Aug. 20, 1935. K. Y. JOHANNESSON 2,011,639

FOUNTAIN PEN DESK SET

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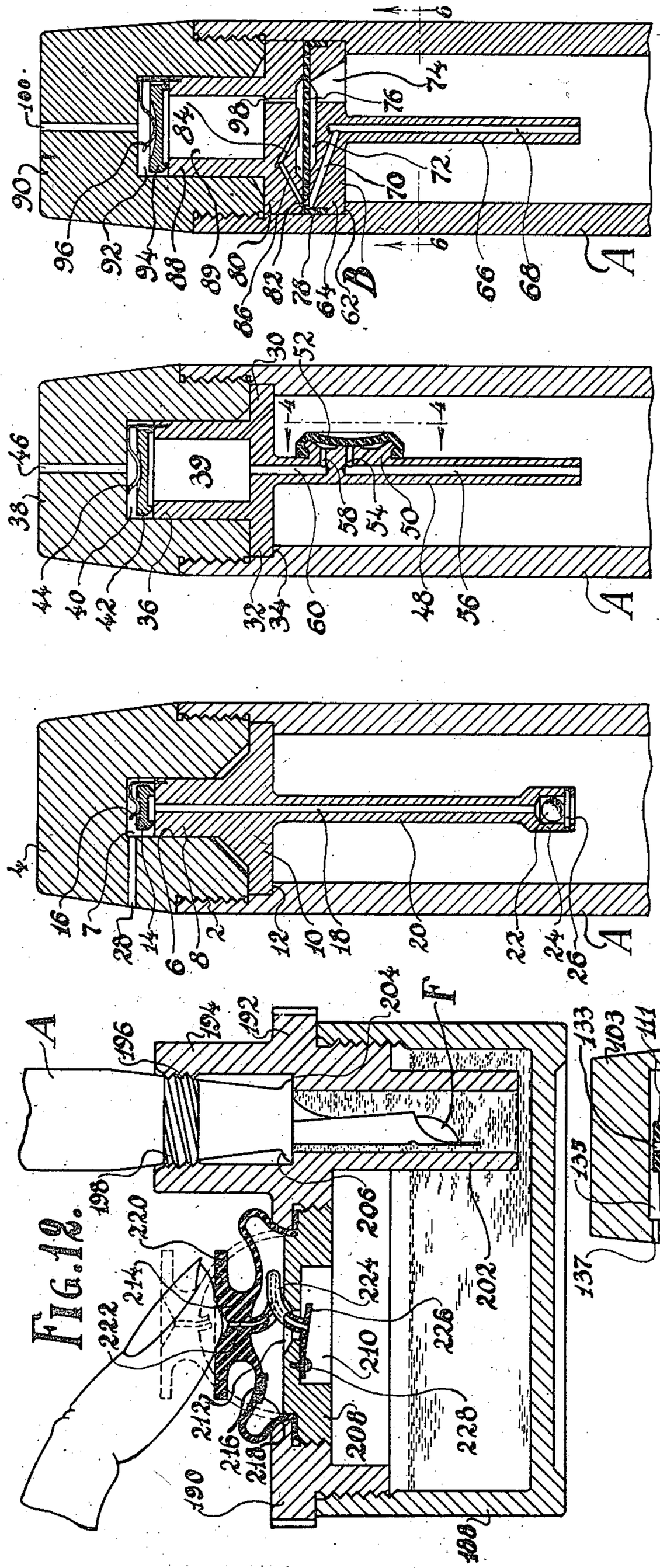

FIG. 1.

FIG. 2.

FIG. 3.

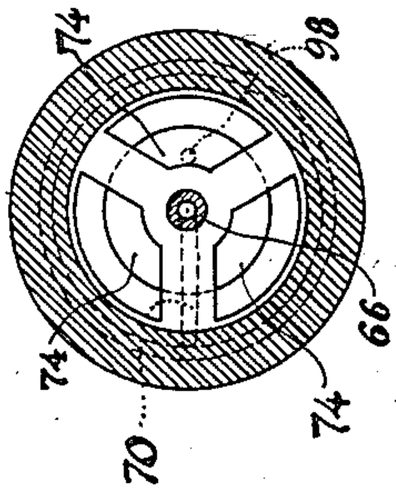

FIG. 6.

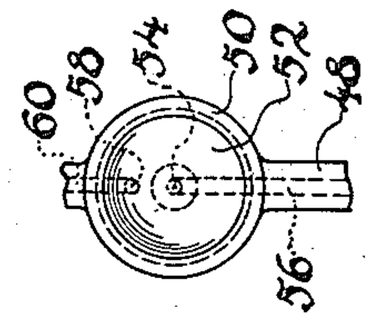

FIG. 4.

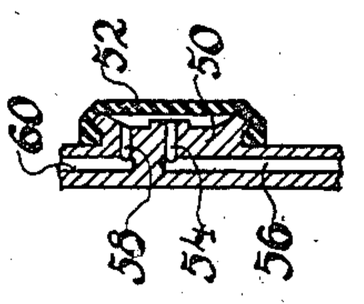

FIG. 5.

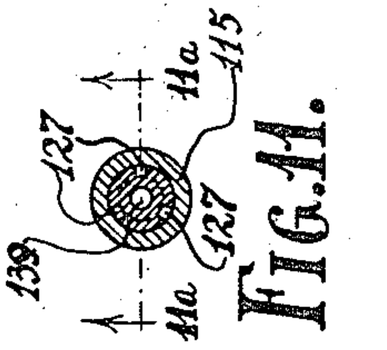

FIG. 11.

FIG. 12.

