July 19, 1949. H. N. BLISS 2,476,275

VARIATOR

Filed Oct. 18, 1946

3 Sheets-Sheet 1

Fig. 1

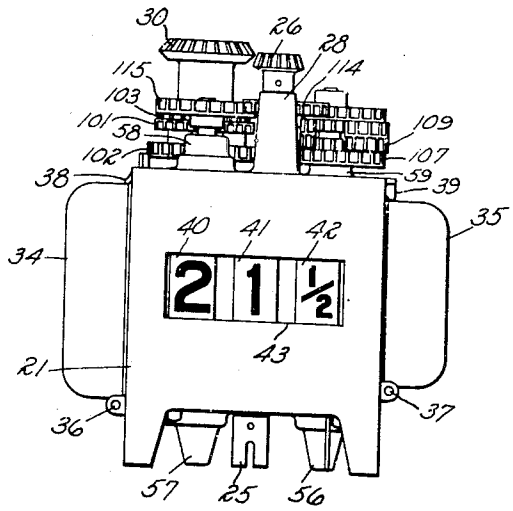
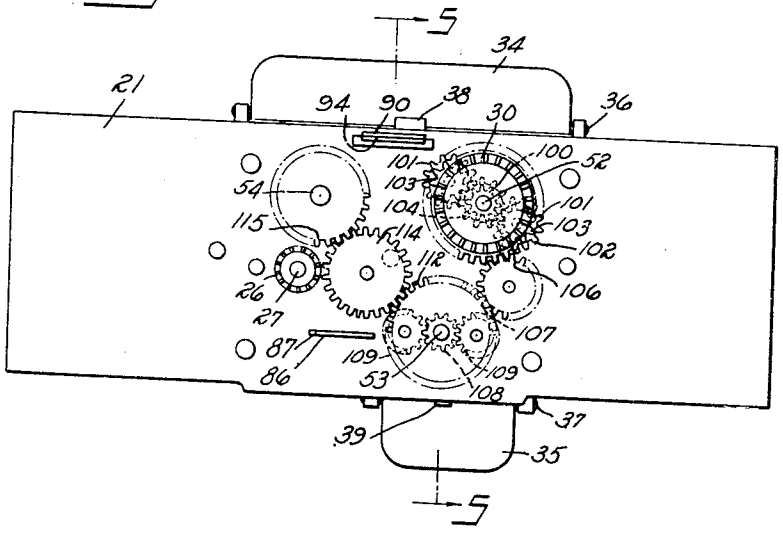


