Feb. 17, 1970 D. SAMIRAN 3,495,671

POWER ASSISTED POGO STICK

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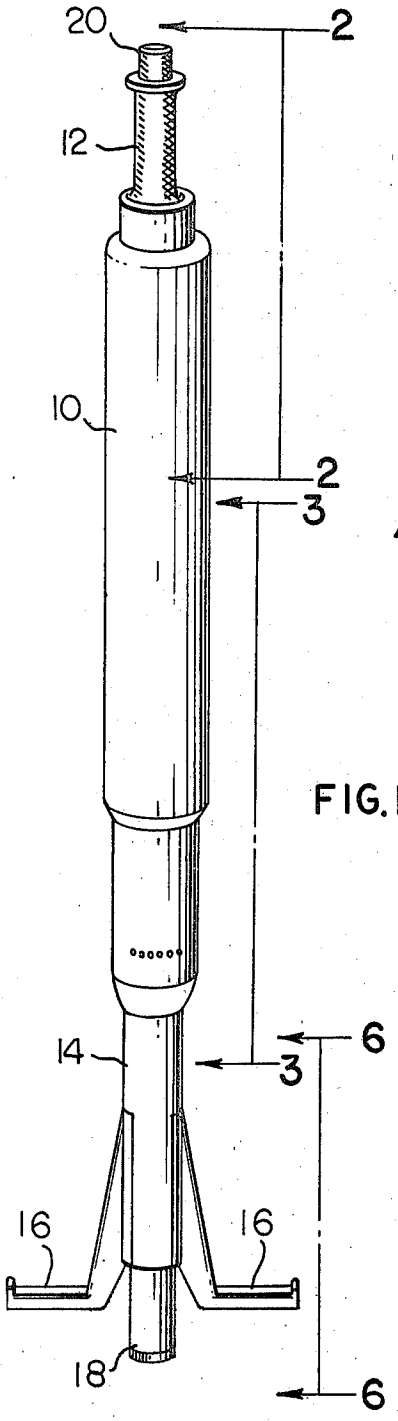

FIG. 1

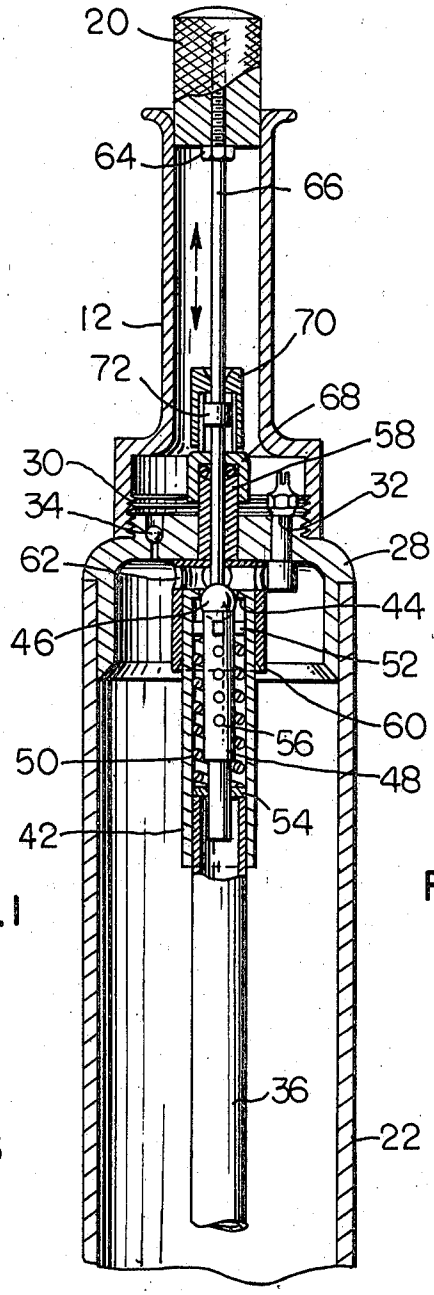

FIG. 2

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POWER ASSISTED POGO STICK

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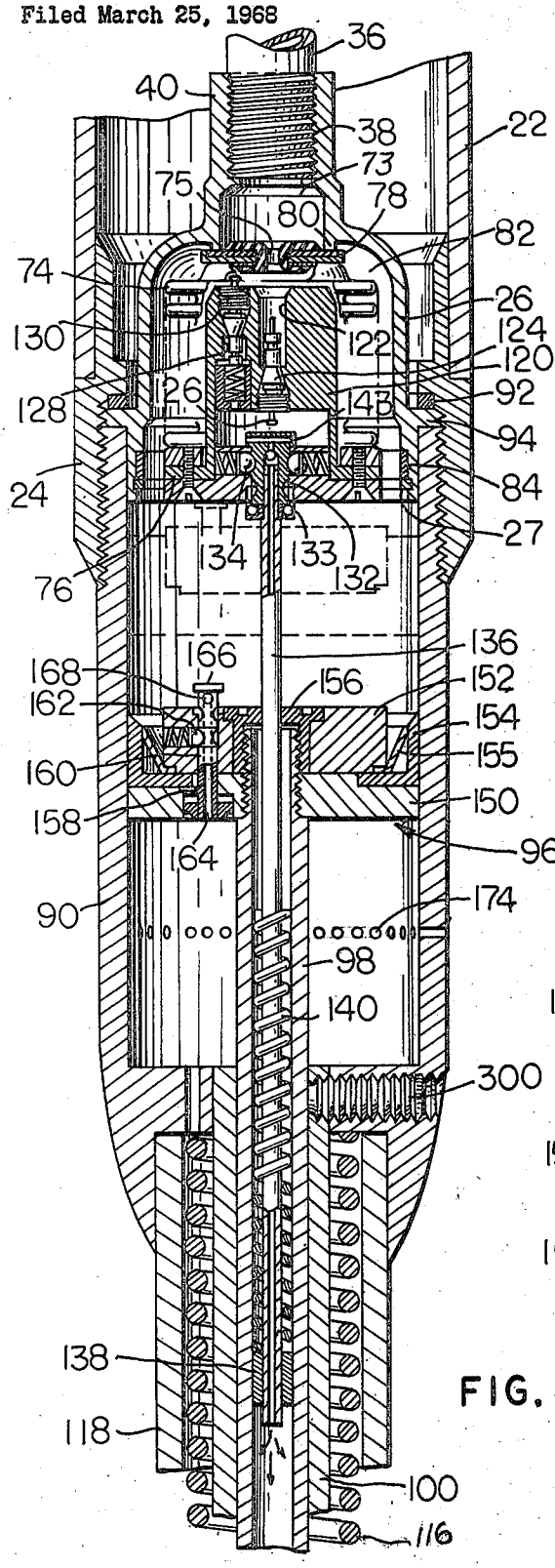

