Feb. 13, 1945. E. M. LEWIS 2,369,304

HYPODERMIC SYRINGE

Filed July 18, 1944

Fig. 1.

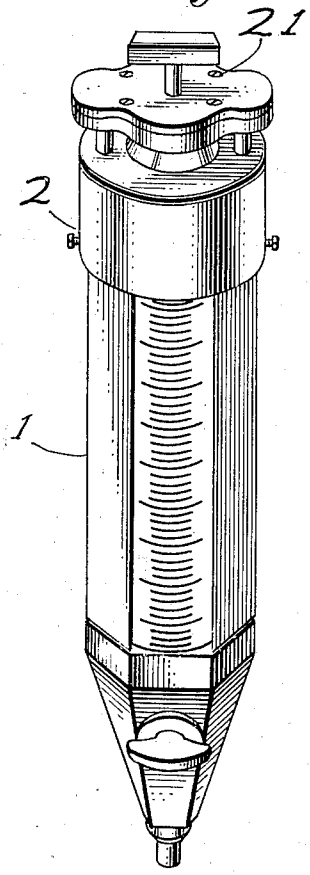


Fig. 2.

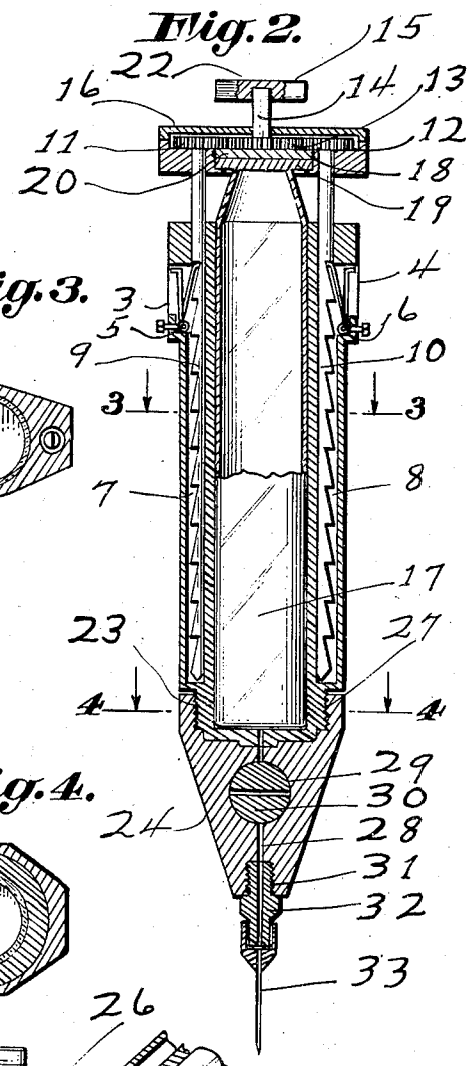


Fig. 3.

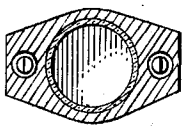


Fig. 4.

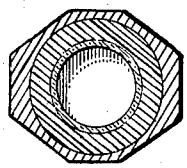
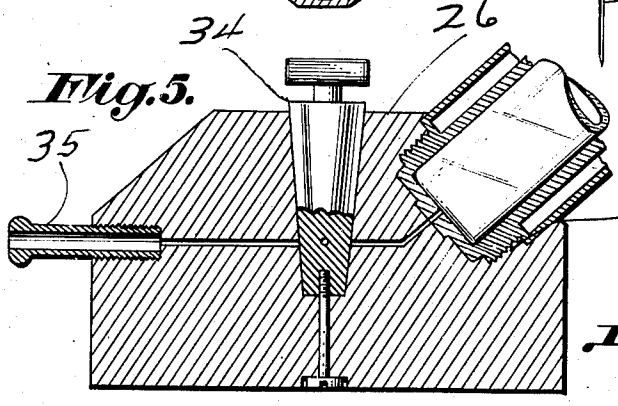


Fig. 5.



Inventor.

Everett Marion Lewis

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UNITED STATES PATENT OFFICE

2,369,304

HYPODERMIC SYRINGE

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Application July 18, 1944, Serial No. 546,709

3 Claims. (Cl. 128—215)

This invention relates to a hypodermic syringe which may be employed in administering subcutaneous, intramuscular or intravenous treatments, or it may be employed in collecting blood for chemical tests or for microscopical examinations and it may also be employed in collecting and in transmitting blood from a donor to a recipient in blood transfusion.