Fig. 2



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VARIATOR

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Filed Oct. 18, 1946

3 Sheets-Sheet 2

Fig. 3

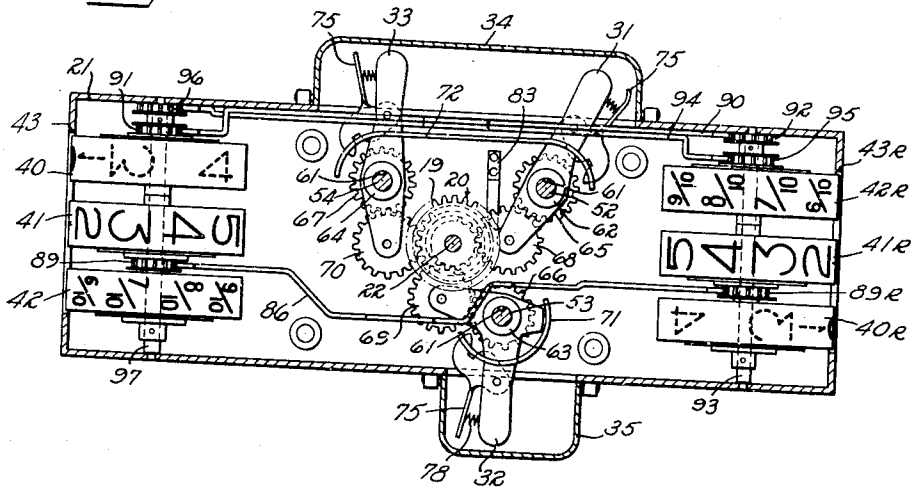
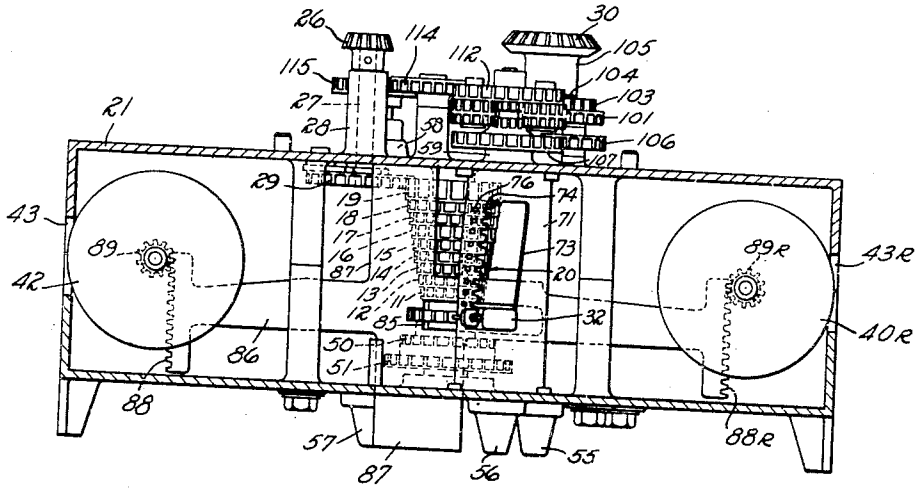


Fig. 4



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July 19, 1949. H. N. BLISS 2,476,275

VARIATOR

Filed Oct. 18, 1946

3 Sheets-Sheet 3

Fig. 5

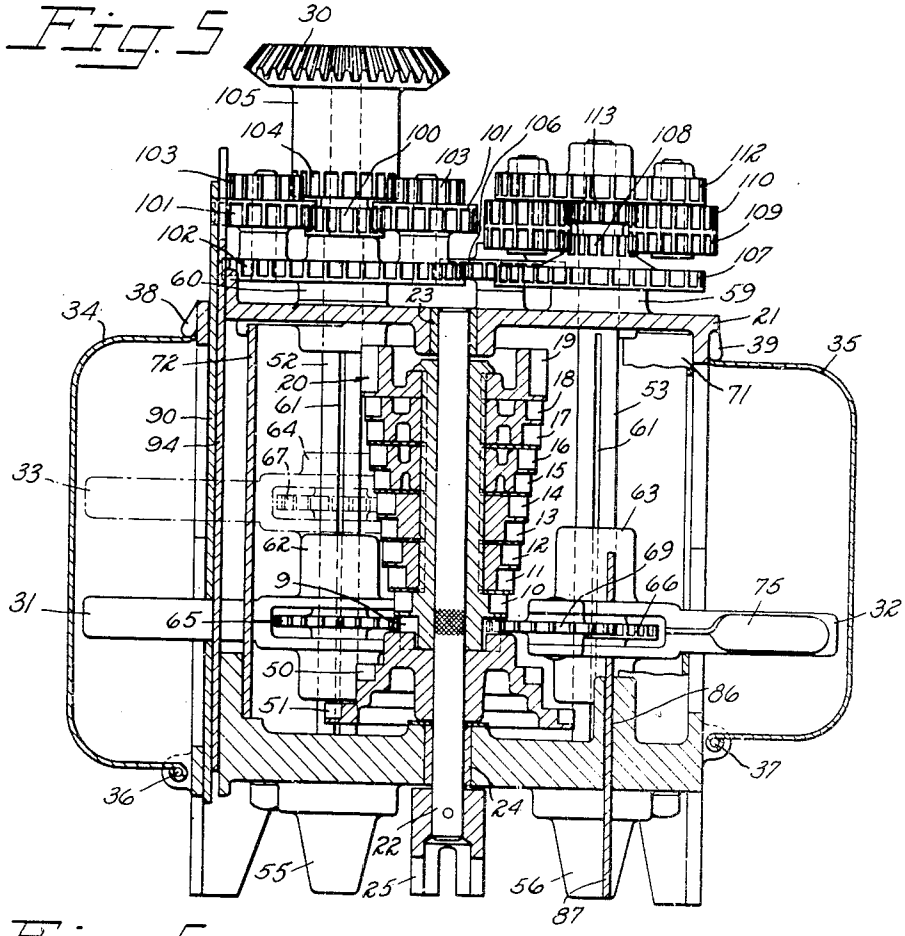
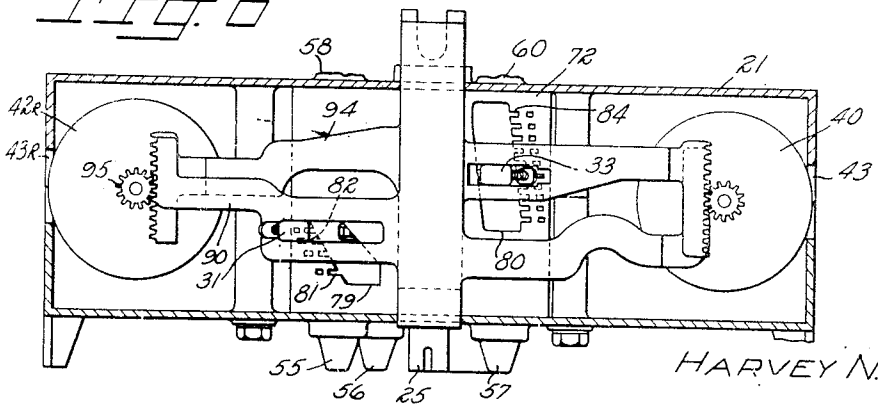