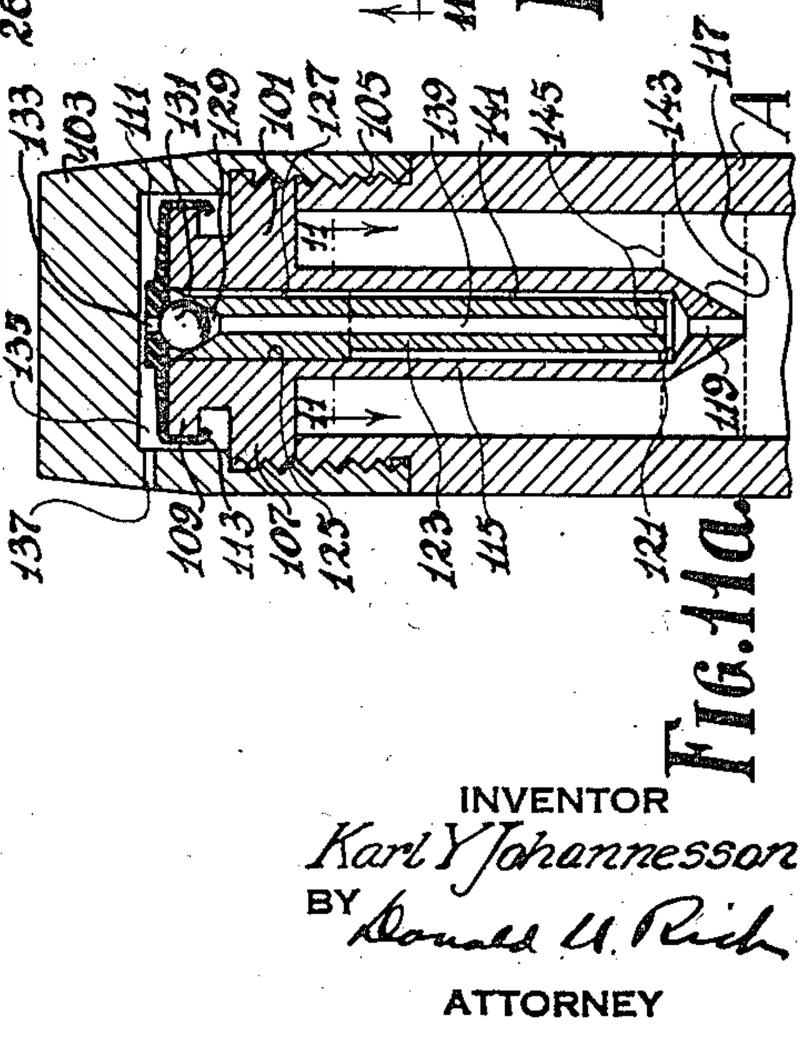

FIG. 10.

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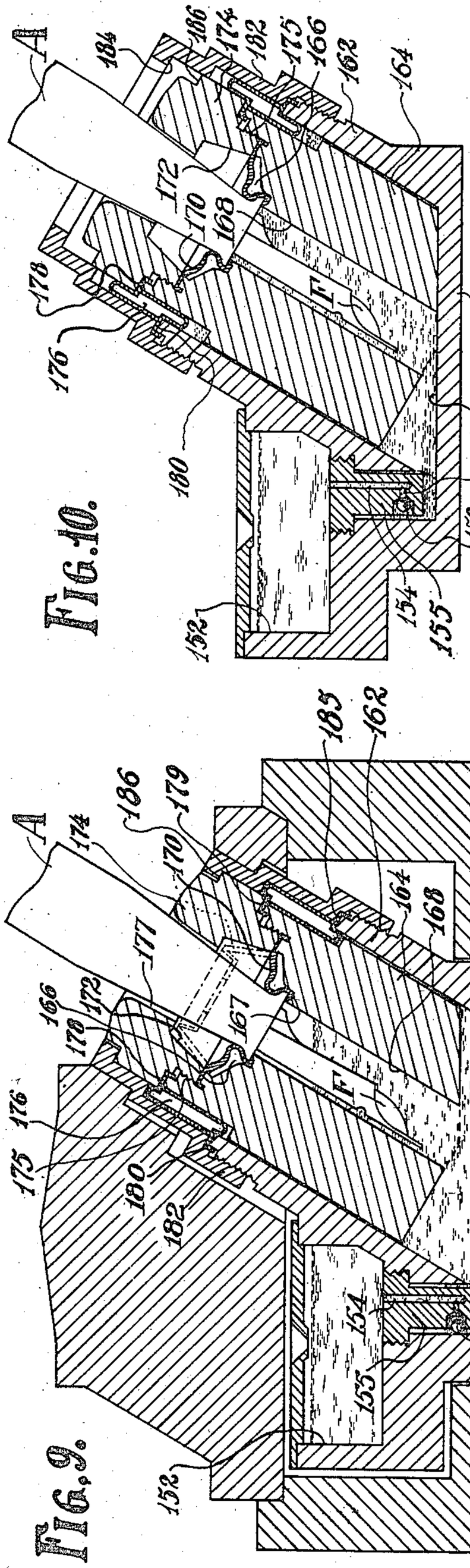

FIG. 10.

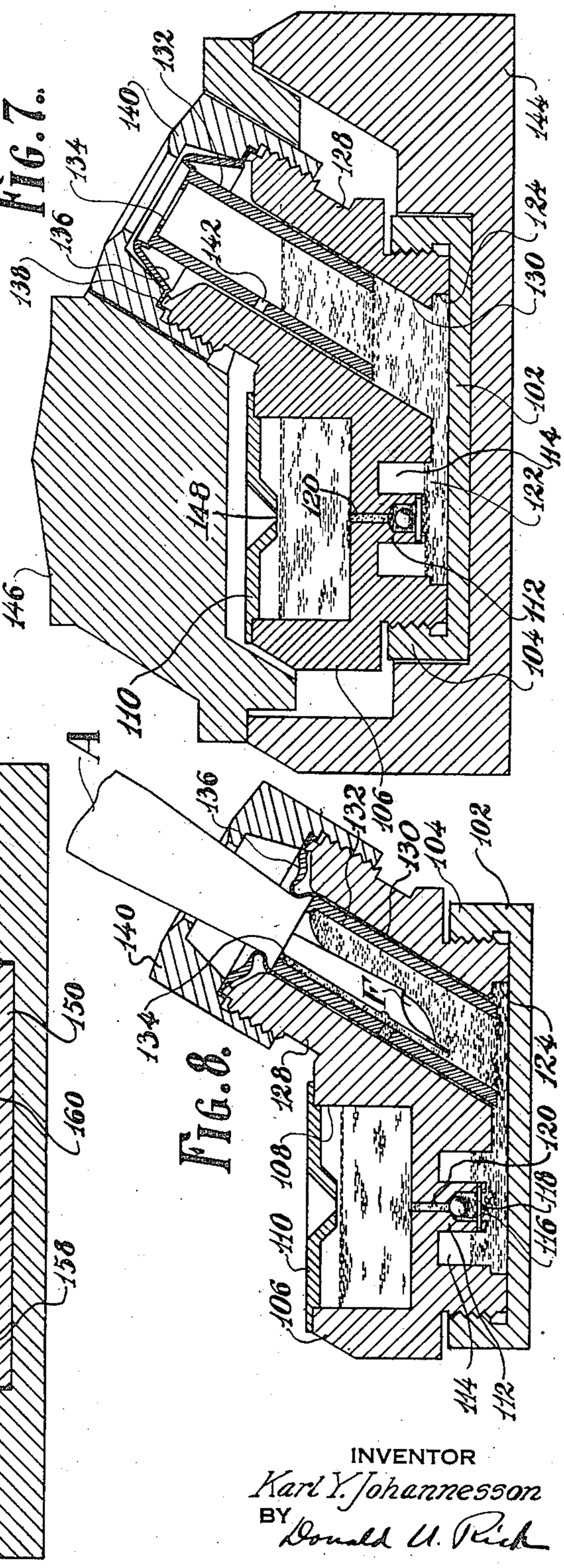

FIG. 7.