FIG. 3

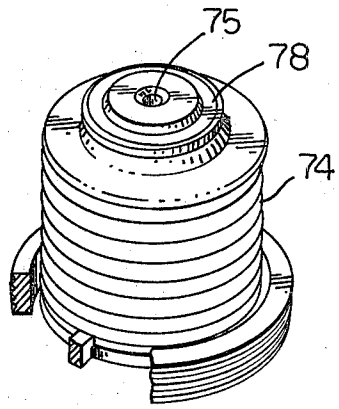

FIG. 4

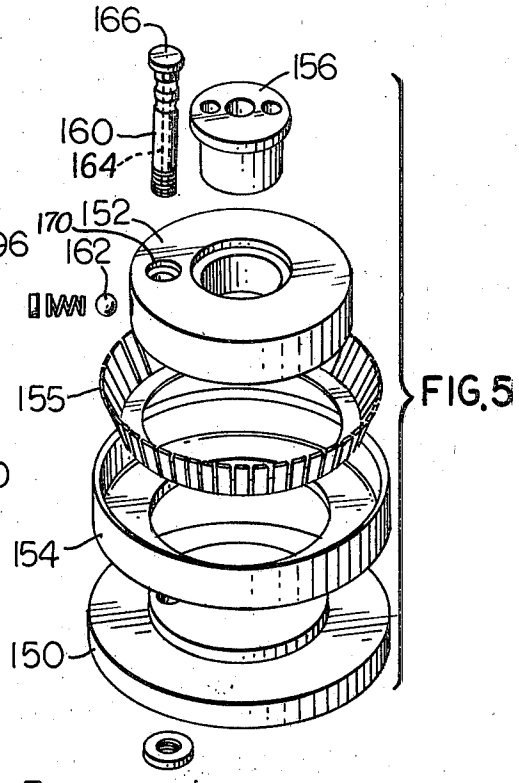

FIG. 5

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POWER ASSISTED POGO STICK

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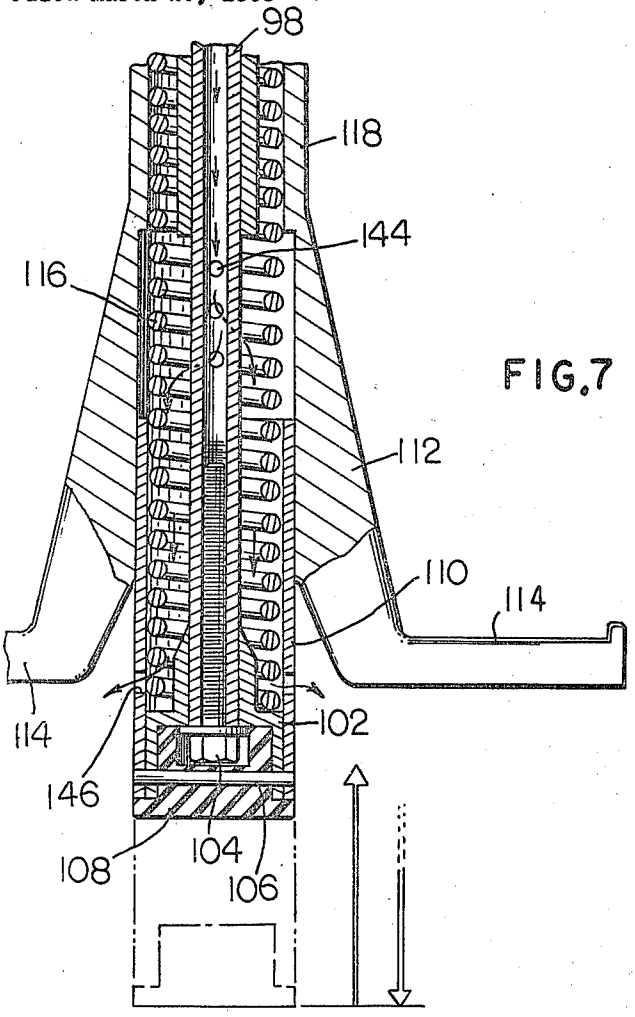

