Dec. 3, 1968 R. B. HAMLIN 3,413,867

VARIATOR

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Fig. 1

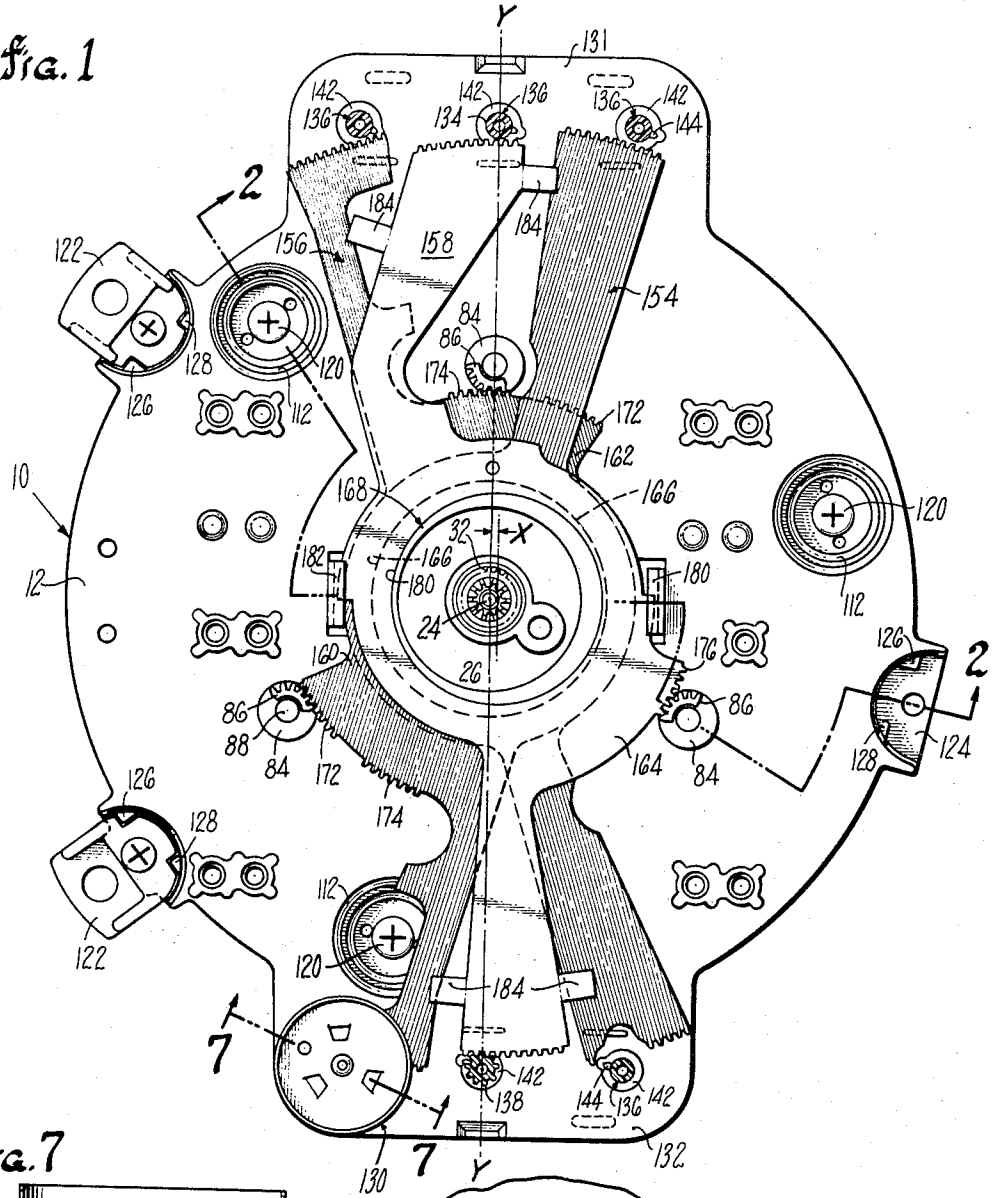
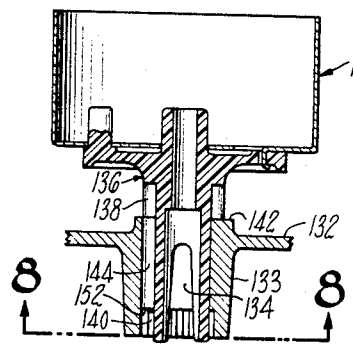