FIG. 9.

FIG. 8.

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Patented Aug. 20, 1935 2,011,639

UNITED STATES PATENT OFFICE

2,011,639

FOUNTAIN PEN DESK SET

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Application July 20, 1933, Serial No. 681,265

19 Claims. (Cl. 120—64)

This invention relates generally to fountain pens and has particular reference to pens and filling apparatus therefor.

One object of this invention is the provision of a new and improved desk set comprising a fountain pen and a holder therefor having means for filling the pen with ink.

Still another object of this invention is the provision of a new and improved ink well with which a fountain pen is adapted to cooperate for filling the pen.

A further object of this invention is the provision of a fountain pen which is so constructed as to allow air to leave the pen barrel under certain conditions, but in which the outer air is prevented from entering the barrel.

A still further object of this invention is the provision of a fountain pen, the barrel of which is adapted to be supplied with ink by pressure whereby no vacuum is created above the ink in the barrel.

A still further object of this invention is the provision of a desk set including an ink well or filling apparatus and a fountain pen, which set is simple in construction, easy and inexpensive to manufacture and strong and durable in operation.

Other objects and advantages of this invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a longitudinal sectional view through the upper portion of a fountain pen showing one form of the present invention;

Fig. 2 is a sectional view through the upper portion of a pen showing a modified form of the invention;

Fig. 3 is a sectional view through the upper portion of a pen showing still another modification of the invention;

Fig. 4 is a view of one of the valves shown in Fig. 2, the view being taken on the line 4—4, Fig. 2;

Fig. 5 is a fragmentary detail view of one of the valves shown in Fig. 2, the view showing the valve in open position;

Fig. 6 is a view taken on the line 6—6, Fig. 3;

Fig. 7 is a sectional view of one form of the ink well or filler;

Fig. 8 is a sectional view of the ink well or filler shown in Fig. 7 with the outer casing or housing removed and showing a pen in position therein;

Fig. 9 is a view similar to Fig. 7 but showing a modified form of ink well or filler with a pen in position therein;

Fig. 10 is a sectional view of the ink well or filler shown in Fig. 9 with the housing therefor removed and showing a pen in filling position;

Fig. 11 is a sectional view of a portion of another modified form of the invention, the view being taken on the line 11—11, Fig. 11*a*;

Fig. 11*a* is a longitudinal sectional view through the upper portion of a pen showing the form of the invention shown in Fig. 11, the view being taken on the line 11*a*—11*a*, Fig. 11, and

Fig. 12 is a sectional view of a modified form of ink well or filling apparatus.

Referring now more particularly to the drawings Figures 1, 2, 3 and 11*a*, each disclose the upper portion of a fountain pen, these figures disclosing several modifications of the device. In the construction shown in Fig. 1 the pen comprises a barrel indicated generally at "A", the upper end portion of which is internally threaded as shown at 2 for securing a cap or end closure 4 the interior of which latter is provided with a bore 6 in which is fitted the cylindrical stem 8 of a vent member 10 which is seated on a shoulder 12 formed in the barrel "A"; the end closure member 4 bearing against the vent member 10 to secure the latter in position. As clearly shown in Fig. 1 the stem 8 of vent member 10 does not completely fill the bore 6, the upper portion of the latter constituting a valve chamber 7 in which is positioned a valve 14 retained by a spring 16 to normally close the upper end of a bore 18 which extends through the vent member 10 and through a tube 20 depending therefrom and provided at its lower end portion with a valve chamber 24 in which is seated a ball check valve 22 retained by a pin 26. Formed in the cap or end closure member 4 and extending from valve chamber 7 to the atmosphere is an air duct 28.

In the form of the invention shown in Figs. 2, 4 and 5 the upper end portion of the barrel "A" is closed by means of a vent member in the form of a valve housing 30 which includes a base member 32 seated on a shoulder 34 formed in the barrel "A" and a cylindrical bushing 36 extending upwardly from the base member 32 and arranged within a recess formed in an end closure or cap 38, the interior of the bushing constituting an air chamber 39. The upper end portion of the recess constitutes a valve chamber 40 in which is positioned a valve 42 retained in seated position on the upper end portion of bushing 36 by a spring 44. Leading from the valve chamber 40 to the atmosphere is an air duct or vent 46. The valve housing 30 also includes a tube 48 which depends from the base member 32. A portion of the tube

48 is enlarged to form a holding element 50 for a flexible and elastic diaphragm 52 which is adapted to close an air port or duct 54 leading from the longitudinal bore 56 in the lower portion of the tube. The duct 54 is formed in the enlarged portion 50 and the latter is also provided with a duct 58 which communicates with an air duct 60 in the upper portion of the tube 48 which leads into the interior of the bushing; the air chamber 39. In effect, the construction of the tube, more particularly the enlargement 50, the ducts 54 and 58, the diaphragm 52 and the air chamber 39 constitutes a valve arrangement which is operative as more fully described hereinafter.