FIG. 6

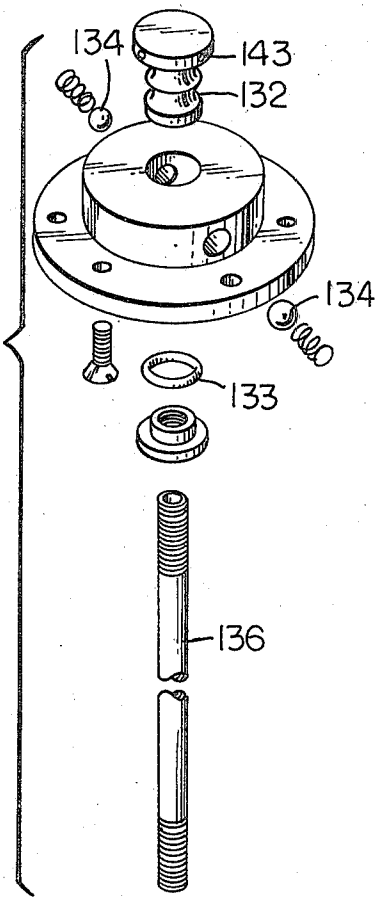

FIG. 7

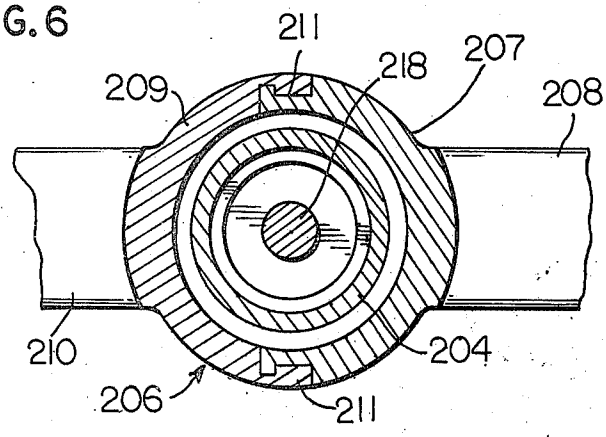

FIG. 12

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POWER ASSISTED POGO STICK

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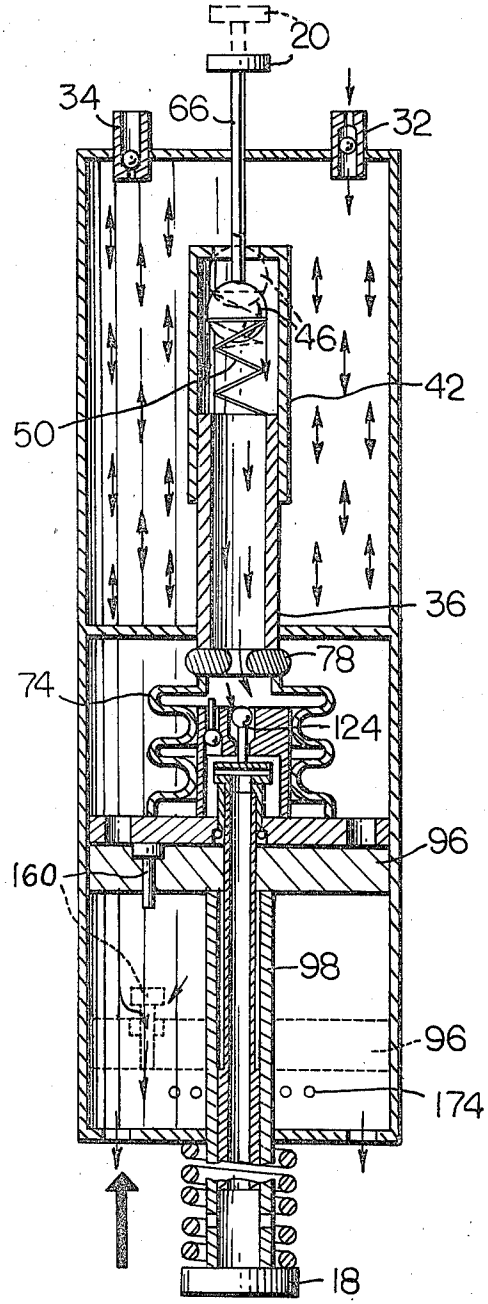

