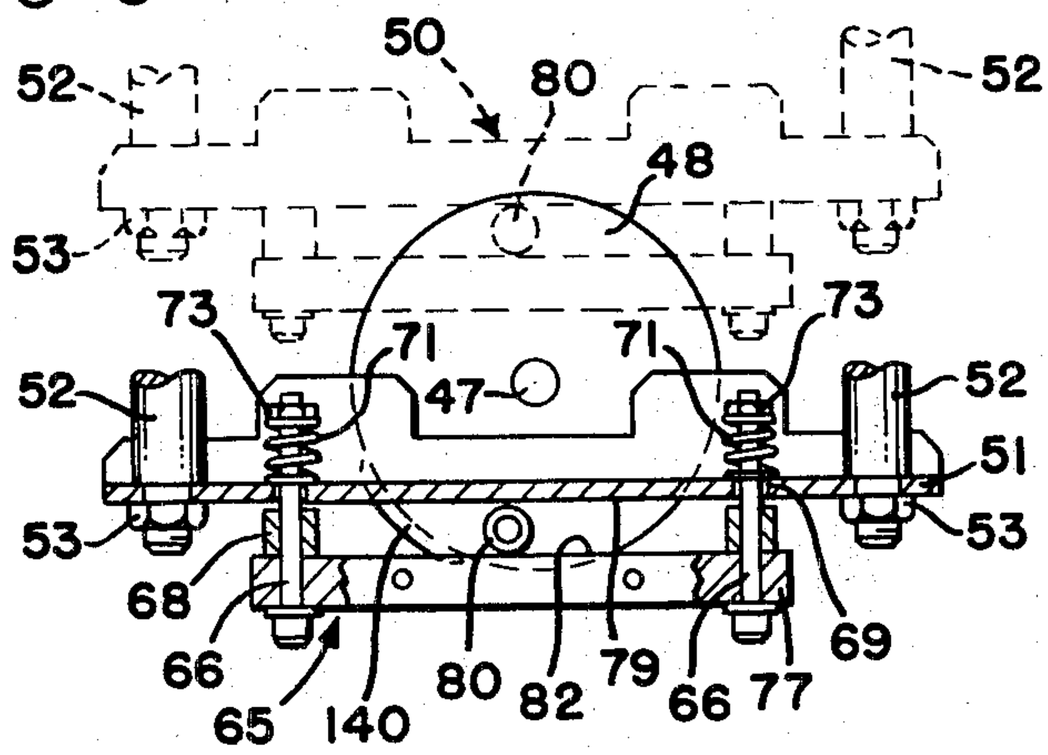


FIG-10

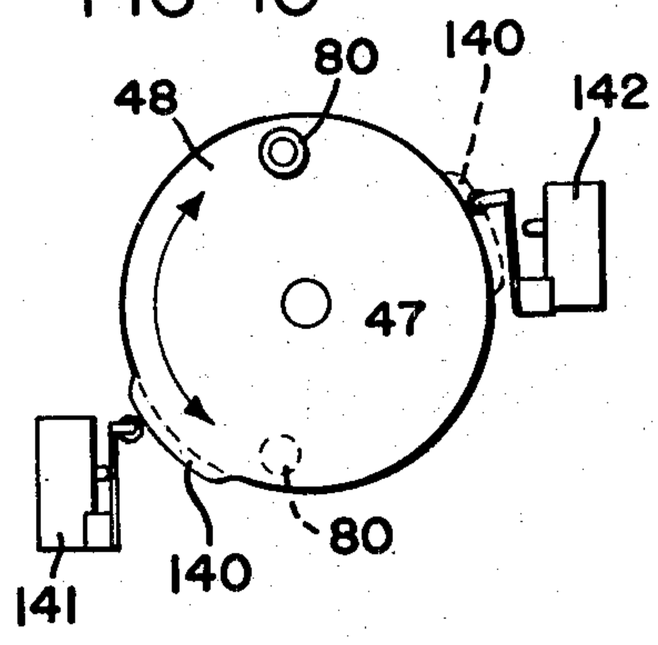