In the form of the invention shown in Fig. 3 the upper end portion of the barrel "A" is provided with an internal shoulder 62 which supports a multi-part valve member "B" comprising a base member 64 from which tube 66 depends, the tube 66 being provided with a bore 68 which communicates with a bore 70 formed in the lower valve member 64 and extending upwardly at an incline therethrough. The valve member 64 is provided with a central depression 72 in direct communication with the interior of the barrel through a plurality of relatively large apertures 74. In effect, the valve member 64 is substantially wheel-shaped in plan, depression 72 being formed in the hub portion thereof and the apertures 74 being defined between what may be termed spokes; the latter being connected by a rim seated on shoulder 62. The bore 70 is formed in one of the spokes as shown clearly in Fig. 6. The depression 72 is covered by an elastic diaphragm 76 covering the lower valve member 64; said diaphragm being marginally flanged as shown at 78 and being retained in position by the upper valve member 80. The diaphragm 76 is provided with an air port 82 which communicates with an air duct 84 formed in the upper valve member 80 and discharging into a recess 86 formed in the lower surface of the upper valve member 80 and covered by the beforementioned diaphragm 76. The upper valve member 80 also includes a cylindrical bushing 88 which extends upwardly therefrom and is arranged within a recess formed in a cap 90 secured to barrel "A" and bearing against the upper valve member 80 to secure the multi-part valve member "B" and diaphragm 76 in assembled relation. The bushing 88 does not extend the full depth of the recess in the cap 90 whereby to provide a valve chamber 92 in the cap 90 in which is a valve 94 supported on the upper end of the bushing 88 and normally retained in seated position by a spring 96. The recess 86 is in communication through a port 98 with the interior of the bushing 88; said interior constituting an upper air chamber 89, which is closed by the valve 94. The valve chamber 92 is in communication with the outside atmosphere through a vent 100 formed in the cap 90.

In the form of the invention shown in Figs. 11 and 11*a* the barrel "A" at its upper end supports a vent member indicated generally at 101 which is threadedly engaged within a cap or end closure 103; the latter being secured to the barrel by being threaded thereto as shown at 105. The vent member 101 comprises a supporting portion 107 which rests on the upper end of the barrel "A" and is formed with a head 109 with which an elastic diaphragm 111, formed of rubber or the like, is grippingly engaged as shown at 113. Depending from the supporting portion 107 of vent member 101 is an outer tube 115 provided with a reduced lower end portion 117, substantially nozzle shaped and having a port 119 therethrough which communicates with the interior or bore 121 of said tube. The bore 121 extends entirely through the vent member 101 and has an inner tube 123 arranged therein, said inner tube providing a longitudinal bore 139. The tube 123 at its upper end portion is of a diameter such as to snugly fit within the bore 121 whereby said inner tube is held in position as shown at 125, while the lower end portion of the tube 123 is reduced in diameter and concentrically arranged within the outer tube 115 whereby to provide an air space 141 between the inner and outer tubes as clearly shown in Fig. 11*a*. The upper end portion 125 of the inner tube 123 is provided with a plurality of longitudinal air ports 127 therethrough which connect the air space 141 with the space between the diaphragm 111 and the upper end portion of the vent member 101. The inner tube 123 is provided at its upper end portion with a tapered valve seat 129 in which is positioned a ball check valve 131 adapted, under certain conditions, to close a port 133 formed in the diaphragm 111, and the cap 103 is provided with a recess 135 in which the head 109 of vent member 101, and the diaphragm 111 are arranged. A duct 137 extends through the cap 103 to the atmosphere to vent air from the recess 135.

The lower end portion of the fountain pen shown herein may be conventional and is so shown, as any desired type of point and feeder bar may be used with the ink well or filling apparatus now to be described. Referring to Figs. 7 and 8, which disclose one form of the invention, it can be seen that the filling apparatus comprises a base 102 having an upstanding annular flange 104 to which is secured a reservoir member 106 having a well 108 for receiving ink, said well being provided with a cover 110 and having a valve fitting 112 arranged within a recess 114 formed in the lower portion of the reservoir member 106, the fitting having a non-floating check valve 116 retained by a pin 118 and adapted, under certain conditions, to close a duct 120 leading from the well 108 through the fitting, said duct being adapted to supply ink to a sump 122 formed by a recess 124 in the bottom of the reservoir member 106 as shown clearly in Fig. 7.

Formed as a part of the reservoir member 106 is a cylinder 126 constituting a pen receiving member, said cylinder being provided with a central bore 130 in which is mounted a cylindrical plunger tube 132 the upper end portion of which is provided with a pen receiving opening 134. Connected with the tube 132 at its upper end portion in any suitable or desired manner is a pen gripping member 136 formed of elastic material, substantially frusto conical in form and surrounding the upper end portion of the tube 132 and provided with a securing flange 138 arranged on the upper end portion of the member 128 and secured by a nut 140, the latter being internally recessed to accommodate the pen gripping member 136. The tube 132 is provided with an air port 142 which, when the tube is in its normal position as indicated in Fig. 7 is above the level of the ink in the well. The well just described is preferably arranged within a housing 144 provided with a removable cover portion 146 which, when removed, permits access to the ink in the well 108 through an opening 148 formed in the cover 110. Obviously, the apparatus may be supplied with ink through opening 148.

Figs. 9 and 10 disclose a modified form of ink well or filling apparatus comprising a base 150 so formed as to hold ink and having an ink well 152 formed therein from which ink may pass through an ink duct 154 in a valved fitting 155 secured in a suitable opening in the base member 150 as clearly shown in the drawings. The fitting 155 includes a ball check valve 158 which controls the flow of ink from the well 152 (through duct 154 and passage 156) to the sump 160. It is to be understood that the word "sump" is used for convenience in description as the member 150 is so formed that it is adapted to hold ink. The member 150 also includes a cylinder 162 in which is slidably mounted a plunger 164 having a central depression 166 in its upper end portion and a longitudinal bore 168 extending therethrough, the central depression being so formed as to provide an annular shoulder 167 at the upper end of the bore 168. Secured to the upper end portion of the plunger 164 is an elastic pen grip member 170, which, when in its normal position as indicated in dotted lines in Fig. 9, is arranged within a recess 172 formed in the lower end portion of a plug 174 threadedly connected as at 175 with the plunger 164 and serving to secure the pen grip 170 in position. The plug 174 is provided with an aperture or pen receiving opening 177 which communicates with the recess 172, and it will be apparent that when the pen barrel "A" is inserted through the aperture and through the pen grip member 170 to the position shown in Figs. 9 and 10, it closes the upper end of bore 168 of plunger 164, the pen grip member being deflected from the position shown in dotted lines in Fig. 9 to that shown in full lines in said figure to engage the shoulder 167 and to sealingly engage the barrel "A".