FIG. 8

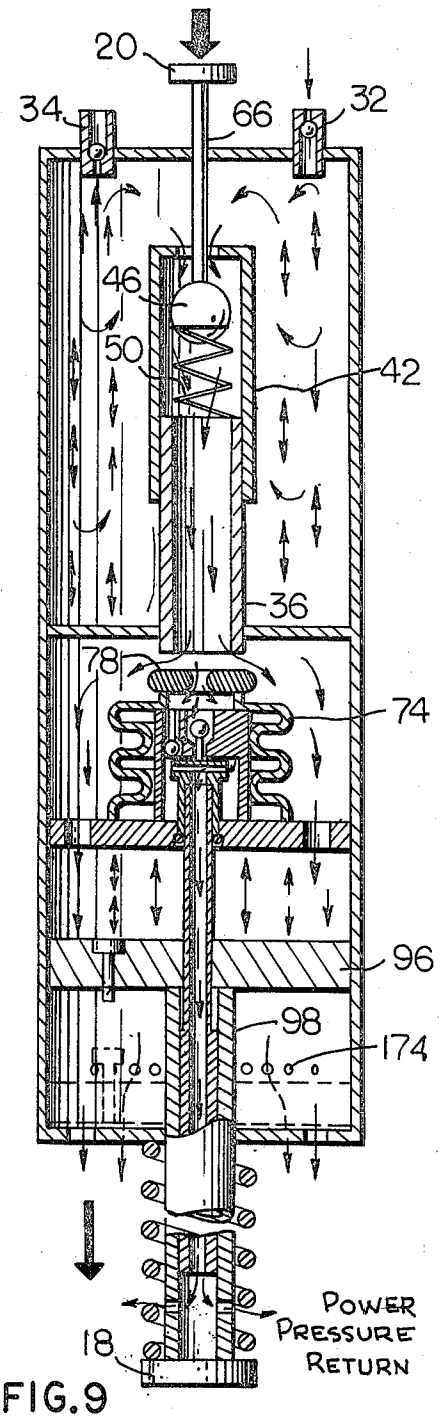

FIG. 9

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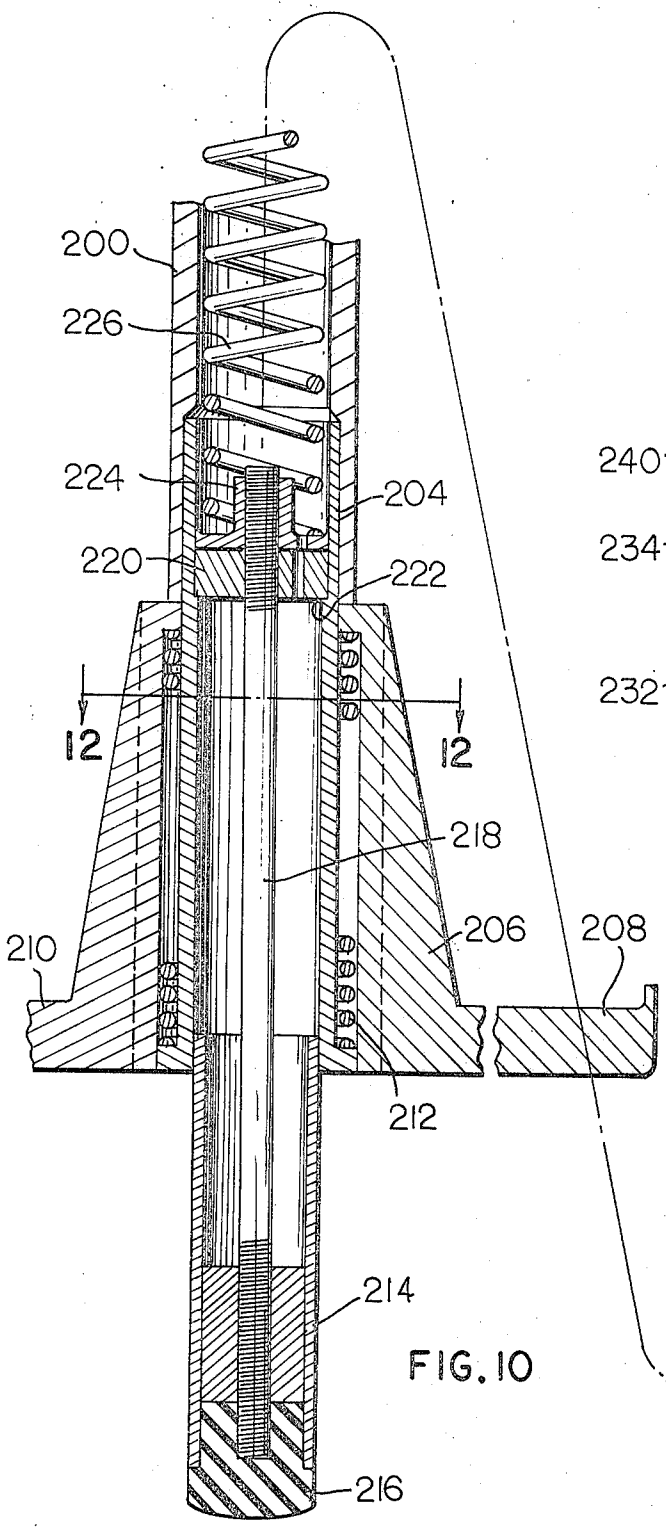

FIG. 10

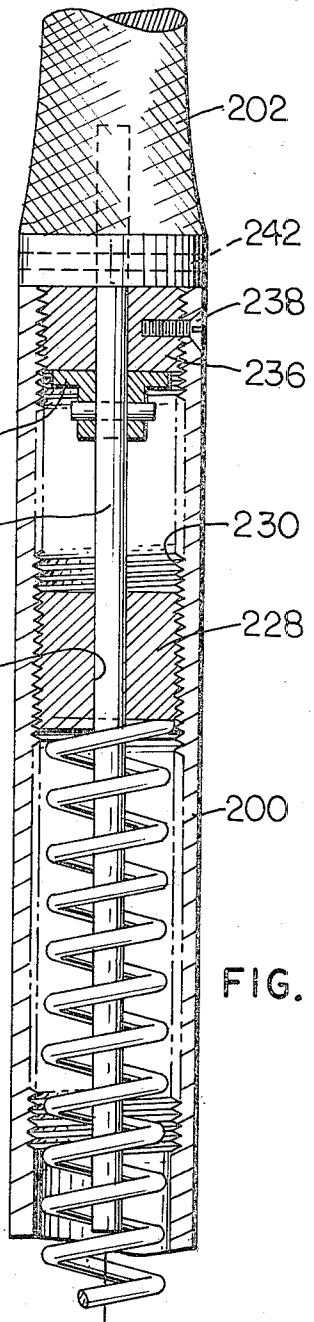

FIG. 11

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United States Patent Office 3,495,671 Patented Feb. 17, 1970

3,495,671

POWER ASSISTED POGO STICK

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Filed Mar. 25, 1968, Ser. No. 715,860
Int. Cl. B62b 19/00
U.S. Cl. 180—8 11 Claims

ABSTRACT OF THE DISCLOSURE

Pogo stick having power means for actuating the pogo stick and in which the power means is fluid operable by fluid from a reservoir in the stick and with valves controlling the flow of fluid partly operated by the operator of the stick and partly operated by the movement of the parts of the stick relative to each other.

The present invention relates to pogo sticks and is particularly concerned with improvement in pogo sticks relating to power operation thereof and to certain other features tending to make the pogo sticks easier and safer to use.

Pogo sticks are, of course, well known and comprise rod-like members having grip means at the upper end and foot support members toward the lower end.

In the conventional type pogo stick a rod-like projection extends downwardly from the foot supporting members and is resiliently biased in the downward direction. The foot supporting members are connected with the hand grip means so that by stepping on the foot support members and grasping the hand grip means, the pogo stick can be operated by jumping up and down on it. The operation of a pogo stick requires considerable skill and can also be somewhat hazardous for the reason that all of the power is derived from manipulation of the weight of the user and for the further reason that when the pogo stick is at rest, the foot support members are in an elevated position so that a balancing technique must be developed before one can successfully get on and use a pogo stick.

The present invention is particularly concerned with a pogo stick arrangement in which the drawbacks referred to above are eliminated.

A particular object of the present invention is the provision of a pogo stick with a power assist apparatus incorporated directly therein which will produce a substantial part, or all of the power, necessary to move the pogo stick in a vertical direction.

Another object of the present invention is the provision of a power assisted pogo stick in which the control of the power apparatus is effected, at least in part, by the relative movement of the relatively movable parts of the pogo stick.

Another object of the invention is the provision of a pogo stick arrangement in which the foot supporting members on which the operator stands are disposed closely adjacent the ground when the pogo stick is in idle position thus making it much easier and much safer to commence operation of the pogo stick.

Another object of this invention is the provision of a power assisted pogo stick in which the power is derived from compressible fluid which is charged directly into the pogo stick, thereby providing for a completely self-contained structure.

The foregoing objects as well as still other objects and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view showing an assembled stick in accordance with the present invention.

FIGURE 2 is a vertical sectional view, drawn at enlarged scale, of the portion of the stick indicated by the line II—II on FIGURE 1.

FIGURE 3 is a vertical sectional view, drawn at enlarged scale, of the portion of the stick indicated by the line III—III on FIGURE 1.