FIG-11

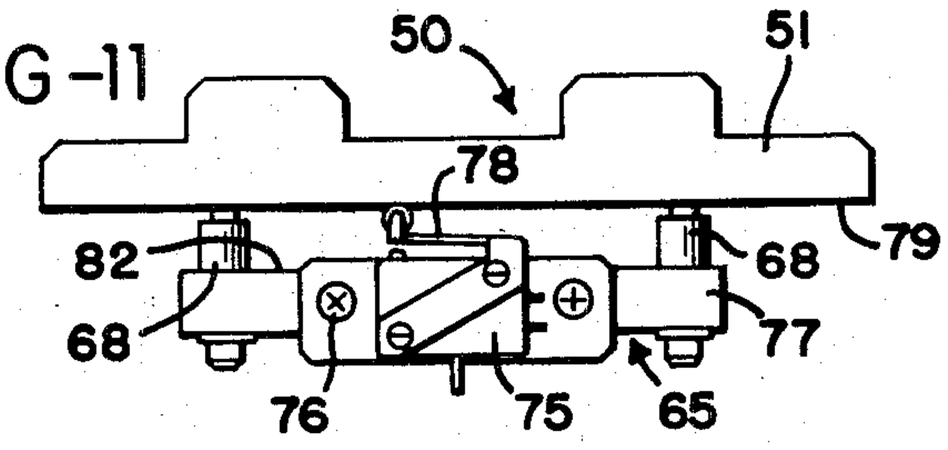


FIG-12

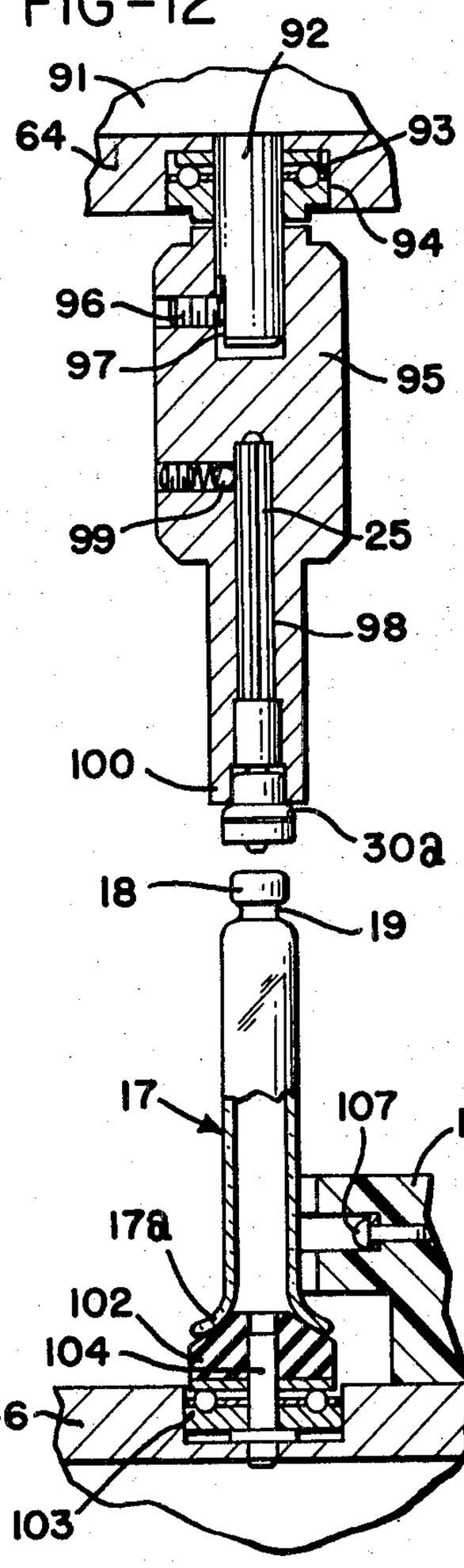