The upper end portion of the plunger 164 is reduced in diameter to receive a hollow, cylindrical torus 176 which is provided with upper and lower oppositely extended securing flanges 178 and 180 respectively. The upper flange 178 of the torus overlaps the upper end portion of the plunger 164 and the plug 174 is so formed as to provide an annular shoulder 179 which engages the flange 178 and secures the same between the plunger and plug. The torus 176 is enclosed by a screw cap 182 secured to the upper end portion of the cylinder 162 of the well 150 as clearly shown in said Figs. 9 and 10. With the construction just described it is apparent that the torus 176 is retained within a housing formed by the reduced upper end portion of plunger 164 and the screw cap 182 and for further securing the torus the screw cap is provided with an inwardly extending annular shoulder 185 which serves to clamp the lower flange 180 of the torus between the upper end of the cylinder 162 and the screw cap. The screw cap 182 is provided with an inwardly extending annular shoulder 184 with which a shoulder 186 formed on the plug 174 is adapted to cooperate to limit upward movement of the plunger, the shoulder 186 being formed by reducing the diameter of the outer or upper end portion of the plug 174.

Fig. 12 also discloses an ink well or filling apparatus, this form being a modification of those shown in Figs. 7 to 10 inclusive and comprising an ink receiving base 188 which is closed by a removable cover member 190, the cover includes a pen receiving stem 192 having an upstanding cylindrical portion 194 which is interiorly threaded at 196 in such a manner as to cooperate with the external threads 198 on the barrel of a fountain pen of the type shown herein. The pen receiving portion 192 also includes a tubular stem 202 the diameter of which is less than the internal diameter of the upstanding portion 194 whereby to provide an annular shoulder 204 against which the lower end portion 206 of the pen barrel is adapted to contact in a sealing manner to prevent escape of ink into the interior of portion 194 when filling a pen.

The cover 190 is connected to the ink receiving base 188 in an air tight manner and is provided with an opening in which is secured a plug 208 having central depression 210 in its lower surface and an opening 212 extending through said plug into the recess. The plug 208 secures a pump element 214 of elastic material such as rubber or the like, having an air opening 216 therein which is normally closed by an elastic valve member 218. The pump 214 includes a button member 220 having an opening 222 therethrough which is in communication with a tube 224 extending through the opening 212 formed in the plug 208. As clearly shown in Fig. 12 the lower end portion of the tube 224 is provided with a valve plate 226 secured as by a fastener 228 to the plug 208 and said valve plate 226 is adapted to close the opening 212 under certain conditions as hereinafter more clearly described.

From the description above it is believed that the construction shown in the drawings will be apparent to those skilled in the art. The pens shown in the drawings are each adapted to be filled with ink under pressure by either of the filling apparatus shown in Figs. 7, 8, 9, 10 and 12, and when the lower end portion of a pen is inserted into a filling apparatus as indicated in the beforementioned drawings or figures, ink will be forced under pressure through the feeder bar "F" into the barrel "A"; the operation of the filling apparatus being hereinafter more fully described.

As will be more fully described in connection with the operation of the filling apparatus, ink is forced into the pen barrels "A" of each of the pens shown and described under pressure and, in the form shown in Fig. 1, as the ink enters the barrel "A" the air within the barrel above the ink and within the tube 20 will be compressed until the air pressure reaches a point sufficient to unseat the valve 14 and permit escape of air to the atmosphere through air duct 23 following which the valve 14 will be re-seated by means of spring 16 and the operation just described repeated until the ink within the barrel reaches the level of the valve 22. The valve 22 is buoyant and, when the ink reaches the same said valve will rise until it closes the bore 18. When the bore 18 is closed by the valve 22 it will be obvious that ink will not flow into the bore, nor can any air escape through the bore 18 and therefore, as ink continues to be forced into the barrel "A", the pressure of the air in the barrel above the ink will increase until it reaches a point where no more ink can be forced into the barrel. The pressure on the ink within the barrel will obviously be in excess of atmospheric pressure and it is apparent that the air in the barrel above the ink will expand until it reaches atmospheric pressure and during such expansion a certain quantity of ink will be forced out of the pen barrel until the pressure within the barrel balances atmospheric pressure, the ink level lowering until the valve 22 lowers to uncover or open bore 18. This is the normal level of the ink in the barrel when filled to capacity,

and being somewhat below the valve 22 it is apparent that the pen when in use, may held in any position without ink passing into the tube 20.

In the form of the invention shown in Fig. 2, as ink enters the barrel "A" under pressure by operation of the filling apparatus hereinafter described, the air within the barrel "A" of the pen is compressed which obviously will also compress the air in tube 48 and, because diaphragm 52 is normally in the position shown in Fig. 5, being undeflected, the air in bore 60 and chamber 39 will be compressed. Normally an air passage is established through bore 56, ports 54 and 58 and bore 60 to air chamber 39 and the diaphragm 52 is not deflected because the same air pressure prevails on both sides of the diaphragm 52. This, obviously, is the condition when the ink level in the barrel "A" is below the lower end of the tube 48. Compressing the air as mentioned above will cause the air in chamber 39 to reach a point in excess of the action of the spring 44 and valve 42 will then be unseated to permit escape of air from chamber 39 to the atmosphere through port 46, following which the valve 42 will be re-seated on the end of bushing 36. This action will be repeated until the ink closes the lower end of tube 48 to form two independent and non-communicating columns of air, one within the barrel "A" outside of tube 48 and the other within the tube 48. As ink continues to be forced into the barrel it will also pass into the tube 48, but the level of the ink will rise more quickly in the bore 56 of tube 48 than in the barrel outside of the tube for the reason that the air volume in chamber 39 and bores 60, 58, 54 and 56 decreases less for a definite rise of ink in bore 56 than does the air volume in the barrel "A" for the same rise of ink level. This is due to the fact that the air volume in bore 56 is substantially less than the air volume in chamber 39.

In effect, as the ink level rises, the air pressure in barrel "A" increases more than the air pressure in air chamber 39 until the pressure of the air against valve 42 and within chamber 39 reaches a point in excess of the combined action of the spring 44 and the atmosphere whereupon valve 42 will unseat to permit venting of the air from chamber 39. Such venting of the air, as just described causes a sudden drop of air pressure in chamber 39, and the resultant air pressure will be less than the pressure of the air within the barrel "A" outside of tube 48 which will cause the diaphragm 52 to deflect to the position shown in Fig. 2 where port 54 is closed and severing communication between bore 56 and chamber 39. Continued entrance of ink under pressure into the barrel "A" after port 54 has been closed by diaphragm 52 will cause ink to rise in bore 56 and the barrel "A" until the pressure of air above the ink in bore 56 increases to a point where it balances the pressure of the air on the ink in barrel "A". Increase in ink level within the barrel and the bore 56 obviously increases the respective air pressures in the bore 56 and barrel "A" but because the pressure of the air within bore 56 is less than that in the barrel "A" the diaphragm 52 will remain in a deflected position such as shown in Fig. 2.