FIGURE 4 is a perspective view of an automatic valve arrangement forming a part of the structure illustrated in FIGURE 3.

FIGURE 5 is an exploded perspective view of a piston illustrated in FIGURE 3.

FIGURE 6 is a vertical sectional view, drawn at enlarged scale, of that portion of the stick indicated by line VI—VI on FIGURE 1.

FIGURE 7 is an exploded perspective view showing another portion of the structure illustrated in FIGURE 3.

FIGURE 8 is a schematic vertical sectional view showing the parts of the structure in one operative position.

FIGURE 9 is a view like FIGURE 8 but shows the parts of the structure in another operative position.

FIGURE 10 is a sectional view showing the lower portion of a mechanical pogo stick embodying a feature of the present invention.

FIGURE 11 is a sectional view of the upper end of the pogo stick of FIGURE 10; and

FIGURE 12 is a sectional view indicated by line XII—XII on FIGURE 10 showing how the foot support bracket could be formed to provide for a certain amount of independent movement of the foot supports.

Referring to the drawings somewhat more in detail, the pogo stick in FIGURE 1 comprises an elongated cylindrical central part **10** which, at the upper end, has hand graspable member **12** which may, as shown, be knurled.

At the lower end of cylindrical portion **10** is a smaller cylindrical part **14** which has connected thereto the foot engaging members **16**. Telescopically engaging portion **14** and spring urged downwardly, as will be seen hereinafter, is a ground engaging member **18**.

The pogo stick according to one form of the present invention is power assisted and projecting from the upper end of hand graspable member **12** is a control element **20** which can be depressed for initiating power operation of the pogo stick and released to interrupt the operation of the pogo stick.

Turning now to FIGURES 2 and 3, it will be seen that the central cylindrical portion **10** of the pogo stick comprises a cylinder **22** which is fixed at the lower end to a member **24** (FIGURE 3) and which member **24**, in turn, is engaged by a dome-like member **26** which forms a lower closure for the lower end of cylinder **22**. The upper end of cylinder **22** is closed by an upper closure member **28** so that the inside of cylinder **22** is closed and forms a reservoir compartment. The hand graspable member **12** is threaded to upper closure member **28** at **30** and can be removed therefrom to expose a filling valve **32** through which the reservoir chamber is filled.

Upper closure member **28** may also carry a relief valve **34** which opens at a predetermined pressure so as to relieve excessive pressures that might be developed within the reservoir chamber due to change in temperature or the like.

Extending axially along the axis of cylinder **22** is a pipe **36** which, at its lower end, is threaded at **38** to a tubular upstanding portion **40** of lower closure member **26**. At its upper end pipe **36** threadedly receives another pipe **42**, the upper end of which is formed inwardly at **44** to form a seat for a valve ball **46**. Valve ball **46**, on the side opposite the aforementioned seat, is engaged by the tube **48** which is spring urged upwardly toward the upper end of pipe **42** by a compression spring **50**. Compression spring

50 at its upper end bears beneath lugs 52 formed on tube 48 while at its lower end spring 50 bears on a washer 54 resting on the upper end of pipe 36. Tube 48 has radial holes 56 therein, and, inasmuch as member 48 is tubular, holes 56 provide communication of the inside of pipe 42 with the inside of pipe 36.

Extending through the center of upper closure member 28 is a tubular sleeve-like element 58 which has an enlarged cylindrical portion 60 that surrounds the upper end of pipe 42. Lateral holes 62 in the upper end of portion 60 provides communication between the reservoir space and the upper side of ball 46.

The aforementioned control element 20 will be seen in FIGURE 2 to be reciprocably mounted in the upper end of hand graspable member 12 and to be connected by a nut to a rod 66. Rod 66 extends sealingly through member 58 so as to be engageable with ball 46 but by depressing element 20 the ball can be moved off its seat thereby to permit pressure fluid from the reservoir chamber to pass through ports 56 in tube 48 into the tube and downwardly therethrough into pipe 36.

A detachable packing gland 68 is provided for sealing rod 66 to member 58 and rod 66 is made captive on the sealing gland by a detachable nut 70 within which is confined an enlarged portion 72 of rod 66 with freedom of axial movement.

Turning to FIGURE 3, it will be seen that the pressure supplied to pipe 36 will be supplied to a chamber 73 in lower closure member 26 at the lower end of pipe 36. This chamber communicates via relatively restricted port 75 with the interior of a sylphon bellows 74.

Sylphon bellows 74 has its lower end anchored on a structure 76 that is fixed in the lower end of lower closure member 26 as by a lock ring 27. The upper end of the sylphon bellows carries a valve disc 78 which engages an annular valve seat 80 at the bottom end of chamber 73. It will be apparent that when the sylphon bellows is expanded, the space 82 on the outside of the bellows is sealed from chamber 73 by the engagement of valve disc 78 with seat 80.

The interior of the sylphon bellows is normally closed off so that pressure passing from chamber 73 through restricted port 75 to the inside of the bellows will urge it upwardly toward seat 80 with a greater thrust than the pressure standing in chamber 73 will urge the sylphon bellows downwardly.

The space around the sylphon bellows leads to ports 84 of substantial size in the aforementioned structure 76. These ports lead from around the sylphon bellows into the upper end of a power cylinder 90. Power cylinder 90 at its upper end is threaded to member 24 and is operable to retain lower member closure 26 in place in sealing engagement with gasket 92 due to the flange 94 on closure member 26 which is engaged by the extreme upper end of pipe 90.

Reciprocably mounted in cylinder 90 is a power piston 96 which provides the power assist for the pogo stick in response to the controlled supply thereto of fluid under pressure from the reservoir in cylinder 22. The supply of pressure fluid to piston 96 is under control of the valve formed by valve disc 78 and valve seat 80. It will be apparent that whenever valve disc 78 engages valve seat 80, the piston 96 is sealed off from pipe 36. However, when valve disc 78 moves downwardly away from seat 80, pressure fluid can flow from pipe 36 into chamber 73 and from therearound the outside of bellows 74 and through ports 84 into the upper end of cylinder 90 so as to exert a downward pressure on piston 96.