FIG-13

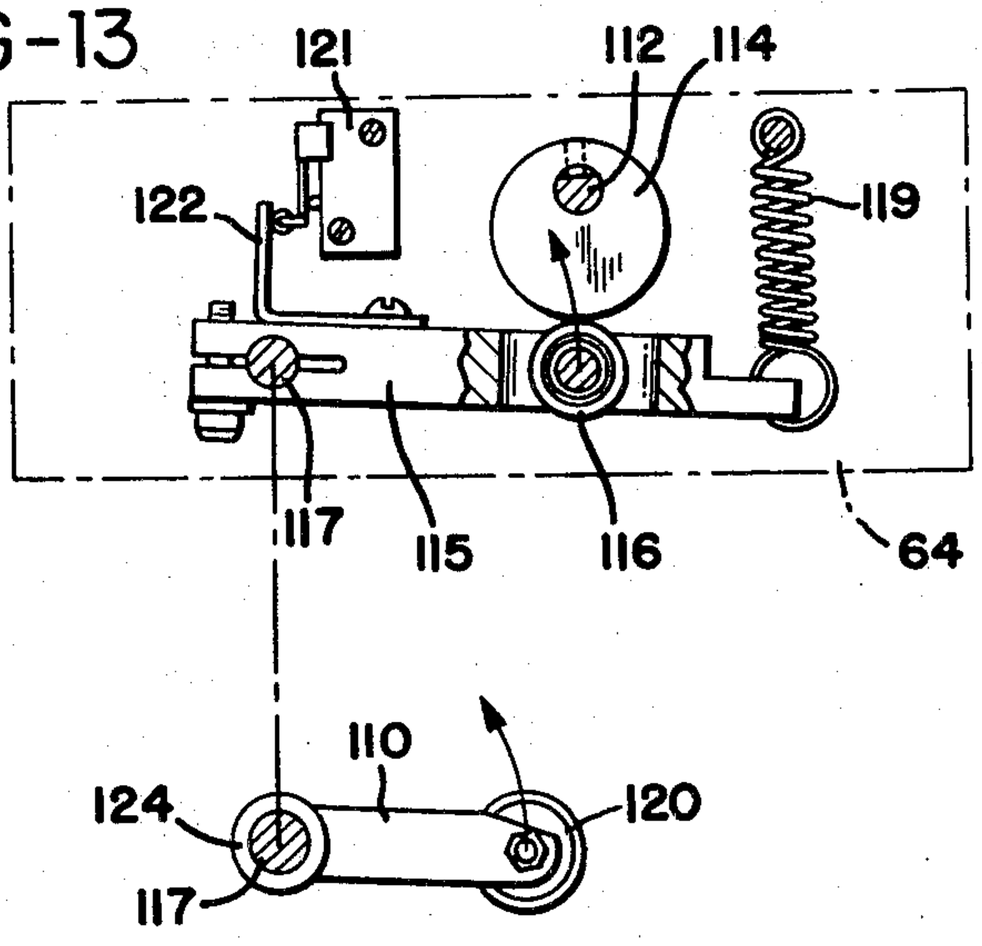
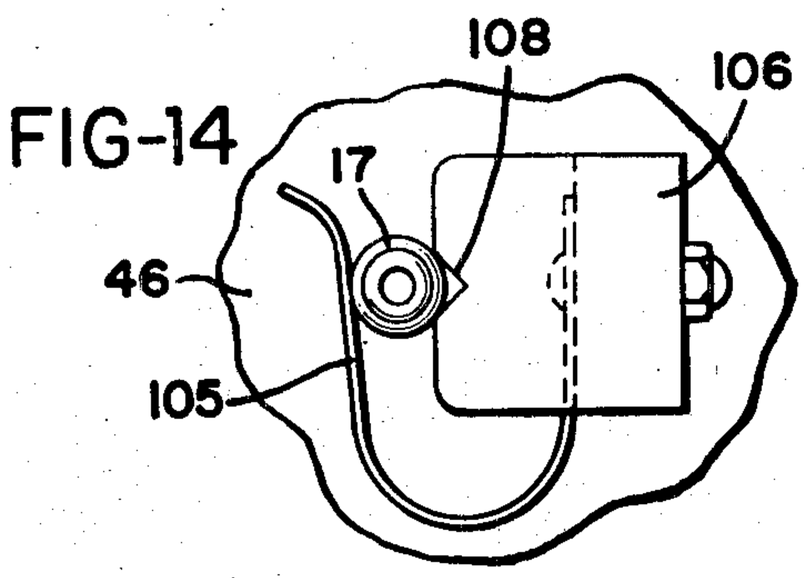