Fig. 7



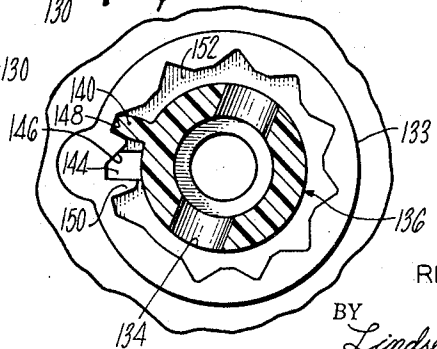


Fig. 8

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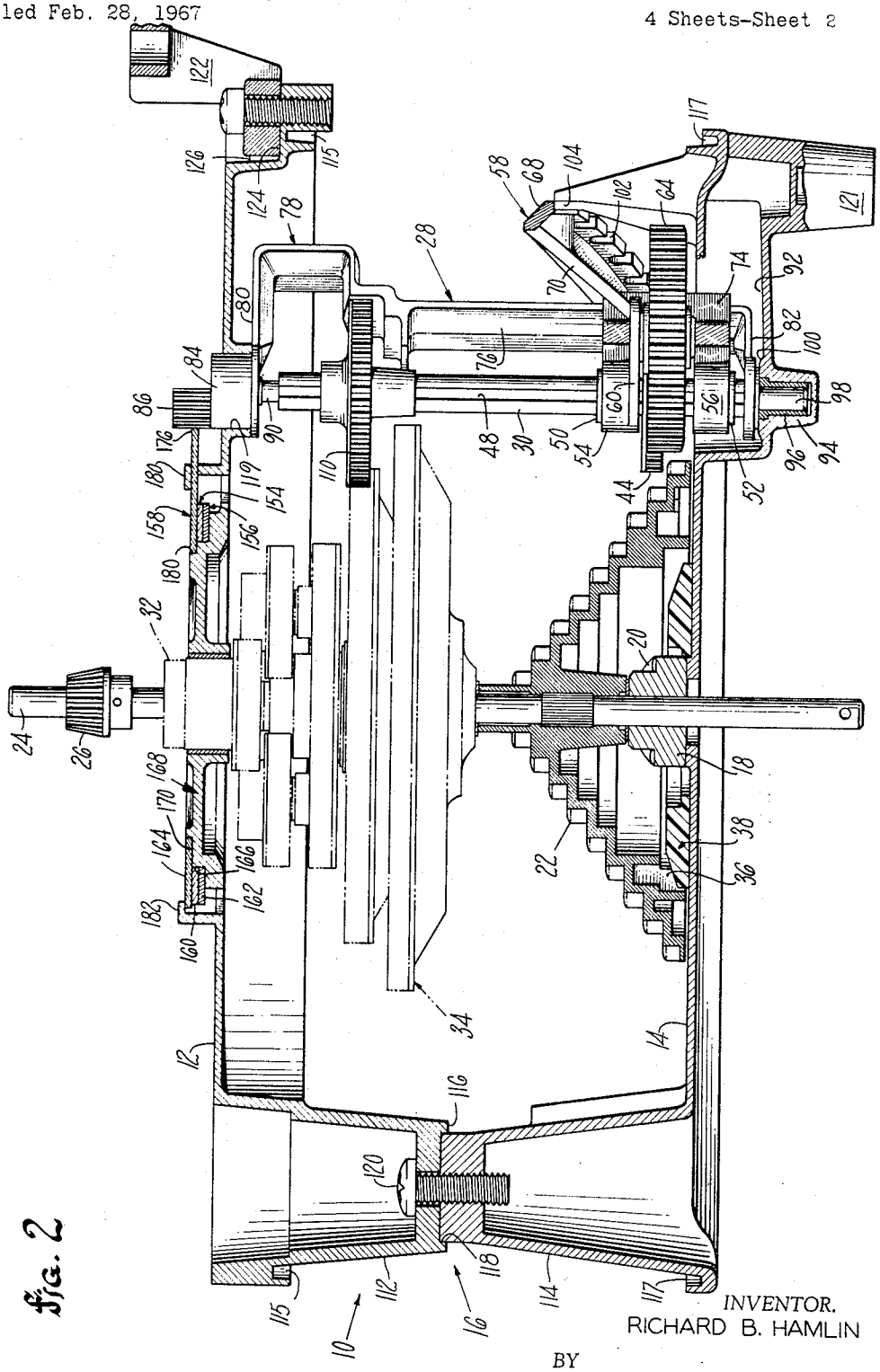