Piston 96 is threadedly connected to the upper end of tubular member 98 which extends downwardly into and is reciprocable in a sleeve 100 fixed to the lower end of cylinder 90. Considering FIGURE 3 together with FIGURE 6, it will be noted that tubular member 98 at its lower end has connected thereto a fitting 102, secured in place by cap screw 104 and that a pin 106 holds a rubber-like ground engaging block 108 in place on member 102. Member 102 is telescopically engaged by another tubular sleeve like member or ferrule 110 which extends upwardly into and terminates inside a bracket 112 forming a part of the foot support structure. Bracket 112 comprises the opposed foot engaging members 16 (FIGURE 1), previously referred to and on which the operator stands.

A compression spring 116 bears at its lower end on fitting 102 while at its upper end, as will be seen in FIGURE 3, it bears on the underside at the lower end of cylinder 90. The bracket 112 previously referred to includes a tubular upper section 118 that extends upwardly and telescopically engages the lower end of cylinder 90 and is fixed thereto.

At this point it will be seen in FIGURES 1 and 2 that the bracket 112 with its foot support members 16 is rigid with cylinders 90 and 10 so that the entire body of the pogo stick is resiliently supported on spring 116. A downward thrust on the foot supporting members 16 will cause spring 116 to be compressed with simultaneous upward movement of tubular member 98 and piston 96 in cylinder 90.

Returning to FIGURE 3, the control of pressure fluid to the upper side of piston 96 is accomplished by an automatic valving arrangement formed in part by disc 78 and seat 80 and by valving located inside member 26. A second valve member is reciprocably mounted in structure 76 while still a third valve member provided in piston 96 exercises a control influence.

It will be noted that in FIGURE 3, structure 76 comprises a member 120 upstanding inside bellows 74 and having an axial passage 122 extending therethrough. Located within passage 122 is a valve 124 which may be of the type commonly employed in connection with pneumatic tires. The valve is normally closed and comprises a stem 126 projecting therefrom which can be depressed to open the valve.

A second bore 128 in member 120 includes another valve 130 of the same type but opening in the opposite direction and serving as a pressure relief valve.

Structure 76 has a central bore therein and reciprocably mounted in the said bore is a control member 132 which has two operative end positions. The two operative end positions are defined by axially spaced annular recesses in member 132 which are adapted for engagement by spring pressed ball detent means 134 in structure 76. The member 132 is mounted on the upper end of a relatively small elongated tube or pipe 136 which extends downwardly through piston 96 and terminates within tubular member 98 that is fixed to piston 96. Near its lower end tubular element 136 has a stop collar 138 thereon and resting on stop collar 138 and extending upwardly inside tubular member 98 is a compression spring 140.

Member 132 has passage means 143 at the upper end which communicates with the space in member 120 at the lower end of valve 124 and which also communicates with the interior of tubular element 136. The lower end of tubular element 136 opens to the interior of tubular element 98 and this member, in turn, has lateral ports 144 therein near the lower end which can communicate with the atmosphere via ports 146 in the lower end of sleeve-like member 110. The passage described above commencing with passage 143 in member 132 and leading to the atmosphere thus forms an exhaust passage so that the space at the lower end of member 120 into which valve 124 opens is always exhausted to the atmosphere.

A sealing ring 133 is mounted on the lower end of member 132 and sealingly engages the lower side of structure 76 when member 132 is in its upper position.

It has been mentioned that the piston 96 is also provided with a valving arrangement, and this will be seen in FIGURE 3, taken together with FIGURE 5. The

piston **96** comprises a lower disc-like member **150** and an upper and somewhat smaller diameter upper member **152** between which is clamped the cup-like sealing member **154**. A spreader disc **155** maintains the lip of sealing member **154** in sealing engagement with the inside of cylinder **90**. A clamp nut **156** holds the aforementioned parts in assembled relation.

The assembled piston is provided with a bore **158** in which is reciprocably mounted a valving member **160**. The valving member **160** has two end positions determined by axially spaced grooves thereon which are engageable by a spring pressed ball detent **162** carried by upper member **152**.

Member **160** has a passage **164** extending axially thereinto from the bottom and terminating underneath a head **166** at the upper end of the member in lateral ports **168**. The piston is provided with a recess **170** (FIGURE 5), in upper part **152** for receiving head **166** and located within the recess is a seal ring **172** which is sealingly engaged by head **166** of member **160** when it is in its lowered position.

As will be seen in FIGURE 3, cylinder **90** is provided with ports **174** therein at such a position that the space above piston **96** communicates with the atmosphere when the piston is near the bottom of its stroke.

The operation of the power assisted pogo stick described above will be understood upon reference to FIGURES 8 and 9, together with the following description.

Let it be assumed that the reservoir chamber, which is space inside cylinder **22** (FIGURE 2), has been charged with a compressible fluid. A charge of compressed air is possible but it is preferred to use Freon gas or carbon dioxide or some other gas which will liquefy within the range of pressures that can be employed in connection with a device of the nature disclosed. For example, the gas should liquefy within the range of about 150 pounds per square inch. If cylinder **22** is charged with a fluid of this nature, the power assisted pogo stick can continue in operation for a long time.

The compressed gas in cylinder **22** (FIGURE 2) is normally closed off from the motor of the pogo stick by ball **46** which is held up against the seat with a thrust greater than that developed thereon by the compressed gases.

However, upon depressing control element **20**, ball **46** is moved off its seat and gas can then flow downwardly through pipe **36** and through port **75** (FIGURE 3) to the inside of bellows **74**. A small amount of gas thus supplied to pipe **36** will fill bellows **74** and press disc **78** tightly against seat **80**.

If, now, an operator grasps portion **12** (FIGURE 2) by the hand and places his feet upon the foot support members **16** (FIGURE 1), and further assuming the operator's weight is sufficient to collapse spring **116** (FIGURE 6), the pogo stick structure will descend on member **110** (FIGURE 6) and this will cause upward movement of piston **96** in cylinder **90**. As the piston approaches its uppermost position the upper end of member **160** will engage the underside of structure **76** and will move downwardly to its closed position. The piston during its upward movement with member **160** in its upper position as shown in dot-dash outline in FIGURE 8. The piston **96** is in its uppermost position and with member **160** moved to its lower position as illustrated in full lines in FIGURE 8. It will be apparent that during upward movement of piston **96** gas or air thereabove can pass freely to the other side of piston **96** via member **160**. However, when piston **96** reaches its upper position and member **160** is moved downwardly, the passage from the top to the bottom side of piston **96** is closed.