When inflow of ink into the barrel stops as determined by air pressures within the barrel "A" and tube 48, a certain amount of ink will be forced out of the barrel due to the expansion of the air trapped above the ink in the barrel and in the bore 56 until the pressure of the air in the pen balances the outside atmospheric pressure which will occur when the ink in the pen has receded to a level somewhat lower than the end of tube 48. It is obvious that the diaphragm 52 will again assume the position illustrated in Fig. 5 as soon as the receding ink again opens bore 56 whereby identical air pressure on opposite sides of diaphragm 52 are established.

In the form of the invention shown in Figs. 3 and 6 as ink is forced into the barrel the air in the latter and in air chamber 89 is compressed in the same ratio because there is direct communication between the interior of the barrel and said air chamber through ducts 68, 70, 82, 84 and 98; the diaphragm 76 being retained in its normal and undeflected position because the air pressure on opposite sides thereof is uniform. When the air pressure within chamber 89 is sufficient, the valve 94 is unseated to permit venting of excess air through port 100 and this operation is repeated until the ink reaches the lower end of tube 66 to close bore 68 to separate the air in barrel "A" from that in chamber 89. With the bore 68 closed against passage of air therethrough it is obvious that the pressure of the air within the barrel "A" will increase beyond that in the chamber 89. Ink will be forced upwardly within bore 68 which will compress the air thereabove to a point such as to cause the air pressure within chamber 89 to unseat valve 94 thereby causing a sudden drop in air pressure within such chamber 89 to a point below the pressure of the air in barrel "A" and, the air in barrel "A" will act through the openings 74 against the diaphragm 76 to close a duct 84.

With duct 84 closed as just described, the pressure of the air on the ink in barrel "A" causes ink to rise in bore 68 thereby compressing the air thereabove until the pressure thereof balances the air pressure in barrel "A" whereupon it will be apparent, the diaphragm will be returned to its normal or undeflected position, and chamber 89 be in communication with bore 68.

In the form of the invention shown in Figs. 11 and 11*a* it can be seen that normally the port 133 in the diaphragm 111 is closed by the ball valve 131. It can also be seen that with the parts in their normal position as shown in Fig. 11*a* the ball valve 131 closes port 139 against escape of air therethrough. The specific arrangement shown in Fig. 11*a* provides three columns of air; one within the barrel "A", another indicated at 141 around the tube 123, and a third, the bore 139 of the inner tube 123 and these columns are normally at a uniform pressure. This condition prevails as long as communication exists between them and the interior of the barrel at the lower end of tube 123 by means of the port of opening 119 in the nozzle portion 117 of tube 115. As ink enters the barrel "A", the air in these three columns is compressed; the air in column 141 passing through ports 127. When sufficient pressure has developed beneath the diaphragm 111, the latter will be deflected to uncover port 133 to permit escape of air through said port to the atmosphere through vent 137. As long as the ink level remains below the nozzle 117, the valve 131 will remain seated to close the upper end of bore 139. When, however, the ink reaches the lower end of the nozzle 117 as shown by the ink level indicated in dotted lines at 143, the lower end of the nozzle 117 is closed and air communication between the interior of the barrel "A" and the vent member is severed. Increase of ink in the barrel "A" to the level diagrammatically indicated by a broken line at 145 establishes three

independent columns of air, the pressure of which will increase at the same ratio as ink continues to be forced into the barrel "A". This increasing air pressure will become sufficient to deflect diaphragm 111 to allow air to escape through the port 133 from the column 141 causing the air pressure in the same to decrease and the ball valve 131 to be lifted from its seat 129 by the higher pressure in air column 139 to close port 133 in diaphragm 111 whereby preventing further air-escape. Immediately after the closing of port 133 by ball valve 131 the pressure of the air columns 139 and 141 again will increase due to ink being pressed into bores 139 and 121 by the higher pressure of the air above the ink in the barrel "A" outside of tube 115. It will be apparent, therefore, that the air pressure in columns 139 and 141 will retain the ball valve 131 in its elevated position closing port 133 in the deflected diaphragm. It is apparent that above described movements of diaphragm 111 and valve 131 and changes in air pressures and ink levels will occur in immediate succession and in effect almost simultaneously. As the ink continues to be forced into the pen barrel the air above the ink becomes further compressed until a maximum quantity of ink has been admitted into the barrel. Expansion of the air within the barrel against the ink causes a reversal of flow of the ink out of the pen barrel until the ink level has receded to its normal which is somewhat below the nozzle 117. The ball valve 131 will drop to its seat 129 and the diaphragm 111 will assume its normal position as soon as the air pressure within the vent member 101 has dropped sufficiently due to the lowering of the ink level in the pen and within the columns 139 and 141.

From the description above it can be seen that the present invention has provision for filling a pen, the means for effecting this being such as to automatically, by air pressure, control the amount of ink to be contained in the barrel. In Fig. 1 this is effected by the closing of bore 18 in tube 20 by the valve 22; in Fig. 2 by the deflection of diaphragm 52 by air pressure within the barrel in excess of that within the valve arrangement whereby said diaphragm closes port 54 against escape of air from bore 56 to bore 60; in Fig. 3 by deflection of diaphragm 76 and in Fig. 11*a* by the closing of port 133 by valve 131 so as to prevent escape of air from the vent unit 101 to the atmosphere. In each instance, subsequent to operation of the valves to shut off further venting of air, ink continues to be forced into the barrel of the pen as the result of the cooperation of the pen with the desk set in a manner presently to be described but the pressure within the pen barrel will automatically become balanced with atmospheric pressure due to expansion of the air within the barrel to exclude ink in excess of that required for normal filling of the pen.