FIG-14



United States Patent Office

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Patented Nov. 24, 1970

3,541,663

SYRINGE NEEDLE ATTACHMENT DEVICE

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Filed Aug. 21, 1968, Ser. No. 754,192
Int. Cl. B23p *19/04*
U.S. Cl. 29—208 7 Claims

ABSTRACT OF THE DISCLOSURE

A device for attaching a needle assembly to a glass barrel of a syringe. The mechanism automatically places the needle assembly on the head of the syringe barrel and then deforms the metal connector of the needle assembly around the head of the barrel. The machine automatically adjusts to the length of the barrel and it provides a preset downward force so that the needle assembly is properly sealed to the barrel.

BACKGROUND OF THE INVENTION

The use of syringes throughout hospitals and the like to administer drugs to patients is extensive, thus creating problems of sterilizing the syringes as well as the handling and filling thereof. A new approach has occurred in recent years, that is, the use of prefilled throw-away or disposable syringe assemblies which are used only once and then disposed of. In this manner, they can be sterilized at the factory and placed in a sealed container until ready for use.

However, this presents a problem since only the more frequently used drugs can be provided in this manner, and then the dosage provided in the syringe is often more or less than the amount desired. Since the less frequently used drugs are not provided in syringes of this type, the hospital must still maintain the reusable syringes and all the related sterilization equipment.

SUMMARY OF THE INVENTION

A small machine for attaching the needle assembly to the glass barrel of the syringe thereby enabling drugs to be placed in the barrel at the hospital and the needle assembly to then be secured in place. This permits the proper drug and dosage thereof to be prefilled directly at the hospital. In addition, the system greatly reduces the cost of the drugs and the syringes since the drugs can be bought in bulk quantities as well as the components of the syringe assembly.

The machine includes means for holding the glass barrel in an upright position and means for holding the needle assembly in alignment with the top of the glass barrel. The machine automatically brings the needle assembly into contact with the barrel and deforms the metal head of the needle assembly around the head of the glass barrel to form a sealed unit. A precise pressure is applied between the needle assembly and the glass barrel so that in every case the amount of sealing pressure does not vary. In one embodiment, the machine automatically adjusts for the length of the glass barrel and the barrel is mounted on a bearing member which permits it to rotate with the needle assembly during the deforming operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the apparatus in accordance with the invention;

FIG. 2 is a fragmentary view of the disassembled needle assembly and barrel;

FIG. 3 is a view similar to FIG. 2 but illustrating the needle assembly connected to the glass barrel;

FIG. 4 is a plan view of the assembled syringe;

FIG. 5 is an electrical schematic of the electrical system for the apparatus;

FIG. 6 is a front elevation partially in section of the apparatus;

FIG. 7 is a section view taken along the lines **7—7** of FIG. 6;

FIG. 8 is a sectional view taken along the lines **8—8** of FIG. 6;

FIG. 9 is an elevation view partially in section for raising and lowering the top housing;

FIG. 10 is an elevation of the cam assembly for operating the electrical switches;

FIG. 11 is an elevation view of the saddle assembly;

FIG. 12 is a sectional view taken centrally through the support means for the needle assembly and barrel;

FIG. 13 is a plan view, partially in section, of the mechanism for moving the deforming arm toward and away from the needle assembly; and