FIG. 2

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Fig. 3

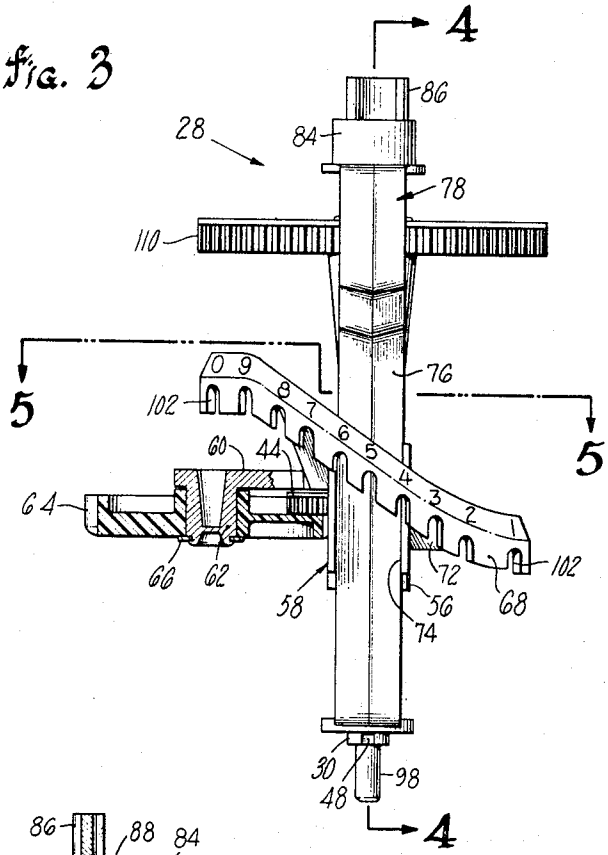

Fig. 4

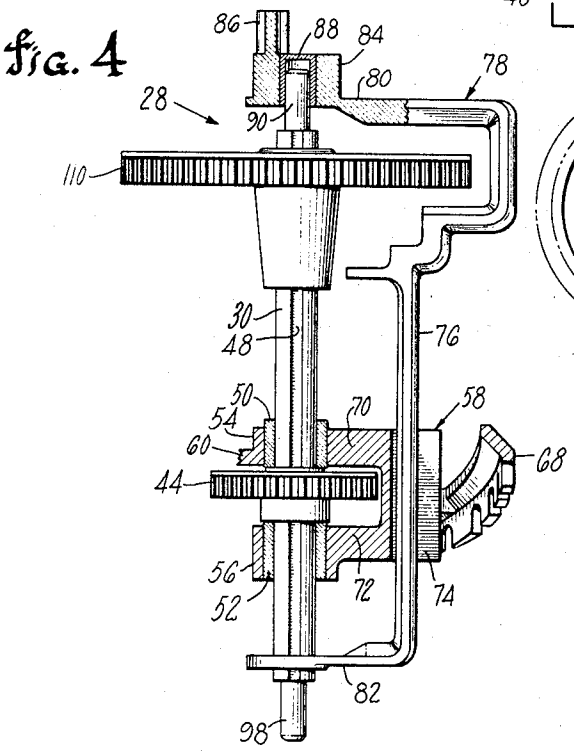

Fig. 5

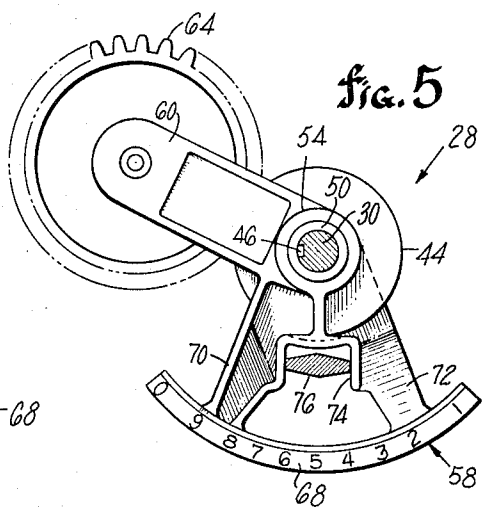

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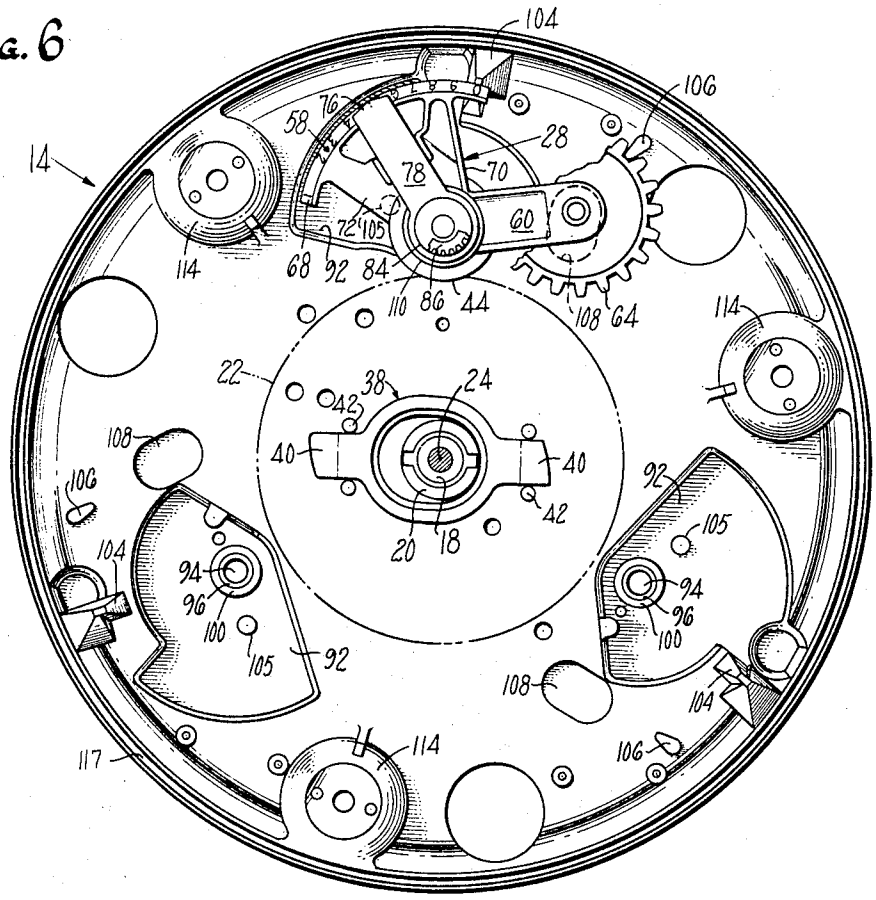
Fig. 6



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United States Patent Office

3,413,867
Patented Dec. 3, 1968

3,413,867

VARIATOR

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Filed Feb. 28, 1967, Ser. No. 619,408
28 Claims. (Cl. 74—348)

ABSTRACT OF THE DISCLOSURE

In a variator for a fuel dispenser, a gear cone rotatably supported on a frame with a plurality of range arm assemblies mounted thereon, the range arm assemblies each including a unitary gear positioning carriage having a helical detenting rack engageable with the frame for obtaining varying outputs from the gear cone in accordance with a selected setting, and a plurality of rotary amplifying levers respectively driven by the range arm assemblies for operating price posting wheels, the rotary amplifying levers having circular hub portions supported in stacked relation for rotation on the frame.

This invention relates to speed change mechanisms or variators and has as a primary object the provision of an improved variator having a minimum number of parts of which a relatively large number are of identical construction providing significant cost saving economies in the manufacture of the variator.

Another object of this invention is to provide an improved variator specifically designed for facile assembly in a high speed operation.

A further object of this invention is to provide an improved variator primarily usable in a computing head of a gasoline dispensing apparatus and which incorporates a unique range arm assembly for selectively establishing a price at which the variator is set to compute.

Another object of this invention is to provide a new and improved range arm assembly particularly suited for a variator of the type having a plurality of range arm assemblies and which by appropriate selection of its output gear may be used for each of the range arm assemblies of the variator.

A further object of this invention is to provide an improved variator of rugged, lightweight and compact construction of minimal overall height.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which is exemplified in the construction hereafter set forth, and the scope of the invention is indicated in the appended claims.