Fig. 6



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Patented July 19, 1949

2,476,275

UNITED STATES PATENT OFFICE

2,476,275

VARIATOR

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Application October 18, 1946, Serial No. 703,968

8 Claims. (Cl. 74—681)

1

The present invention relates to liquid dispensing apparatus, and more particularly to variable mechanisms hereinafter called "variators" for use with liquid dispensing apparatus to permit the mechanical measurement of the fluid dispensed in terms of money units, this being accomplished under conditions where the cost per unit may vary from time to time.

It is conventional in gasoline dispensing apparatus, for example, to provide a register for simultaneously indicating the units of quantity dispensed and the cost of same. To provide for fluctuations in price per unit, there is provided a variator or equivalent mechanical arrangement between the meter and the register, which variator is adapted to be manually adjusted for varying the input to the cost register in accordance with the particular price per unit of the gasoline dispensed.

It is an aim of the present invention to provide a variator in which the parts are of light weight and may be easily and inexpensively manufactured and may be readily assembled together into a sturdy and efficient unit.

Another aim of the invention is to provide a variator which is of improved design in that it is more efficient and has a corresponding compactness permitting the mounting of the device within a relatively much smaller space.

A further object of the invention is to provide a variator in which the changeover to a different price per unit is simplified whereby manual setting of the variator by the operator is facilitated.

Another object of the invention is to provide a variator which is accurate in operation and which will perform satisfactorily over long periods of time without repair or breakdown.

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 will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings—

Figure 1 is a front view of the assembled device;

Fig. 2 is a top view of the device turned through an angle of 90°;

Fig. 3 is a view similar to Fig. 2 and partly in cross section inasmuch as the top of the casing has been removed;

Fig. 4 is a side view (right-hand side of Fig. 1) with the side of the casing removed;

Fig. 5 is a cross sectional view taken along the line 5—5 of Fig. 2; and

Fig. 6 is a fragmentary side view of the device (left-hand side of Fig. 1) with the side plate removed.