Referring now to the filling apparatus and more particularly to the form shown in Figs. 7 and 8, the lower end portion of a pen is engaged with the upper end of the tube 132. Normally, the tube 132 is in the position shown in Fig. 7. The pen is inserted through the aperture 134 in the upper end of the tube 132 until the end of the barrel contacts with the upper end of said tube as shown in Fig. 8. Downward pressure on the barrel "A" obviously forces the tube 132 downwardly in portion 128 which will cause the pen grip member 136 to sealingly engage the end portion of the barrel "A" in a manner such as shown in Fig. 8. The pen grip member 136 has substantially a hinge action as will be evident from the drawings and will act to forcibly hold the tube 132 with its associated pen against retraction of the tube 132 in portion 128. The emersion of the plunger tube 132 into the ink places the ink under pressure as will be apparent which will force the ink through the conventional openings in the feeder bar "F" into the pen barrel "A". Placing the ink under pressure as just described causes the ink to exert pressure against the ball valve 116 to close the port 120. The recess 114 functions as an accumulator of the pressure set up against the ink and also as a storage chamber for ink displaced by reason of the downward movement of the plunger tube 132. It is to be understood that the recess 114 is of such dimensions as to accommodate substantially the entire amount of ink displaced by the action of the plunger tube 132. Since the valve 116 is of the non-floating type, it will drop to its normal position subsequent to impact of the ink thereagainst whereby ink may flow through the duct 120 into the well 108; this flow of ink from the sump 124 to the ink well continuing until the air within recess 114 has expanded to substantially atmospheric pressure. The pressure on the ink in the sump 124 obviously causes the ink to flow through the feeder bar into the pen barrel, the ink continuing to flow into the barrel until the pen has been filled to the proper level as described hereinbefore with reference to the operation of the pens shown in Figs. 1, 2, 3 and 11*a*. As the air pressure in the recess or accumulator 114 drops as the result of passage of ink into the well 108, it will be apparent that ink will flow out of the barrel "A" of the pen until the air pressure in the barrel "A" above the ink balances the atmospheric pressure acting on the ink in the ink well 108 whereupon no further ink will be forced out of the barrel "A" and the pen will have been filled to its proper level.

It will be obvious to those skilled in the art that the filling operation of either of the pens shown and described is entirely automatic, the only manual operation required being simply that of the insertion of the pen into the plunger tube 132 and the force exerted to cause downward movement of the plunger tube 132 to the position shown in Fig. 8. Upon withdrawal of the pen from the desk set or filling apparatus the pen grip member 136 will assume its normal position shown in Fig. 7 and during downward movement of the tube 132 the port 142 will enter the ink as shown in Fig. 8. Upon withdrawal of the pen and upward movement of the tube 132 the bore 142 will be open to the atmosphere thereby allowing outside air to pass below the pen grip member 136 to relieve the vacuum created by the upward movement of the tube 132.

In Fig. 9 a pen is shown inserted into the bore 168 of plunger 164 and the pen grip member 170 is deflected from its normal position to sealingly engage the lower end portion of the barrel "A". In this particular construction the pen point and feeder bar are retained in the ink so as to be continually moist for use. The air within the torus 176 has sufficient initial pressure to maintain the plunger 164 in its outermost position as shown in Fig. 9 and, with the parts as shown in Fig. 9 there is substantially no pressure on the ink within the ink well member or sump 160. It will be apparent that without any pumping action or downward movement of the plunger 164 the pen may be in-

serted for storage in the bore 168 and firmly held in position by means of the pen grip member 170. Downward pressure on the barrel "A" of the pen will cause downward movement of the plunger 164 to the position shown in Fig. 10 which places the ink in the desk set member under pressure whereby it is forced upwardly in the barrel "A" through the feeder bar "F". Downward movement of the plunger 164 as described will cause the ball valve 158 to close the passage 156 whereby the ink in sump 160 is retained under pressure.

The torus 176 not only serves as a sealing element between cylinder 162 and plunger 164 but also functions as a means for returning and maintaining the plunger in its normal or extended position, and it can be seen that deflection or distortion of the torus from its normal position (Fig. 9) to that shown in Fig. 10 effects an increase in the pressure of the air therewithin so that upon release of the pen barrel "A" the air pressure within the torus causes upward movement of the plunger 164 to its normal or extended position This obviously relieves the ink within the sump 160 of pressure and permits the valve 158 to leave the port 156 whereby ink from the well may pass through ports 154 and 156 into the sump 160 to replenish the ink in the latter to an amount in accordance with that forced into the pen barrel.

In Fig. 12 the pen barrel "A" is threadedly engaged or connected with the filling apparatus, in which position the feeder bar "F" and pen point are arranged in the ink in the stem 202, the latter functioning as a supply tube. Element 214 constitutes a pump element which, when pressed downwardly causes air to be forced into the base 188 through the opening 212, actuation of said pump element causing the air to unseat the valve member 226. Obviously, no air can escape from the well 188 through tube 224 so long as the opening 222 therein is kept closed by means of an operator's finger as shown in Fig. 12. The air within the well 188 causes operation of the valve 226 to close the opening 212 as the pump element 214 moves upwardly; this upward movement of the pump element permitting air to pass through port 216, opening valve 218 so that further downward movement of the pump element 214 forces additional air past valve 226 through the opening 212. The pump element 214 therein is adapted to build up a pressure within the well 188 on the ink therein which will cause ink to be forced through the stem 202 and through the feeder bar "F" within the barrel "A".

The combined action of either of the pens shown and described with the filling apparatus shown and described produces a desk set which is highly efficient in operation; the pens being retained filled to their normal capacity by the simple expedient of forcing the pen and the plunger downwardly whereby to place the ink in the filling apparatus under pressure so that it passes into the pen barrel; the proper amount of ink retained in the pen or forced into the pen being automatically regulated by the valve arrangements shown in Figs. 1, 2, 3 and 11*a*.

The drawings herein illustrate certain embodiments of the present invention, but it is to be understood that they are for illustrative purposes only and various changes in the form and proportions of the specific constructions may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A desk set of the character described comprising a pen filling apparatus holding ink, means shiftable into said apparatus and so formed as to place the ink under pressure, and a pen for actuating said shiftable means and receiving ink from said apparatus, said pen being so formed as to include means for venting air only therefrom upon entrance of ink.

2. A desk set of the character described comprising a pen filling apparatus holding ink, tubular pen receiving means shiftably mounted in said apparatus, and a pen for sealingly engaging said pen receiving means and for shifting said means into the apparatus whereby to place the ink therein under pressure to cause it to enter the pen, said pen including a valve controlled vent means for air, the valve thereof being operative in response to ink level within the pen to control admission of ink into said pen.