In the drawings:

FIG. 1 is a top plan view, partly in section and partly broken away, of a variator incorporating the present invention;

FIG. 2 is an enlarged elevational section view, partly in section and partly broken away, generally taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged elevational view, partly in section and partly broken away, showing a range arm assembly of the variator;

FIG. 4 is a view of the range arm assembly, partly in section and partly broken away, generally taken along line 4—4 of FIG. 3;

FIG. 5 is a view of the range arm assembly, partly in section and partly broken away, generally taken along line 5—5 of FIG. 3;

FIG. 6 is a transverse section view, partly in section and partly broken away, of the variator and showing a range arm assembly in a lock-out position;

FIG. 7 is an enlarged section view, partly broken away and partly in section, generally taken along line 7—7 of FIG. 1 and showing a number wheel assembly mounted on an upper platform of the variator; and

FIG. 8 is an enlarged section view, partly broken away and partly in section, generally taken along line 8—8 of FIG. 7.

Referring now to the drawings in detail wherein a preferred embodiment of this invention is illustrated, a frame 10 of a variator is shown in FIG. 2 having an upper frame member on platform 12 supported on a lower frame member or base 14 by a plurality of vertical supports such as that shown at 16.

A bushing 18, keyed to a central hub 20 of the base 14, provides thrust bearing support for a gear cone 22 suitably secured on a vertical drive shaft 24 shown extending upwardly through the platform 12 and with a bevel gear 26 fixed to an upper axial end thereof. The drive shaft 24 is adapted to be driven, e.g., by a conventional meter, not shown, of a gasoline dispensing apparatus whereby the bevel gear 26 can be used to drive a quantity counter, not shown, of a register associated with the variator for progressively registering the number of gallons passing through the meter during each dispensing operation.

The illustrated gear cone 22 has a series of nine separate gear steps of varying diameter, and a plurality of range arm assemblies such as that shown at 28 in FIGS. 2 and 3 are provided, with each range arm assembly having a range shaft 30 mounted in a vertical position, as described more specifically below, to be selectively driven by any one of the series of gear steps at varying speeds, in a relationship of one through nine inclusive, by adjustment of the range arm assembly to different vertical positions representing, e.g., different prices per gallon.

To provide a price for the total gallonage dispensed, a take-off spur gear 32 is shown in broken lines in FIG. 2 as being rotatably mounted on the drive shaft 24 for driving a cost counter, not shown, of the register by the combined outputs of the range shafts which are respectively transmitted by gearing, described in detail below, to a suitable adding differential 34, also shown in broken lines in FIG. 2, coaxially mounted on the drive shaft 24 for driving the take-off gear 32.

As will be readily understood by one skilled in the art, three range shafts such as 30 are conventionally provided and the differential means 34 is designed so that the outputs of the range shafts are combined to drive the take-off gear 32 in the ratio of 1:10:100, respectively, whereby the output of a first range shaft may be equal to multiples of ten cents, the output of a second range shaft may be made equal to multiples of one cent and the output of a third range shaft may be made equal to multiples of tenths of a cent. The output of the take-off gear 32 thus can be varied within a wide range to provide different prices per gallon of the gasoline dispensed for registering the cost of the total gallons passing through the meter at a prevailing unit price as determined by the setting of the variator.

To permit operation of the drive shaft **24** in one angular direction while yet preventing improper reverse rotation, three equiangularly spaced one-way ratchet teeth such as that shown at **36** are formed within the bottom of gear cone **22** for cooperating with a plastic no-back pawl **38**. As best seen in FIG. 6, the pawl **38** embraces the central hub **20** of the base **14** and has arms **40** extending in opposite radial directions and disposed between a plurality of pins **42** fixed to the base **14** and positioning the slide **38** for linear reciprocable movement to an extent limited by the central hub **20**.

Referring now to the range arm assembly **28** as best seen in FIGS. 2–5, the range shaft **30** has a sliding spur gear **44** keyed thereto by a key **46** and fitted for longitudinal movement along a keyway **48** in the range shaft **30**. The sliding gear **44** is supported in captured relation between a pair of bushings **50**, **52** retained within upper and lower vertically spaced hubs **54**, **56** of a gear positioning carriage **58**.

The positioning carriage **58** has a radial arm **60** shown extending outwardly from the upper hub **54**, and an integral substantially hollow post **62** (FIG. 3) depends from the radial arm **60** for rotatably supporting the hub of an idler spur gear **64** in mesh with the sliding gear **44**. The idler gear **64** is preferably formed of "Delrin," nylon or similar tough, self-lubricating plastic material. The lower end of post **62** is of tubular shape and is of sufficient length to permit its being simply flared over a retaining washer **66** to rotatably secure the idler gear **64** in operative position.

The positioning carriage **58** is provided with an integral helical detenting rack **68** having upper and lower end portions secured to the upper and lower hubs **54**, **56**, e.g., by radially extending brace members **70**, **72**. The brace members **70**, **72** together form a generally U-shaped channel **74** which receives an upright portion **76** of a range arm frame or bail **78** having apertured upper and lower horizontal arms **80**, **82** formed in a continuation with the upright portion **76** for receiving opposite axial ends of the range shaft **30**. The upper arm **80** of the bail **78** has an annular knob or hub **84** formed thereon with an integral gear segment **86** extending axially upwardly therefrom and a bushing insert **88** (FIG. 4) fitted within the hub **84** serving to provide bearing support for an upper axial end **90** of the range shaft **30**.

The above described range arm assembly provides for the positioning carriage **58** to be angularly and axially positioned on the range shaft **30**, and the bail member **78** is coupled by the U-shaped channel **74** to the positioning carriage **58** to be simultaneously angularly positioned in accordance with the angular position of the carriage.