2

The invention will be described with particular reference to the specific embodiment shown in the drawings whereby the principle of operation of the device will become readily apparent. It is to be understood that the specific embodiment is given merely by way of illustration and that variations in the design of the device, such as the substitution of equivalent gears or gear ratios to carry out the same principle of operation, are intended to be included within the scope of the invention.

Referring to the drawings, the device is housed in a suitable rectangular casing 21. The input to the device, such as from a conventional meter of the type utilized with gasoline dispensing apparatus (not shown in the drawings), is applied to the main shaft 22 through a suitable coupling 25, the main shaft 22 being journaled in the top and bottom of the casing at 23 and 24 respectively.

The connection between the meter and the register (the register is not shown in the drawings) for permitting the indicating of the gallonage dispensed is through a bevel gear 26 which is fixed to a shaft 27 rotatably mounted in a bearing 28 and driven by a spur gear 29. The spur gear is in mesh with the uppermost gear 19 of the cone of gears 20 fixed to the main shaft 22. The cone of gears 20 will be described in detail hereinafter. It thus will be seen that there is a fixed driving connection between the meter and the register through the shafts 22 and 27 for the purposes of indicating the gallonage of liquid dispensed. The connection herein described is one which is designed for convenience and obviously any other drive between the meter and the register could be substituted, the particular driving connection, as such, being no part of the present invention.

The connection to the register for permitting the indicating of the cost of the liquid dispensed is effected through a bevel gear 30 which is differentially and adjustably connected by gearing to be described more fully hereinafter with the cone of gears 20 fixed on the main shaft 22. The output of the bevel gear 30 can be varied at will within a wide range, in accordance with the invention, to provide for different prices per unit of the liquid dispensed.

In the embodiment shown, three manually operable range levers 31, 32 and 33 are provided for setting the output of the cost take-off bevel gear 30. Access is had to the range levers through doors 34 and 35 pivoted on the casing at 36 and 37, respectively, and releasably held in closed position by the keepers 38 and 39, respectively.

By connections to be described later, the setting

of the range levers 31, 32 and 33 and hence the output to the cost take-off gear 30 is shown on price wheels 40, 41 and 42 disposed at the front of the casing, and corresponding price wheels 40R, 41R and 42R at the rear of the casing. The indicia on these wheels are viewable through windows 43 and 43R in the front and rear of the casing, respectively.

An important feature of the device is the cone of gears 20 consisting of a series of gears 9 to 19 of increasing diameter from bottom to top. In accordance with the invention, the number of teeth in these gears 9 to 19 is increased from bottom to top in numerical sequence, that is, the lower gear 9 has nine teeth, the second gear 10 has ten teeth, etc. until gear 19, which has nineteen teeth. The principle employed here is to utilize a series of gears which vary in numerical sequence, that is, each gear varies from the preceding gear by one tooth. In the specific embodiment shown, this amounts to steps of ten percent from the base gear 10. Any other numerical sequence of gears could be utilized if desired. This is distinctly different from the conventional cone of gears utilized in variators in which the number of teeth in the gears are in the order of an arithmetical progression, that is, each gear varies in steps of one-hundred percent from the base gear utilized. In such prior art variators, the top gear has nine times the number of teeth of the bottom or base gear, which results in a cone of relatively heavy weight and utilizing more material having an undesirably wide base requiring a considerable amount of space, and also making it more difficult to set the apparatus conveniently.

As mentioned heretofore, the cone of gears is fixed to the main shaft 22 so as to turn therewith. For convenience in assembly and fabrication of the cone of gears, it will be observed that the gears have been formed in integral pairs, as, for example, gear 9 and gear 10 comprise a single unit, gear 11 and gear 12 comprise a single unit, etc. It will be understood that this construction of the cone has been selected merely for convenience in fabricating the device and that the particular manner in which the cone is assembled is immaterial from the standpoint of the invention involved.