At about the same time that piston **96** reaches its upper position the valve member **160** will move downwardly, the upper end of member **132** being pushed to the upper of its two positions by piston **96** then engages stem **126** of valve **124** and moves the valve in its opening direction. By the time piston **96** reaches its uppermost position valve **124** is open and the pressure within bellows **74** will be exhausted through valve **124** and through passage **142** and down tubular element **136** to the atmosphere. The exhausting of fluid from inside bellows **74** through valve **124** will take place more rapidly than pressure can be built up within bellows **74** by the supply of pressure fluid thereto through restricted port **75**. Accordingly, due to the pressure unbalance existing on the opposite of the upper end of bellows **74**, it will be moved downwardly so as to separate disc **78** from seat **80**. This will permit a rapid supply of pressure fluid in large quantity from pipe **36** around bellows **74** and through ports **84** to the upper side of piston **96** so as to drive piston **96** downwardly relative to cylinder **90**. Since piston **96** is secured to a member resting on the ground, it will be evident that the pogo stick structure will be thrust upwardly by the aforementioned supply of pressure fluid.

The valve **130** previously referred to, which can function simply as a relief valve to relieve excessive pressures from the inside of the bellows, can also serve as an auxiliary bypassing valve when the bellows opens because the upper end of the bellows may engage and open this valve also if desired. Valve **130** will not permit pressure to decay inside bellows **74** more rapidly than it can be built up through port **75**.

Assuming that an operator is standing on the foot support members **16**, the piston **96** will be moved to its uppermost position in the aforesaid manner. By pressing on control element **20**, a supply of pressure fluid to the upperside of piston **96** can be initiated. Alternatively, the control element **20** can be depressed and then the operator can place his weight upon the foot support members **16**.

A particular feature of the present invention is to be found in the fact that the foot support members **16** are disposed close to the ground by the time piston **96** reaches its uppermost position. Thus, if the supply of pressure fluid is cut off, the idle position of the pogo stick has the foot support members disposed close to the ground and the piston **96** in its uppermost position whenever there is weight disposed on the foot support members **16**. This makes the pogo stick easy and safe to mount and permits the operator to place himself in a balanced position prior to initiating operation of the pogo stick. This is, of course, a particular benefit in connection with a device of this nature.

Returning now to the operation of the device, as piston **96** moves downwardly in cylinder **90** it gets to the point that clamp nut **156** of piston **96** engages the upper end of spring **140**. This will place a downward thrust on tubular member **136** and pull member **132** down to its lower position. This will not interrupt the exhaust passage through member **132** and tubular element **136** but it will move member **132** away from stem **126** of valve **124** so that this valve will close. When valve **124** closes, pressure commences to build up within bellows **74** and it commences to expand and to move disc **78** toward seat **80** and eventually the disc **78** seats on seat **80** and cuts off its supply of pressure fluid to the upper side of piston **96**. This will take place even though valve **130** is in its open position because the rate of flow therethrough is not sufficient to prevent the build-up of pressure within bellows **74** and, in any case, valve **130** will be not more than partly open.

The supply of compressed gas above piston **96** continues to drive it downwardly and the piston will move past the ports **174** in cylinder **90** so as to permit the exhaust of pressure fluid from above piston **96**. Also, as the piston approaches the lower closed end of cylinder **90** the member **158** will be engaged and moved to its upper position which it is illustrated in dot-dash outline in FIGURE 8 and also in FIGURE 9 wherein the piston is shown in dot-dash outline in its lowermost position. With the pressure above piston **96** exhausted it can again move upwardly in

cylinder **90** and the aforementioned process will be repeated. The pogo stick will thus continue in operation as long as there is a supply of pressure fluid to the piston **96**. The supply can be interrupted by the operator getting off the pogo stick or by releasing the control element **20** which will interrupt the supply of pressure fluid through pipe **36** to piston **96**.

An improvement in pogo sticks as contemplated within the preview of the present invention is illustrated in FIGURES 10, 11, and 12. In these figures, it will be seen that the pogo stick comprises a principal tubular member **200** having a hand graspable element **202** at the upper end thereof. Connected to the lower end of tubular element **200** is a second tubular portion **204** on which is reciprocably mounted a bracket means **206** comprising the two foot engaging members **208** and **210**.

A compression spring **212** engages underneath a shoulder on the upper end of bracket means **206** and on top of a shoulder on the lower end of tubular portion **204** so as resiliently to support bracket means **206** thereon and for a purpose to be described more in detail hereinafter.

The ground engaging portion consists of a ferrule or tubular member **214** having a rubber-like ground engaging element **216** at the lower end thereof and reciprocable in tubular member **204**. A rod **218** is fixed to member **214** and extending upwardly, is threadedly connected to a disc **220** that bottoms against a shoulder **222** in the upper end of tubular member **204**. A lock nut **224** is threaded to the upper end of rod **218** and engages disc **220**.

A compression spring **226** bears at its lower end on the upper side of nut **224** and extends upwardly through tubular member **200** and at its upper end engages the underside of a block **228**. Block **228** is threaded in the threaded internal portion **230** of tubular member **200**. Block **228** has a bore **232** therethrough through which extends a shaft **234**. The shaft **234** is nonrotatably connected with member **228** as by being keyed in bore **232**, for example, or as by being square and by forming the bore **232** square. Shaft **234** extends rotatably through a block **236** fixed in the upper end of tubular member **200** as by a screw **238**. On the underside of block **236** a collar **240** is pinned to shaft **234**. The upper end of shaft **234** extends into hand graspable member **202** and may be pinned thereto as by transverse pin **242**.

It will be evident at this point that hand graspable member **202** can be rotated relative to tubular member **200** and thereby adjust the compression on spring **226** so as to adapt the pogo stick to operators of different weight.