To provide a variator of minimal over-all height, the base **14** is integrally formed with a plurality of equiangularly spaced recessed pockets **92** for receiving each range arm assembly **28**. Each pocket **92** has a downwardly extending tubular bearing compartment **94** shown having a closed bottom, and a bushing **96** (FIG. 2) is fitted in each bearing compartment **94** for providing radial bearing support for a lower axial end **98** of the range shaft **30**. In addition, a boss **100** surrounds each bearing compartment **94** for effecting thrust bearing support for the bail **78**. As best seen in FIG. 6, three such pockets **92** are provided with their bearing compartments **94** positioned adjacent the lowest gear step of the gear cone **22** at equal radial distances from the drive shaft axis and at angular intervals of 120°.

As illustrated, the idler gear **64** of the range arm assembly **28** has a diameter greater than that of its sliding gear **44** and is disposed relative to its range shaft **30** such that the idler gear **64** can be selectively meshed with the gear cone **22** by vertically and angularly adjusting the positioning carriage **58**. In this regard, the helical detenting rack **68** is provided with a series of ten index notches along its lower edge portion such as at **102** for receiving a stud **104** and for thereby accurately positioning the idler gear **64** in appropriately correlated vertical and angular positions in mesh with the gear steps of the gear cone **22**. For changing the setting of the variator and thus for varying the unit price at which it is set for computing, the different vertical positions and the correspondingly different angular positions of the range arm assembly **28** are shown indicated by numerical indicia 1 through 9 provided on its helical detenting rack **68**.

A tenth notch denoted by the numeral zero is shown at the upper end of the helical rack **68** and is indicative of a lock-out position whereby upon setting its corresponding notch upon the stud **104**, the idler gear **64** is positioned outwardly of the gear cone **22** in engagement with a lock-out stud **106**. A recess **108** (FIG. 6) is provided for accommodating the lower projecting portion of the post **62** supporting the idler gear **64** when the range arm assembly is in its lowermost position in engagement with the largest gear of the cone **22**.

In fitting together the parts of the range arm assemblies **28**, an output gear **110** of proper size is pressed fit on the range shaft **30** in a properly located axial position thereon for driving a corresponding input gear of the associated differential **34**. The upper part of the frame portion **76** is shown suitably stepped to provide three vertically spaced horizontal stops suited to underlie marginal portions of output gears of varying diameter and to maintain the components in assembled relation before journaling the range arm assemblies in proper position on the frame **10** with the bushing insert **88**. Also, the deformable tubular post **62** further facilitates assembly of the idler gear **64** in proper meshing engagement with the sliding gear **44** of each range arm assembly **28**. Moreover, since each individual range arm assembly **28** is of identical construction except for its output gear **110**, the entire positioning carriage **58** and the bail **78** are each cast as single piece integral units to effect significant cost saving economies in the manufacture and assembly of the variator.

To provide additional time savings in the assembly of the variator as well as to further reduce its cost of manufacture, both the platform **12** and the base **14** are individually cast of a suitable rugged, but lightweight material to provide integral units of generally circular configuration. In view of the above described structure, many of the various parts provided on the base **14** can be integrally formed thereon such as, e.g., the pins **42**, the recessed pockets **92** as well as their bearing compartments **94**, the locating studs **104**, suitable limit pins **105** for the carriage **58** and the tooth-like lock-out studs **106**.

In addition, each of the vertical supports **16** comprise a hollow depending post portion **112** and an upstanding hollow post portion or seat **114** respectively formed as integral portions of the platform **12** and base **14** in a symmetrical arrangement thereon adjacent their respective marginal edges. Preferably, three such supports **16** are provided for maintaining the platform **12** in parallel spaced relation above the base **14**, and the depending and upstanding post portions **112**, **114** are shown tapered, respectively, toward one another. Specifically, each depending post portion **112** has a cup-shaped end with a recessed bottom **118** and a downwardly projecting rim **116** thereby forming a socket which is adapted to be fitted onto the upper end of its mating seat **114** in overlapping nesting engagement to provide self-locating and self-aligning vertical assembly for quick and easy attachment of the platform **12** to the base **14** once the range arm assemblies **28** have been oriented in their respective pockets **92**, and the gear cone **22** and the differential **34** are properly mounted on the drive shaft **24**.

If desired, a cylindrical cover, not shown, can be positioned within conforming annular guideways **115**, **117** respectively formed on the platform **12** and base **14**, and a suitable sliding door can be provided for access to the

range arm assemblies for adjusting the setting of the variator.

Obviously, it is a simple matter to fit the upper extensions of the drive shaft **24** and the range arm assemblies **28** through suitable openings formed in the platform **12** such as that shown at **119** in FIG. 2, whereupon screw fasteners **120** may be easily installed to secure the post portions **112**, **114** together and thereby secure the entire variator assembly, it being seen that the enlarged annular hubs **84** formed on the top of the bails **78** of the range arm assemblies **28** provide for journaling the range arm assemblies in respective openings **119** in the platform **12**.

For securing the variator in assembled operative position in a gasoline dispensing apparatus, a plurality of depending posts **121** (only one being shown in FIG. 2) are formed on the base **14**, and detachable reversible mounting lugs **122** are provided for extension upwardly or downwardly of the platform **12** with each mounting lug **122** fitted into a corresponding seat **124** formed on the marginal edge of the platform **12**. Each seat **124** has a pair of projections **126**, **128** which are of an unequal size for one-way receipt of each of the mounting lugs **122** to ensure that they are properly oriented for purposes of assembly.

Since it is not unusual for the price of gasoline to fluctuate frequently, it is desirable to provide visual indication of the prevailing unit price and for this reason it will be understood that two opposite sets of number wheels **130** are provided for visually displaying the unit price corresponding to the setting of the variator.