3. In a desk set of the character described, the combination with a filling apparatus holding ink and having plunger means operative to place the ink under pressure, of a pen for actuating said plunger means, air vent means in said pen, and valve means associated with the air vent means and operative in response to variations in ink level in the pen to close said air vent means so as to trap air within the pen whereby to control passage of ink to the pen.

4. A desk set of the character described comprising a filling apparatus holding ink and having a plunger means extending into the ink adapted when actuated in one direction to place the ink under pressure, and a pen engageable with the plunger means in sealing relation for actuating said plunger means whereby ink is forced under pressure into the pen, air vent means in the pen, and a valve associated with the vent means and operative in response to variations in level of the ink in said pen to control escape of air through the vent means.

5. A desk set of the character described comprising a filling apparatus holding ink and having a plunger means extending into the ink adapted when actuated in one direction to place the ink under pressure, and a pen engageable with the plunger means in sealing relation for actuating said plunger means whereby ink is forced under pressure into said pen, air vent means in the pen, said air vent means being so formed and arranged as to receive ink thereby closing said air vent means against admission of air from the interior of the pen, and a valve adapted to close said air vent means, said valve being operative in response to air pressure within the pen in excess of the pressure of the air within the vent means.

6. In a device of the kind described, an ink reservoir member having a well, a pen receiving portion having a bore, a sump in communication with the pen receiving portion, valve controlled means for admitting ink from the well to the sump, and a plunger member in the bore of the pen receiving portion for receiving the point and feeder bar of a pen to be filled, a gripping member secured to the upper end portion of the plunger member and so formed as to closely grip the lower end portion of a pen, said plunger member being axially shiftable in the bore of the pen receiving portion by said pen to compress the ink in said sump whereby it is forced into the pen under pressure.

7. In a desk set, an ink holding member provided with a plunger having its upper end so arranged as to be engaged by a pen whereby said plunger may be shifted into the ink, and resilient means connected with the plunger and so formed as to grippingly engage the pen to hold the latter

when the plunger is shifted and to tend to hold the plunger in its shifted position.

8. In a desk set, an ink holding portion provided with a plunger having its upper end portion formed to be engaged by a pen whereby it may be shifted by said pen into the ink, and resilient means adapted to sealingly engage the pen when the plunger is in its shifted position in such a manner as to prevent movement of the plunger in the reverse direction.

9. In a desk set, an ink holding portion provided with a plunger normally retained in extended position relative to the ink holding portion and having its upper end formed to be engaged by a pen whereby said plunger may be shifted into the ink, and resilient means connected with the plunger adapted to grip the pen when the plunger is shifted as beforementioned in such a manner as to act against the plunger such as to tend to restrain the latter against shifting in the reverse direction.

10. In a desk set, a pen filling apparatus holding ink and provided with a plunger having its upper end portion formed to be engaged by a pen whereby said plunger may be shifted by the pen into the ink, and a pen grip member connected with the plunger and adapted to sealingly engage the pen when the plunger is shifted, said member being so formed as to tend to hold the plunger in the ink when in engagement with the pen.

11. In a desk set, an ink holding member having a cylinder and a plunger shiftably mounted therein, said plunger having its upper end portion formed to be engaged by a pen whereby said plunger may be shifted from its outer position by said pen into the ink to fill said pen, a pen grip member connected with the plunger and so formed as to sealingly engage the pen, said pen grip member being so formed as to tend to hold the pen in the ink when it is in engagement with the pen, and resilient means connected with the cylinder and plunger and tending to hold the plunger in its outer position.

12. In apparatus of the class described, an ink holding member comprising a reservoir and a well portion in communication therewith, a valve adapted to isolate the well from the reservoir, said reservoir including a chamber adapted to hold ink, a plunger slidable in said chamber and in uninterrupted communication with the reservoir, and resilient means connected with the plunger and so formed as to grippingly engage a pen to hold the latter when the plunger is shifted in the chamber.

13. In apparatus of the class described, an ink holding member having a reservoir and a well in communication therewith, a cylinder forming a part of said reservoir, a pen-carrying plunger slidably mounted in the cylinder and in free and uninterrupted communication with the the reservoir, resilient means connected with the plunger and so formed as to grippingly engage a pen to hold the latter as the plunger is shifted in the cylinder by said pen, and a check valve adapted to close communication between the well and reservoir upon shifting movement of the plunger in the cylinder whereby the ink in said reservoir will be retained under pressure to force it into the pen.

14. An ink receptacle having an ink reservoir and a cylinder in free and uninterrupted communication therewith, a well member holding ink, a plunger in said cylinder, and means including a check valve for controlling passage of ink from the well member to the reservoir upon insertion of a pen into said plunger and shifting of the latter in the cylinder to isolate the well member from the reservoir whereby the ink in the reservoir is placed under pressure to force a charge of ink into the pen.

15. The combination of an ink receptacle and a means for forcing ink into fountain pens through the pen point end of the same, of a fountain pen having an ink holding barrel, a pen point at one end and an air vent means at the opposite end of said pen, said air vent means including a valve operative in response to variations in level of the ink in said pen to control escape of air through said vent means.

16. In a desk set, an ink holding member having a chamber and a plunger shiftably mounted therein, means sealing the joint between the chamber and plunger, said plunger having its upper portion formed to be engaged by a pen whereby the plunger may be shifted by said pen, and means associated with said plunger to hold the pen in sealing relation with the plunger.

17. In a desk set, an ink holding member having a chamber and a plunger shiftably mounted therein, for movement from its normal position, means sealing the joint between the chamber and plunger and tending to hold the plunger in its normal position, said plunger having its upper portion formed to be engaged by a pen whereby the plunger may be shifted by applying pressure to the pen, means associated with said plunger operable to hold the pen in sealing relation with the plunger and said last named means being operable to its holding and sealing position upon application to the pen of a pressure less than that necessary to shift the plunger.

18. In apparatus of the class described, a receptacle having a storage chamber and a dispensing chamber communicating with the storage chamber, a pen carrying plunger located in the dispensing chamber, a back check valve controlling passage of fluid from the storage chamber to the dispensing chamber, and means which includes a flexible sac cooperating with said plunger and said back check valve for forcing ink into a pen when pushing the pen down with the plunger.

19. An ink receptacle having an ink reservoir and an upstanding neck which is in communication with said reservoir, mechanism associated with said receptacle which includes sealing means and a plunger device operable upon insertion of a pen in the neck for forcing a charge of ink into the pen and for refilling said neck from the reservoir upon withdrawal of the pen from the neck.

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