FIG. 14 is a plan view of the spring clip utilized to hold the glass barrel in position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The assembling machine **10** is shown in FIG. 1 and includes a base **11** having a plurality of feet **12** adapted to be mounted on a flat horizontal surface. The base or lower housing **11** has two vertically extending support posts **14** which support the upper housing **15** for vertical movement toward and away from the base **11.**

The syringe **16** is shown in FIGS. 2–4 and includes the glass barrel **17** having the annular head **18** formed at the upper end thereof with the recess **19** (FIG. 3) between the head **18** and the body **21** of the barrel. The needle assembly **22** includes the hollow needle **24**, the plastic cover **25** for the needle **24**, and the metal connector **27** which houses a resilient seal **28** having a check valve (not shown) therein. The connector **27** is made of metal and has the annular wall **30** having an inner diameter slightly greater than the outer diameter of the head **18** of the barrel **17** and adapted to be received over the head and have the lower edge portion **31** thereof deformed over the head **18,** as shown in FIG. 3, to lock securely and seal the needle assembly **22** on the glass barrel **17.**

The piston **33** is reciprocally mounted in the glass barrel **17** and the plunger rod **35** is removably secured thereto for effecting reciprocation of the piston **33.** In practice, the piston **33** is first placed in the glass barrel **17** and then the drug is placed into the barrel from the opening **36** in the head thereof, and then the needle assembly **22** is secured thereto by the machine **10.** The plunger rod **35** is usually not secured in place until shortly before the drug is to be administered.

The mechanism of the machine **10** which raises and lowers the upper housing **15** is shown in FIGS. 6–11

and includes the drive motor **40** and a gear unit **41** rigidly secured in the base **11** by the bracket **43** which includes the plate **41** fastened to the top wall **45** of the base **11** and the downwardly extending flange portion **45** to which the gear unit **43** is secured. The output shaft of the gear unit **43** has a circular drive disk **48** rigidly secured thereto adapted to ráise and lower the saddle assembly **50**, as will be described.

The saddle assembly **50** includes (FIGS. 9 and 11) the cross member **51** having its ends secured to the vertical actuator rods **52** by the nuts **53** which engage the threaded connections **54** on the lower ends **55** of the actuator rods **52** and clamp the ends of the cross member **51** against the shoulders **55** formed on the rods. These rods extend vertically through the support posts **14** and have their upper ends **56** rigidly secured to the cross plate **57** in the upper housing **15** by the nuts **58** which engage the threaded ends **59** of the actuator rods **52**, as shown in FIG. 6. The lower end of the posts **14** are rigidly secured to the top wall **46** of the base **11** by the nuts **60** which engage the threads **61** on the reduced diameter end portions **62** of these rods, whereas the upper ends of the posts extend through openings **63** in the lower cross member **64** of the upper housing **15** and are unsupported at this point.

The cross member **51** of the saddle assembly **50** has secured thereto an actuator plate **65** which extends parallel thereto and its ends are secured in position by the elongated screws **66** which extend through the openings **67** in the ends of the actuator plate **65**, through the spacer blocks **68**, and through the openings **69** in the cross member **51**. A coil spring **71** surrounds each of the screws **66** between the top surface **72** of the cross member **51** and the nut **73** on the end of the screws **66** so that the actuator plate **65** can move with respect to the cross member **51** against the bias of the springs **71**. In effect, when the preset pressure is applied to the actuator plate **65** it will move away from the cross member **51**. A suitable electrical switch **75** is secured by the screws **76** to the side **77** of the actuator plate **65** with its actuating arm **78** resting against the bottom surface **79** of the cross member **51** so that, when the distance between the actuator plate **65** and cross member **51** changes, the switch **75** is actuated.