The platform **12** is provided with a pair of ledges **131**, **132** (FIG. 1) projecting radially outwardly from opposite sides of the platform **12** with each ledge **131**, **132** having three downwardly extending cylindrical projections **133** such as that shown in FIG. 7 providing three mounting sockets **134** which are arranged in side-by-side linear alignment for mounting opposite price posting number wheels **130**. It will be understood that each set of number wheels comprises three wheels of increasing order with each number wheel having suitable indicia whereby each set of number wheels will indicate the gasoline price up to 99.9¢. It will be sufficient to describe only one of the number wheels since each number wheel is of substantially identical construction.

Referring to FIGS. 7 and 8, a number wheel **130** is shown comprising a cup shaped indicia bearing rim and a supporting shaft **136** secured thereto and preferably formed of plastic. The shaft **136** is provided with an integral drive pinion **138** adjacent its upper end and a single tooth or detent lug **140** at the lower axial end thereof which is slotted to permit radial inward flexing of the tooth **140** on the shaft **136**. A boss **142** surrounds a mounting socket **134** to serve as a seat for the drive pinion **138**, upon fitting the shaft **136** in its socket **134**, the tooth **140** passes through an axial slot **144** in the socket and is received within an enlarged bottom portion thereof. To set the number wheel **130** to a zero angular position shown in FIG. 8, the shaft **136** is turned to cam the resilient tooth **140** over a cam or limit stop **146** and into an adjacent indentation **148** both formed in the depending sidewall of the socket, the shaft **136** being thereafter retained in the socket by the limit stop **146** and a similar limit stop **150** provided on the opposite side of the slot **144**. The number wheel **130** is accordingly retained against axial displacement by the engagement of the tooth **140** with a shoulder **152** which defines the upper limits of the enlarged bottom portion of the socket **134**. A series of angularly spaced detent indentations similar to the indentation **148** are shown formed in the enlarged bottom portion of the socket **134** in corresponding relation to the indicia on the rim of the number wheel **30** whereby upon rotating the number wheel, its tooth **140** will ride over the intermediate projections and spring into the next indentation to effect self-location of the number wheel **130** while also maintaining it in a selected position against unintended movement.

To automatically set each number wheel **130** upon adjustment of the range arm assemblies **28**, a plurality of rotary amplifying levers **154**, **156** and **158** are shown for operating corresponding number wheels of the opposite sets in response to angular movement of the positioning carriages **58**. Each of the rotary amplifying levers **154**, **156** and **158** is formed of lightweight rigid material such as aluminum sheet metal and are respectively provided with circular hub portions **160**, **162** and **164** centrally positioned on the platform **12** in a vertically stacked arrangement with each lever having suitably formed gear teeth on its opposite ends for meshing with the drive pinions **138** of its corresponding pair of number wheels.

The rotary amplifying levers **154**, **156** which operate the highest and lowest order number wheels, are of identical construction wherein the levers **154**, **156** need only be mounted in relatively transposed relation for rotation about a common axis to provide suitable cross drives to their respective number wheels of the opposite sets. As seen in FIGS. 1 and 2, the hub portions **160**, **162** of levers **154**, **156** are radially supported on an upstanding circular wall or bearing **166** concentric with the central drive shaft **24** and axially supported on a boss **168**, both of which are integrally formed on the platform **12**. The rotary amplifying levers **154** and **156** each have a double set of mutilated gears **172**, **174** formed on their hub portions **160** and **162** for meshing engagement respectively with the gear segments **86** associated with the ten cent and one-tenth cent range arm assemblies, and the remaining or third rotary amplifying lever **158** is shown with a single mutilated gear **176** provided on its hub portion **164** for meshing engagement with the gear segment **86** of the one cent range arm assembly, whereby rotary movement of the carriage of each range arm assembly **28** is transmitted to their corresponding number wheels **130** of the opposite sets for indicating the position of the range arm assemblies and accordingly the established price. Each of the above mentioned mutilated gears are of sufficient size to ensure proper rotation of their respective number wheels through each of the various detented positions corresponding to the various settings of the range arm assemblies, and excessive travel is prevented by reason of the aforementioned limit pins **105** which will be seen to limit the angular movement of the levers **154**, **156** and **158** as well as their associated range arm assemblies.

To compensate for the side-by-side linear alignment of each set of number wheels so that each opposite pair of corresponding number wheels will be provided with the same angular displacement or amplification for a corresponding angular movement of their respective gear positioning carriage **58**, the hub portion **164** of the uppermost rotary amplifying lever **158**, for operating the intermediate order number wheels, is supported for rotation about an axis parallel to but eccentric to the common rotational axis of levers **154**, **156**. In this regard, a second upstanding circular wall or bearing **180** of less diameter than the circular bearings **166** is provided immediately above the bearing **166** having an eccentric axis which is shown offset a distance "X" perpendicular to a major axial plane Y—Y of the variator which extends through the central drive shaft axis and the sockets **134** for mounting the intermediate order number wheels of the opposite sets. The eccentricity of the bearing **180** is designed to enable the rotary amplifying lever **158** to provide the same amplification or drive ratio between its drive gear segment **86** and number wheel pinion **138** as is provided by the identical levers **154**, **156**, thus enabling the number wheels to be identically constructed.