The primary object of the invention is to provide a hypodermic syringe which will facilitate the collecting of blood for various chemical tests and for microscopical examinations and a hypodermic syringe which will also facilitate the collecting of blood from a donor and the expeditious transmitting of blood from a donor to a recipient in blood transfusion.

Another object of the invention is to provide a syringe of this character embodying a mechanism the component parts of which are so constructed, arranged and assembled that a relatively high vacuum may be produced within the chamber or cavity of the syringe and may be retained therein for a reasonable length of time or immediately employed as a suction means whereby the collecting of blood is facilitated and whereby various fluids and liquids may be more easily and readily drawn into the chamber or cavity of the syringe.

A still further object of the invention is to provide the syringe with a detachable tip or distal end portion so constructed that the barrel of the syringe together with the mechanism and fittings thereof may be disconnected from the said tip or distal end portion and employed interchangeably with a suitable base or distal end portion in collecting and in transmitting blood from a donor to a recipient in blood transfusion.

With these and other objects in view, the invention resides in the novel combination and arrangement of parts which will be hereinafter described and particularly pointed out in the claims.

The preferred embodiment of the invention has been illustrated in the accompanying drawing, although no restriction is necessarily made to the precise details of construction therein shown, as changes, alterations and modifications within the scope of the claims may be resorted to when desired.

In the drawing—

Figure 1 is a vertical view of a syringe constructed in accordance with the invention.

Figure 2 is a vertical longitudinal sectional view through the syringe.

Figure 3 is a transverse sectional view on line 3—3 of Figure 2.

Figure 4 is a transverse sectional view on line 4—4 of Figure 2.

Figure 5 is a transverse sectional view of the base or distal end portion of a blood transfusion apparatus illustrating therein a sectional view of the recessed threaded distal end of the barrel of the syringe in place in the threaded socket of the said base or distal end portion.

Like characters of reference denote corresponding parts throughout the various views in the drawing.

The syringe herein illustrated, comprises barrel 1 which is of oblong octagonal form externally and of cylindrical form internally, made of metal or of glass or a combination of metal and glass, which has formed at the proximal end thereof an enlargement 2 provided with sockets 3 and 4 into which are fitted pawls 5 and 6, the said pawls are made of steel and are of V type spring formation, they are held in place at their base by suitable set screws and their upper or distal end portion is retained in place by suitable metallic lids (not shown in the drawing) pressed into sockets 3 and 4. The aforesaid sockets communicate laterally with longitudinally extending channels or grooves 7 and 8 in which are received longitudinally slidable metallic ratchet shafts 9 and 10, the ratchets of which cooperate and engage with pawls 5 and 6 and serve in latching the said ratchet shafts at definite points along their travel course within the channels or grooves 7 and 8. Ratchet shafts 9 and 10 are provided with ratchets unilaterally thereof extending the greater portion of the length of the said shafts and correspond in number with the cubic centimeter capacity of the syringe. The proximal ends or stock portion of the aforesaid ratchet shafts are provided with gear wheels 11 and 12 attached thereto, which mesh and cooperate with gear wheel 13 and serve in rotating the said ratchet shafts and thereby serve in rotating the ratchets of the said shafts in or out of engagement with pawls 5 and 6. Gear wheel 13 is provided with a shaft 14 attached to the upper side thereof, the proximal end of the said shaft is threaded to accommodate the threaded connection means of knob or handle 15 hereinafter described. The aforesaid gear wheels are contained within housing 16, which is of oblong form, made of metal, and comprises a base, two lateral and two end walls and a cover therefor. The base of the said housing is provided with three openings two of which accommodate the

passage and operation of ratchet shafts 9 and 10, while the third or median opening accommodates the passage of the shaft of piston 17. In the internal median portion of the base of housing 16 there is provided a threaded socket 18, into which is fitted knob 19 of piston 17 which is held in place by threaded plate 20 provided therefor. The cover of the aforesaid housing is provided with a median opening to accommodate the passage and operation of shaft 14 of gear wheel 13, the said cover is held in place by screws 21. Knob or handle 15 is provided with threaded socket 22 which accommodates the threaded connection means of shaft 14 of gear wheel 13, the said knob or handle is employed in rotating gear wheel 13 and thereby gear wheels 11 and 12 in mesh therewith, either in a clockwise or counterclockwise manner; thus ratchet shafts 9 and 10 attached to gear wheels 11 and 12 may be rotated and the ratchets thereof rotated in or out of engagement with pawls 5 and 6.

Piston 17 is of cylindrical form, made of metal or of glass, and has formed at the proximal end thereof knob 19, which is adapted to fit threaded socket 18 of housing 16. The shaft of the said piston is adapted to fit the cylindrically formed internal portion of barrel 1.