The drive mechanism in the base **11** includes a roller **80** rotatably mounted near the periphery of the circular drive disk **48** and received between the bottom surface **79** of cross member **51** and the top surface **82** of the actuator plate **65** so that rotation of the disk **48** causes the roller **80** to engage one of these surfaces to move the saddle assembly **50** between a raised and a lowered position, as shown by the broken and solid lines of FIG. 9. Movement of the saddle assembly **50** causes corresponding movement of the actuator rods **52** thus raising and lowering the upper housing **15**.

The upper housing **15** itself includes the lower **64**, intermediate **57**, and top plates **83** on which most of the components are secured and which are secured together by the side walls **84** of the upper housing **15**. The front and rear plates **85** and **86** can be easily removed by the access of the interior of the upper housing. In addition, the top and lower plates **83** and **84** are secured to the intermediate plate **57** by four vertically extending posts **88** which are secured to the corners of the intermediate plate **57** and are bolted to the top and lower plates **83** and **84** by nuts **89**. Thus by moving the intermediate plate **57** on the actuator rods **56**, the top and lower plates **83** and **64** are similarly moved.

The drive head **90** for the needle assembly is mounted on the lower plate **64** and includes a drive motor **91** having its output shaft **92** extending through the thrust bearing **93** in the opening **94** in the center of the lower plate **64** and having mounted thereon a chuck **95**, as shown in FIGS. 6 and 12. The chuck **95** is secured on the end of the drive shaft **92** by the set screw **96** which engages

the flat **97** on the drive shaft **92**. An elongated recess **98** extends axially through the lower end of the chuck **95** a substantial distance corresponding to the length of the plastic covering **28** on the needle assembly **22**. The plastic covering snugly fits this opening and the spring biased ball detent **99** is urged against the plastic covering **22** so that the needle assembly is held snugly in the recess **98**. The lower end **100** of the chuck **95** engages the metal connector **30** at the radial shoulder **30***a* thereof so that the downward force can be applied to the connector **30**.

As shown in FIGS 12 and 14, the support for the glass barrel **17** includes a rubber disk **102** adapted to have seated thereon the outwardly flared lower end **17***a* of the glass barrel **17**. This rubber disk is supported for rotation of the ball bearings **103** by the upstanding shaft **104** which is supported on the top wall **46** of the base **11**. The bearing **103** is mounted around the shaft so that the downward pressure on the barrel **17** is absorbed by this bearing which permits the support disk **102** to rotate with the barrel. The barrel **17** is held in position by the U-shaped spring clip **105**, shown in FIG. 14, including an upstanding bracket **106** secured on the top wall **46** of the base **11** and which has the clip **105** secured thereto by the conventional connector **107**. The V-shaped groove **108** is provided in the bracket **106** to seat the side surfaces of the glass barrel **17** which is held thereagainst by the spring clip **105**.

The movement of the crimping arm **110** (FIG. 6) toward and away from the metal connector **25** is effected by the drive motor **111** mounted on the intermediate plate **57**. Its drive shaft **112** extends through the plate **57** and has the eccentric cam **114** (FIG. 13) on the lower end thereof adapted to pivot the arm **115** which has the cam follower **116** thereon to engage the outer periphery **116***a* of the cam **114**. The arm pivots about the downwardly extending shaft **117** whose lower end **118** is connected to and supports the crimping arm **110**. The coil spring **119** urges the other end of the arm **115** toward the cam **114** so that the cam follower **116** is maintained in contact with the cam **114** at all times. An electrical switch **121** is mounted on the plate **57** to be actuated by the bracket **122** mounted on the arm **114** so that this switch senses the position of the actuator arm **114** and thus the crimping arm **110**.

The crimping arm **110** is rigidly secured to the lower end of the elongated shaft **117** which is mounted for rotation in the tubular member **124** secured to the lower plate **64** by the screws **124***a* (FIG. 6). The upper end of the pivot shaft **117** extends through the bearing **117***a* mounted in the intermediate plate **57** so that the shaft rotates without any binding forces. Downward movement of the shaft is limited by the collar **125** adjustably secured thereto by the set screw **126** and the coil spring **127** interposed between the collar **125** and the upper end **128** of the tubular member **124** to resist downward movement of the shaft. However, a slight downward movement against the bias of this spring **127** is possible and is required to seat properly the deforming wheel **120** mounted on the outer end of the crimping arm **110** against the metal connector **24** during the deforming operation.