The levers **154**, **156** and **158** are retained in properly stacked relation against axial movement by a pair of generally L-shaped fingers **180**, **182** oppositely disposed in facing relation for receiving diametrically opposed portions of the hub **164** of the lever **158**. Also, any possibility of the underlying levers **154**, **156** overriding intermediate lever **158** is effectively eliminated by the pro-

vision of a pair of wings on each of the lever arms of the lever **158** which project in generally opposite directions thereby to ensure interference free operation of the levers **154, 156** and **158.**

A variator having a construction of the type described above is of compact size with a minimal over-all height and in view of the extensive use of integrally formed parts, a large number of which are identical, the variator is particularly suited for quick and easy manufacture and assembly with considerable savings of cost as well as time.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above-described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. For use in a variator including a frame and a gear cone having a series of gear steps mounted for rotation on the frame, a range arm assembly comprising a range shaft, a sliding gear slidably but nonrotatably mounted on said range shaft, and a unitary gear positioning carriage mounted on said range shaft for independent sliding and rotary movement, said unitary gear positioning carriage having a radial arm projecting outwardly of said range shaft, an idler gear rotatably supported on said radial arm in continuous meshing engagement with said sliding gear and for selective meshing engagement with the series of gear steps for driving said range shaft responsive to rotation of the gear cone, and a helical detenting rack secured to said radial arm and having a series of notches corresponding to the series of gear steps for setting said sliding gear in a selected position axially of said range shaft while retaining said unitary gear positioning carriage against rotation therewith.

2. The range arm assembly of claim **1** wherein said radial arm of said unitary gear positioning carriage has an integral post formed thereon extending parallel to said range shaft for rotatably supporting said idler gear, said post having a tubular axial end deformable for rotatably securing said idler gear against axial displacement relative to said radial arm.

3. The variator of claim **1** wherein the frame includes a lower frame member and an upper frame member secured in spaced parallel relation to the lower frame member, and indicator means supported for operation on the upper frame member for showing a prevailing setting of the variator, and wherein said range arm assembly further includes a bail coupled to said unitary gear positioning carriage for simultaneous rotary movement relative to said range shaft, and a driving connection between said bail and the indicator means for operating the indicator means during a setting operation responsive to rotary movement of said unitary gear positioning carriage.

4. The range arm assembly of claim **1** wherein said gear positioning carriage further comprises a pair of hub members axially spaced apart for sliding movement on said range shaft with said sliding gear retained in captured relation between said hub members for movement therewith axially of said range shaft, said radial arm being fixed to one of said hub members, and said hub members each being joined to said helical detenting rack and forming a gear positioning carriage of unitary construction.

5. The range arm assembly of claim **3** wherein said bail includes a hub providing a bearing for an upper axial end of said range shaft, said hub being journaled in the upper frame member and having an integral gear segment projecting therethrough and constituting a part of said driving connection between said bail and the indicator means.

6. For use in a variator, a variator frame comprising a lower frame member, an upper frame member, and support means for maintaining said upper frame member in elevated assembled relation to said lower frame member including a plurality of posts integrally formed on one of said frame members and projecting toward the other thereof, said other of said frame members having a plurality of integrally formed seats respectively engageable with said posts in overlapping nesting engagement for self-aligning vertical assembly of said upper frame member upon said lower frame member.

7. The variator frame of claim **6** wherein said posts each include a cup shaped end having a projecting rim defining a recessed socket for receiving a corresponding seat in overlapping nesting engagement.

8. The variator frame of claim **7** wherein said seats are provided on said lower frame member, said upper frame member being provided with said posts corresponding in number and arrangement to said seats, said posts each having a cavity formed therein, and wherein a fastener is installed within each said cavity for securing each of said posts to its respective seat.

9. In combination with a variator of a type including a frame, a gear cone having a series of gear steps supported for rotation on the frame, a plurality of range arm assemblies mounted on the frame and respectively having a movable gear positioning member and a gear supported thereon for meshing engagement with a selected one of the series of gear steps for obtaining varying outputs in accordance with a selected setting, a plurality of indicator wheels of increasing order supported for rotation on the frame for respectively indicating the setting of the range arm assemblies, and a driving connection between each of the range arm assemblies and their respective indicator wheels for setting the same when the gear positioning members are moved, an improvement comprising a plurality of rotary amplifying levers in the driving connection corresponding in number to the range arm assemblies for respectively operating their associated indicator wheels, said rotary amplifying levers each having a circular hub portion supported for rotation on the frame in stacked relation.

10. The improvement of claim **9** wherein said plurality of rotary amplifying levers include a pair of interchangeable rotary amplifying levers of identical construction arranged in relatively transposed position on the frame for rotation about a common axis, said pair of levers each having a double set of mutilated gears provided on said circular hub portion thereof for alternative driving connection to different ones of a pair of the range arm assemblies.

11. The variator of claim **9** wherein each gear positioning member is rotatable in a sequence of angular steps in selectively setting its associated gear in meshing engagement with the series of gear steps, and wherein the improvement further comprises a mutilated gear on said circular hub portion of each of said rotary amplifying levers for transmitting angular movement of each of the gear positioning members to their respective indicator wheels.

12. The improvement of claim **9** further comprising a pair of generally L-shaped retaining members provided on the frame in opposed facing relation for maintaining said circular hub portions of said rotary amplifying levers in stacked relation against displacement axially of their rotational axes.

13. The variator of claim **9** wherein a pair of indicator wheels is provided for each of the range arm assemblies with one wheel of each pair provided in each of two sets of indicator wheels of increasing order supported in side-by-side linear alignment on opposite sides of the frame, and the improvement wherein said rotary amplifying levers are positioned with said circular hub portions thereof in stacked relation intermediate the opposite sets of indicator wheels, and said rotary amplifying levers each having a pair of arms rigidly fixed to its said circular hub portion and extending outwardly thereof in generally opposite directions for operating corresponding indicator wheels of the opposite sets.

14. The improvement of claim 10 wherein said plurality of rotary amplifying levers include a third rotary amplifying lever rotatable about an axis parallel to but offset from said common axis of said first pair of levers for providing the same angular displacement to an indicator wheel of an intermediate order as that provided to number wheels of relatively higher and lower order by said first pair of levers responsive to a corresponding angular movement of their respective gear positioning members.

15. The improvement of claim 11 further comprising a hub on each gear positioning member journaled in the frame and forming a bearing for its associated range arm assembly, each said hub having a gear segment integrally formed thereon and projecting beyond the frame in mesh with said mutilated gear on said circular hub portion of its respective rotary amplifying lever.