Barrel 1 has formed about the distal end thereof a recessed threaded portion 23 which accommodates the threaded connection means of the detachable tip or distal end portion 24 of the syringe and the threaded connection means 25 of detachable base or distal end portion 26 of a blood transfusion apparatus; thus barrel 1 of the syringe is adapted to be employed interchangeably with the detachable tip or distal end portion of the syringe and with detachable base or distal end portion of a blood transfusion apparatus.

The detachable tip or distal end portion 24 is of cone and octagonal form, made of metal or of glass, or a combination of metal and glass, the proximal end of which is provided with threaded socket 27 to accommodate the connection means of recessed threaded portion 23 of barrel 1. The said detachable tip or distal end portion is provided with longitudinally extending channel 28 through which fluids, liquids or gases may pass into or out of the chamber or cavity of the syringe; the said tip is provided with valve socket 29 into which is fitted valve 30, held in place by a suitable screw (not shown in the drawing). Valve 30 serves as a means whereby the longitudinally extending channel 28 may be opened or closed to the passage of fluids, liquids or gases into or out of the chamber or cavity of the syringe. In the distal end of the detachable tip or distal end portion 24 there is provided threaded socket 31 which accommodates threaded connection means of tubular syringe adapter 32, the said tubular syringe adapter is provided with threaded connection means about the proximal end thereof to fit threaded socket 31 and the distal end of the adapter is formed to fit the hub of needle 33.

In assembling the syringe, tubular syringe adapter 32 is screwed into threaded socket 31 in the detachable tip or distal end portion 24, needle 33 is then attached to the distal end of the said tubular syringe adapter, valve 30 is fitted into valve socket 29 where it is held in place by a suitable screw (not shown in the drawing). The assembled detachable tip or distal end portion 24 is then screwed in place on recessed threaded portion 23 of barrel 1 where it is in position for use. The shaft of piston 17 is then passed through opening in the median portion of the base of housing 16 to a point where knob 19 thereof becomes fully engaged in threaded socket 18 in the base of the said housing, where it is held in place by screwing threaded plate 20 into the said socket. Ratchet shafts 9 and 10 are passed through their respective openings in the base of housing 16 to a point where gear wheels 11 and 12 attached to the proximal ends of the said shafts are in position to mesh with gear wheel 13. Gear wheel 13 is then placed in mesh with gear wheels 11 and 12 and the attached shaft 14 of gear wheel 13 is passed through the opening in the median portion of cover of housing 16 the said cover is then attached in place by screws 21. Knob or handle 15 is screwed into place on the end of shaft 14. Ratchet shafts 9 and 10 together with piston 17 are then passed into their respective openings in barrel 1. Thus the syringe is assembled ready for use.

When it is found desirable to collect blood for chemical tests or for microscopical examination, knob or handle 15 is turned clockwise to a point where the ratchets of ratchet shafts 9 and 10 are rotated out of position of engagement with pawls 5 and 6. Piston 17 together with ratchet shafts 9 and 10 are then inserted into their respective openings in barrel 1 the distance of their full travel course, knob or handle 15 is turned counterclockwise to a point where the ratchets of ratchet shafts 9 and 10 are rotated into position of engagement with pawls 5 and 6, valve 30 is closed, piston 17 together with ratchet shafts 9 and 10 are then retracted by pulling back on housing 16 to a point where the desired vacuum is produced within the chamber or cavity of the syringe and to a point where the ratchets of ratchet shafts 9 and 10 are engaged with pawls 5 and 6. When the desired vacuum is thus produced, needle 33 is inserted into a vein, valve 30 is then opened at which time the vacuum within the chamber or cavity of the syringe becomes rapidly filled with blood. The blood so collected may be readily expelled from the syringe by slight downward pressure applied on housing 16 after having turned the ratchets of ratchet shafts 9 and 10 out of engagement with pawls 5 and 6 by a clockwise rotation of knob or handle 15.

When it is found desirable to collect blood from a donor for blood transfusion, barrel 1 of the syringe is disconnected from the detachable tip or distal end portion 24 and recessed threaded portion 23 of the said barrel is then screwed into threaded connection means 25 of detachable base or distal end portion 26 of a blood transfusion apparatus, the three-way valve 34 in detachable base or distal end portion 26 being closed. A vacuum may then be produced within the chamber or cavity of the syringe in the same manner as heretofore described and blood for transfusion may be collected in the same manner as heretofore described for the collecting of blood for other purposes, except in the latter instance the blood enters the chamber or cavity of the syringe through needle and adapter attached to flexible tubing (not shown in the drawing), connected to threaded nipple 35. To transmit the blood so collected to a recipient in blood transfusion, three-way valve 34 is turned to close the induction channel and to open the eduction channel of the detachable base or distal end portion 26. Knob or handle 15 is turned clockwise to a point where the ratchets of ratchet shafts 9 and 10 are rotated out of engagement with pawls 5 and 6.