The electrical system for the machine **10** includes a number of electrical switches **75** and **121** which have already been described. In addition, an on-off switch **135** (FIG. 7) is provided in the front plate **136** of the base **11** together with a cycle start button **137** and a light **138** indicates the position of the on-off switch **135**. In addition, the drive disk **48** mounted in the base **11** and driven by the motor **50** has an elongated cam lobe **140** mounted thereon adapted to actuate two electrical switches **141** and **142** (FIG. 10) as the drive disk **48** is rotated. The first of these switches **141** is utilized to hold the circuitry in its energized position once the cycle start button **137** is momentarily depressed and the other of the switches

142 is utilized to start the crimping operation once the upper housing 15 has positioned the needle assembly 22 on the glass barrel 17.

The operation of the attachment device 10 is best described in connection with the electrical schematic shown in FIG. 5. Accordingly, assuming that the electric current is connected thereto through the male plug 150 and that the current is supplied to the conductors 151 and 152, the device 150 operates by merely closing the manual switch 135 located on the front plate 136 of the base 11. A glass barrel 17 is then placed in the spring clip 105 against the bracket 106 with the lower flared end 17*a* being supported on the rotatable disk 102. At the same time the needle assembly 22 is placed into the chuck 95 by merely inserting it upwardly into the chuck 95 until the lower end of the chuck 95 rests against the shoulder 30*a* on the metal connector 30 on the end thereof. The piston 33 will already have been placed in the glass barrel 17 together with a prescribed quantity of drug or other medication.

Now the operation of securing the needle assembly 22 to the glass barrel 17 is ready to be performed and is started by momentarily closing the push button switch 137 in the connector 154 which completes a circuit through the relay coil 155 in conductor 156 causing it to be energized to move the electrical switches 157 and 158 to the position against the contacts 160 and 161. At the same time, the power on lamp 138 and cycle operating lamp 164 in the conductors 165 and 166 are energized to display the condition of the apparatus 10 to the operator.

As the switch 157 moves against the contact 160 the reversible motor 40 is energized by flow of current through the conductors 154, 168, and 169. This initial movement of switch 157 allowing the current flow is maintained (through normally closed switch 140 in line 173) to the drive motor 40 which rotates the disk 48 and thus moves the saddle assembly 50 downwardly bringing with it the actuator rods 56 and the upper housing 15. Once the needle assembly 24 mounted in the chuck 95 comes into contact with the head 18 of the glass barrel 17 the resistance to downward movement of the upper housing 15 is incurred causing the roller 80 to force the actuator plate 77 downwardly against the bias of the springs 71. Movement of this plate 77 with respect to the cross member 51 only occurs when a preset force is exerted between the barrel 17 and needle assembly 22 thus causing the switch 75 in conductor 168 to open and terminate current through the drive motor 40 which immediately stops.

The cam lobe 140 mounted on the drive disk 48 will have rotated sufficiently to close switch 142 completing the circuit through the conductors 175 and 176 to the spin and cam motors 91 and 111 which immediately begin to rotate. At this time the switch 141 has opened by the cam lobe 140 revolving so that the circuit to the relay coil 155 is deenergized causing the switches 157 and 158 to be moved upwardly to the contacts 177 and 178. The motor 91 rotates the chuck 95 and thus the needle assembly 22 and the barrel 17 which rotate with the support disk 102. At the same time, the motor 111 moves the arm 115 and deforming tool 110 against the connector edge 31 to deform it around the head 18 of the barrel 17 to create a fluid tight connection.