16. The variator of claim 11 wherein the indicator wheels each have indicia thereon in spaced relation corresponding to the series of angular steps of its associated gear positioning member, and the improvement further comprising resilient detent means operable upon operation of the indicator wheels for locating the same in any one of a series of positions corresponding to the indicia on the indicator wheels while also maintaining the same in a selected detented position against unintended movement.

17. The improvement of claim 14 wherein said circular hub portion of said third rotary amplifying lever is positioned in overlying relation to each said circular hub portion of said first pair of levers, and wherein said third rotary amplifying lever includes a pair of wings projecting in generally opposite directions for preventing overriding thereof by said first pair of levers to minimize any possibility of interference during a setting operation.

18. The variator of claim 14 wherein said indicator wheels are positioned in side-by-side linear alignment, and wherein the improvement further comprises a bearing formed on the frame concentric to said common rotational axis of said first pair of levers providing radial support for each of said circular hub portions thereof, and a second bearing formed on the frame in eccentric relation to said first bearing and providing radial support for said circular hub portion of said third rotary amplifying lever for maintaining the same for rotation about an axis parallel to but offset from said common rotational axis of said first pair of levers.

19. In a variator, a frame having a lower frame member and an upper frame member supported thereon in spaced relation, a gear cone supported for rotation on said lower frame member, a plurality of range arm assemblies positioned in equally spaced relation to one another in a symmetrical arrangement relative to said gear cone, said range arm assemblies each having a rotary range shaft vertically mounted on said frame, a sliding gear slidably but nonrotatably mounted on said range shaft, and a unitary gear positioning carriage mounted on said range shaft for independent sliding and rotary movement for obtaining varying outputs from said gear cone in accordance with a selected setting, a plurality of indicator wheels of increasing order supported for rotation on said upper frame member for respectively indicating the setting of said range arm assemblies, and a driving connection between each of said range arm assemblies and their respective indicator wheels for automatically setting the same responsive to rotation of each said unitary gear positioning carriage, said driving connection including a plurality of rotary amplifying levers corresponding in member to said range arm assemblies for respectively operating their associated indicator wheels, said rotary amplifying levers each having a circular hub portion supported for rotation on said upper frame member in stacked relation.

20. The mechanism of claim 19 wherein said lower frame member further includes a plurality of recessed pockets integrally formed therein and corresponding in number to said range arm assemblies for seating the same in a variator of minimal over-all height.

21. The mechanism of claim 19 wherein said frame further comprises support means for maintaining said upper frame member in elevated assembled relation to said lower frame member and including a plurality of posts integrally formed on one of said frame members and projecting toward the other thereof, said other of said frame members having a plurality of integrally formed seats respectively engageable with said posts in overlapping nesting engagement for self-aligning vertical assembly of said upper frame member upon said lower frame member.

22. The mechanism of claim 19 wherein said indicator wheels each have indicia thereon for indicating the setting of its respective range arm assembly, said upper frame member including a plurality of mounting sockets formed therein in side-by-side linear alignment each having an enlarged lower end opening with a series of axially extending indentations formed in corresponding relation to said indicia in said upper frame member surrounding said enlarged lower end opening, and said indicator wheels each having a coaxial shaft secured thereto for rotation in response to operation of said rotary amplifying levers, said shaft including a resilient lower end portion having a tooth fixed thereto and received in said enlarged lower end opening of its mounting socket for resiliently locating said indicator wheel in a selected position and maintaining it against unintended movement.

23. The mechanism of claim 20 wherein said recessed pockets each include a tubular bearing compartment formed in the bottom thereof for receiving a lower axial end of said range shaft of its associated range arm assembly.

24. The mechanism of claim 20 wherein said lower frame member further includes an integral locating stud formed thereon adjacent each of said recessed pockets near a side edge of said lower frame member, and wherein said unitary gear positioning carriage of each of said range arm assemblies further comprises a radial arm projecting outwardly of said range shaft and movable axially thereof with said sliding gear, an idler gear rotatably supported on said radial arm in continuous meshing engagement with said sliding gear and for selective meshing engagement with a series of gear steps on said gear cone, and a helical detenting rack secured to said radial arm and having a series of notches corresponding to the series of gear steps on said gear cone engageable with said locating stud in a selected position axially of said range shaft for setting said idler gear in selected meshing engagement with said gear cone.

25. The mechanism of claim 24 wherein said unitary gear positioning carriage of each of said range arm assemblies further comprises a bail coupled to said helical detenting rack for simultaneous rotation therewith relative to said range shaft, said bail having a hub providing a bearing rotatably supporting an upper axial end of said range shaft, said hub being journaled in said upper frame member and having an integral gear segment projecting therethrough and constituting a part of said driving connection between each of said range arm assemblies and their respective indicator wheels.

26. The mechanism of claim 24 wherein said sliding gears of said range arm assemblies are of equal diameter with a like number of teeth, and wherein said idler gears of said unitary gear positioning carriages are of equal diameter with a like number of teeth.

27. The mechanism of claim 25 wherein said circular hub portion of each of said rotary amplifying levers includes a mutilated gear in mesh with said integral gear segment of its respective range arm assembly.

28. The mechanism of claim 19 wherein three said indicator wheels are positioned in side-by-side linear alignment on said upper frame member, and wherein said

upper frame member includes a bearing formed thereon concentric to a rotational axis of said gear cone and providing radial support for said circular hub portions of a pair of said rotary amplifying levers, and a second bearing being formed on said upper frame member in eccentric relation to said first bearing and providing radial support for said circular hub portion of a third rotary amplifying lever for maintaining the same for movement about a rotational axis parallel to but offset from that of said pair of levers.

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