Slight downward pressure is then applied on housing **16** producing a downward movement of piston **17** causing the blood contained within the chamber or cavity of the syringe to flow freely into the vein of the recipient through a tube and needle (not shown in the drawing), attached to the opposite side of detachable base or distal end portion **26**.

When the syringe is assembled as heretofore described and as illustrated in Figures 1 and 2 of the drawing, it is suitably adapted to be employed in collecting blood for various chemical tests or for microscopical examinations and due to the vacuum retaining and controlling means of the syringe it is also suitably adapted for easily and rapidly drawing various fluids and liquids into the chamber or cavity thereof. Fluids or liquids drawn into the chamber or cavity of the syringe may be retained therein or the flow thereof regulated or controlled by operating valve **30** of the detachable tip or distal end portion **24**.

From the foregoing description taken in connection with the accompanying drawing, it is at once apparent that a syringe for the purpose set forth has been provided which will be highly efficient in use.

This application is a continuation in part of application, Serial No. 375,637, filed January 23, 1941.

Having described the invention what is claimed as new is:

1. A hypodermic syringe having means for retaining and controlling a vacuum, comprising a barrel, a piston longitudinally slidable within the said barrel, a housing disposed about and outwardly beyond one end of the piston, a cover for the housing and means for attaching the cover to the housing, means for attaching the housing to the piston, cooperating lateral and median rotary gear members within the housing, ratchet shafts attached to the under surface of the two lateral rotary gear members within the housing and extending downwardly and outwardly therefrom through the base of the housing and parallel with the piston for the greater portion of the length of the piston, a shaft attached to the upper surface of the median rotary gear member within the housing and extending outwardly therefrom through the cover of the housing, a handle detachably attached to the said outwardly extending shaft external to the housing for rotating the median rotary gear member and for rotating the two lateral rotary gear members together with the ratchet shafts attached thereto, channels in the barrel extending longitudinally the greater portion of the length of the barrel to accommodate the operation of the ratchet shafts longitudinally slidable therewithin, sockets in the barrel communicating with the said longitudinal channels and with the ratchet shafts therein, pawls mounted in the said sockets communicating and cooperating with the ratchets of the ratchet shafts within the aforesaid channels, a valve tip having a channel centrally and longitudinally thereof, means in the said tip for opening and closing the longitudinally extending channel therethrough, a socket in the distal end of the said valve tip and means in the socket for connecting a syringe adapter therewith.

2. A hypodermic syringe having means for retaining and controlling a vacuum, comprising a hollow barrel, a piston longitudinally slidable within the said barrel, channels in the barrel extending longitudinally the greater portion of the length of the barrel, a housing disposed about and outwardly beyond one end of the piston and means for attaching the housing to the piston, ratchet shafts detachably attached within the housing to extend outwardly therefrom in a parallel position with regard to the piston, sockets in the barrel communicating with the longitudinally extending channels therein and with the ratchet shafts longitudinally slidable within the said channels, a latching means in the said sockets communicating and engaging with the ratchets of the ratchet shafts for latching the shafts at definite points along their travel course within the aforesaid channels, a valve tip having a longitudinally extending channel therethrough communicating with the chamber of the barrel, means in the said tip for opening and closing the channel thereof, a socket in the distal end of the valve tip and means in the socket for connecting a syringe adapter therewith for the detachable attachment of a hypodermic needle.

3. A hypodermic syringe having an induction and eduction channel for the induction and eduction of fluids and liquids into and out of the chamber of the syringe, a valve for opening and closing the said channel, a socket in the distal end portion and means in socket for connecting a syringe adapter therewith, a hollow barrel, a piston longitudinally slidable within the said barrel, channels in the walls of the hollow barrel extending longitudinally the greater portion of the length of the barrel, ratchet shafts longitudinally slidable within the said channels, a housing mounted about the proximal end of the piston and means in the housing for holding the said ratchet shafts in parallel position with regard to the piston, a latching means in the walls of the hollow barrel communicating with the longitudinally extending channels therein and with the ratchets of the ratchet shafts longitudinally slidable within the said channels, means for latching the ratchet shafts at definite points along their travel course within the longitudinally extending channels in the barrel and means for rotating the ratchet shafts in or out of engagement with the latching means in the barrel.

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