After the single revolution of the eccentric cam 114, the cam switch 121 is again closed so that power flows through the conductor 173, the switch 158, and the conductor 170 to the drive motor 40 causing it to rotate in an opposite direction to raise the housing 15 which moves to its raised or retracted position. Once the motor 40 begins to operate, the spin and cam start switch 142 is released causing the cam and spin motors 91 and 111 to stop with the arm 110 in its retracted position. When the upper housing 15 reaches its upward position, the switch 179 in conductor is opened to terminate flow of current to the motor 40 and thus deenergize the same.

The circuitry and mechanism is then in the same state as it was when the cycle was first started, and the cycle can be repeated by merely pushing the button 137 in conduct or to initiate the same. However, before doing so the completed syringe 16 is removed from the bracket and a new needle assembly 22 and barrel 17 are placed in the machine 10.

The invention has thus provided a machine for attaching the needle assembly to the glass barrel of a syringe thereby enabling the drug to be placed in the barrel at the hospital and the needle assembly to be secured or formed in place. The invention includes means for holding the glass barrel and needle assemblies in alignment and for automatically moving a deforming arm into position to deform the needle assembly over the head of the barrel and thus secure the same together with a preset pressure therebetween which eliminates the possibility of leakage between the needle assembly and the barrel.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A syringe needle attachment device adapted to secure the metal connector on one end of a needle assembly to the head of a glass barrel by deforming the outer periphery of the metal connection over the head of the glass barrel, said device comprising a first and second housings, means on one of said housings adapted to receive and support the barrel of the syringe assembly, chuck means on the other said housings adapted to receive and hold the needle assembly with the metal connector thereof in alignment with the head on the barrel, motor means for moving one of said housings toward the other of said housing until the connector is seated on the head of the barrel, means for rotating said chuck means to rotate the needle assembly and the barrel and for maintaining a preset downward pressure of said connector against the head of the barrel during such rotation, and automatic means for automatically deforming the connector over the head to interconnect securely the needle assembly and the barrel.

2. A device as defined in claim 1 wherein said means for mounting said first housing on said second housing includes at least one post rigidly secured to said first housing, an actuator rod extending through said post and being securely connected to said first housing, and motor means in said second housing for moving said actuator rod between spaced first and second positions.

3. A device as defined in claim 2 wherein means are provided for terminating operation of said motor means when a preset resistance is applied to the movement of said housings toward each other.

4. A device as defined in claim 3 wherein a pair of said posts and actuator rods are provided on opposite sides of said second housing, a saddle assembly interconnecting the ends of said actuator rods, said saddle assembly including a cross member which is rigidly secured to one end of said actuator rods, an actuator plate resiliently mounted on said cross member, an electrical switch mounted on said saddle assembly to sense when there is relative movement between said actuator plate and said cross member, said motor means including a rotating disk having a roller adapted to engage said actuator member to move said saddle assembly and said actuator rods.

5. A device as provided in claim 1 wherein a spring bracket is provided to support the glass barrel on said second housing, a rotatable disk on one of said housings to support the lowermost end of the barrel for rotation, and said spring adapted to hold the barrel on said disk.

6. A syringe needle device as defined in claim 1 wherein said first housing is an upper housing and said second

upper housing is a lower spaced below said upper housing, said upper housing being adapted to be lowered toward said lower housing to move the needle assembly into contact with the barrel, and reversable motor means for raising and lowering said upper housing.

7. A syringe needle attachment device as defined in claim 6 wherein said upper housing includes three parallel horizontal plates, crimping means mounted on the intermediate of said plates and including an arm adapted to pivot a deforming tool to contact with the connector

on the needle assembly, and chuck means mounted on the lowermost of said plates adapted to receive and support said needle assembly with the connector aligned with said tool.

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UNITED STATES PATENTS

3,451,116 6/1969 Shields ---------- 29—208 X

THOMAS H. EAGER, Primary Examiner

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,541,663 Dated November 24, 1970

Inventor(s) Roman Szpur

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 63, after "by" insert -- the --. Column 6, line 34, after "other" insert -- of --. Column 7, line 1, after "lower" insert -- housing --.

Signed and sealed this 11th day of May 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, J
Commissioner of Patent