A second feature embodied in the pogo stick in FIGURES 10 through 12 is illustrated more in detail in FIGURE 12. FIGURE 12 taken in connection with FIGURE 10, it will be noted that the bracket means **206**, instead of being in one piece as is conventional in respect of pogo sticks is made of two pieces which are slidable relative to each other in the vertical direction. This arrangement permits a certain degree of independent movement in the vertical direction of foot engaging portion **208** and **210** so that if the pogo stick is resting on uneven ground or if it comes down on uneven ground, there will be a tendency for the foot engaging portion to adjust themselves to the contour of the ground. As shown in FIGURE 12, bracket means **206** comprise a portion **207** on one side carrying the foot engaging portion **208** and a second portion **209** on the other side.

In FIGURE 12 it will be noted that bracket means generally referred to previously at **206** is made up of separate parts **207** and **209** which are slidably interconnected as shown at **211** in FIGURE 12. Other arrangements providing for a small degree of independent freedom of movement of the two foot engaging members **208, 210** will suggest themselves and it will, therefore, be understood that the arrangement illustrated in FIGURE 12 is merely exemplary of other structures that could be employed to permit some independence of movement of the individual foot engaging members so as to conform the pogo stick to variations in terrain that might be encountered during the use thereof.

In respect of the first described modification, it is considered that most of the parts could be formed of plastic material so as to result in a light structure. However, metal parts are also within the purview of the present invention and it is not intended to limit the invention to any particular structure. One advantage of plastic parts is that joints could be cemented together to make a complete structure very inexpensively, whereas metal parts would require soldering, brazing or the use of epoxy cement or the like. For example, cylinder **22** (FIGURE 2) could be readily joined to member **24** if the two were made of plastic as by an inexpensive cement. Also, the connection of tubular **118** (FIGURE 3) to the lower end of cylinder **90** could be a cemented connection if so desired as well as the central tubular member **100** to the lower end of cylinder **90**.

FIGURE 3 will also show how a set screw **300** could be employed in the lower end of cylinder **90** for locking the pogo stick together in a certain position. This might be advisable for the purpose of shipment, or storage, or for any other reason. Normally, of course, such a screw is retracted from tubular member **98** because tubular member **98** must be free to reciprocate in tubular member **100** when the pogo stick is in use.

Although the present invention has been illustrated and described in connection with a single example embodiment, it will be understood that this is illustrative of the invention and is by no means restrictive thereof. It is reasonably to be expected that those skilled in this art can make numerous revisions and adaptations of the invention.

What is claimed is:

1. A pogo stick comprising: an elongated main portion adapted for use in a substantially vertical position and having hand graspable means near the top and foot engageable means near the bottom, a rod like element projecting axially from the lower end of said main portion and having ground engaging means at the lower end, spring means biasing said rod-like element in the downward direction on said main portion and compressing when weight is placed on said foot engaging means, said main portion having a cylinder formed therein, a piston reciprocable in said cylinder and connected to said rod-like element, said piston moving toward a first end of said cylinder when said spring means is compressed and moving toward the second end of said cylinder as said spring means expands, and said first end of said cylinder and the side of said piston facing said first end of said cylinder defining a working space therebetween, means for supplying fluid under pressure to said working space as the piston approaches said first end of the cylinder thereby to drive the piston toward said second end of the cylinder, means for interrupting said supply of pressure fluid to said working space as said piston moves away from said first end of said cylinder, and means for exhausting fluid from said working space as said piston approaches said second end of said cylinder.

2. A pogo stick according to claim **1** in which said means for supplying fluid pressure to said working space includes a reservoir for fluid under pressure in said main portion of said stick, and valve means for connecting said reservoir with said working space.

3. A pogo stick according to claim **2** in which said valve means includes a normally closed first valve at the outlet side of said reservoir and a manually operable control element connected to said first valve and located for ready actuation by the operator of a pogo stick.

4. A pogo stick according to claim **2** in which said valve means includes a second valve between said first valve and said working space said second valve comprising a valve member having a larger area responsive to fluid pressure to urge the valve member toward closed position and a smaller area responsive to fluid pressure to urge the valve member toward open position, said smaller

area being in communication with the outlet side of said first valve, a restricted port connecting said areas, a normally closed third valve connected between said larger area and the atmosphere, and control means operated by said piston as the piston approaches said first end of said cylinder for actuating said third valve to open position, said control means being operated by said piston as said piston moves away from said first end of the cylinder into position to close said third valve.

5. A pogo stick according to claim **4** in which said cylinder comprises exhaust ports leading to the atmosphere and positioned to be uncovered by said piston as the piston approaches said second end of said cylinder.

6. A pogo stick according to claim **5** in which said piston has an axial passage therethrough and a fourth valve member in said passage, said fourth valve member engaging said second end of said cylinder and being moved thereby to open said passage when said piston approaches said second end of said cylinder and engaging said first end of said cylinder and being moved thereby to close said passage when said piston approaches said first end of said cylinder.

7. A pogo stick according to claim **6** in which said reservoir has a filling opening, said hand graspable means being threadably mounted on the upper end of said main portion, said filling opening being covered by said hand graspable means and exposed when the hand graspable means is removed from said main portion.

8. A pogo stick according to claim **7** in which said control element is mounted in said hand graspable means and protrudes from the upper end thereof.

9. A pogo stick according to claim **4** in which said

second valve comprises a seat communicating with the discharge side of said first valve and a valve disc on the opposite side of the seat from the first valve, a bellows supporting said disc, the space around said bellows leading to said working space, said restricted port leading from inside said bellows to the upstream side of said seat, and said third valve being connected between the inside of said bellows and the atmosphere.

10. A pogo stick according to claim **9** in which said control means comprises a tubular element having a first end position wherein said third valve is open and a second end position wherein said third valve is closed, and cooperating elements of abutment means on said tubular element and piston for operation of the tubular element between its two said positions in response to reciprocation of said piston in said cylinder, said tubular element at one end communicating with the downstream side of said third valve and at the other end with said atmosphere.

11. A pogo stick according to claim **1** in which said foot engageable means includes a separate member for each foot, and means resiliently supporting said separate members for at least a limited amount of independent movement in the vertical direction.

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