Also fixed to the main shaft 22 and below the cone of gears 20 are two gears 50 and 51. The gear 50 in the embodiment shown has eighteen teeth and is therefore a duplicate of gear 18. Theoretically, the gear 50 would not be necessary in the device since its function could be carried out by the gear 18. However, it has been found that as a matter of design, in order to provide suitable space for the movement of other parts of the device, it is preferable to utilize the additional gear 50. The other gear 51 has twenty-seven teeth and thus, with the gears 50 and 9, forms a short cone of three gears having teeth the number of which vary in arithmetical progression, namely, 9, 18, and 27 teeth, respectively.

In the specific embodiment shown, there are three auxiliary drive shafts 52, 53 and 54 parallel to the main drive shaft 22 which are rotatably journaled in the bottom of the casing at journals 55, 56 and 57, respectively, and at the top of the casing by journals 58, 59 and 60. Each of the auxiliary drive shafts 52, 53 and 54 is splined as shown by the longitudinal grooves 61. The range levers 31, 32 and 33 previously referred to are rotatably and slidably mounted on the drive shafts 52, 53 and 54, respectively, by their hubs 62, 63 and 64. Each of the hubs 62, 63 and 64 carries a driven gear 65, 66 and 67, respectively, and each of these gears is keyed to the groove 61 of its respective auxiliary drive shaft so that the driven gear may slide longitudinally (vertically) on the auxiliary drive shaft, but, when rotated, will rotate the auxiliary drive shaft therewith.

In mesh with the driven gears 65, 66 and 67 and also mounted on the range levers 31, 32 and 33, respectively, are idler gears 68, 69 and 70. The various parts are designed such that by sliding and pivoting the range levers 31, 32 and 33 on the auxiliary drive shafts, it is possible to mesh the idler gears selectively with the gears on the main shaft 22, whereby the auxiliary drive shafts 52, 53 and 54 may be rotated when the main drive shaft 22 is rotated by the meter. For convenience in the embodiment shown, the idler gears 68, 69 and 70 and the driven gears 65, 66 and 67 are all of the same size. Accordingly, the speed of rotation of the auxiliary drive shafts 52, 53 and 54 as compared with the speed of rotation of the main drive shaft 22 is directly proportional to the size of the particular gears with which the respective idler gears are in mesh.

For convenience in positioning the range levers 31, 32 and 33 so that each may selectively engage one of the gears on the main drive shaft 22, there is provided a positioning range plate 71 associated with the range lever 32, and a positioning range plate 72 associated with the levers 31 and 33. The range plate 71 has an elongated slot 73 which is slanted in conformity with the steps on the gear cone 20. Along the inner edge of the slot 73 are a plurality of notches 74 at the height of the gears 9 to 18, respectively. When the range lever 32 is inserted into the selected notch 74, it will engage the idler gear 69 mounted thereon with the selected gear of the cone of gears 20.

The locking means for each of the range levers is the same and therefore a single description in connection with the range lever 32 will suffice. Pivotally mounted on the range lever 32 is a latch 75 having a pointed nose adapted to engage into the indentures 76 associated with the notches 74. The latch 75 is pivoted on the range lever 31 and biased into engagement with the openings 76 by a spring member 78. It thus will be apparent that the operator may readily set the range lever in a one-handed operation, merely by pressing the latch 75 to disengage the nose of the latch from the indenture 76 whereupon the range lever may be pivoted outwardly from the notches 74 and then may be slid vertically in the elongated slot 73 to a new position.

The range plate 72 which is associated with the range levers 31 and 33 has two elongated slots 79 and 80 adapted to receive the range levers 31 and 33, respectively. The elongated slot 79 contains three notches 81 for permitting engagement of the idler gear 68 associated with range lever 31 with the gears 9, 50 and 51 selectively. A fourth notch 82 is provided between the levels of the gears 9 and 50 which is hereinafter called a lockout position. When the range lever 31 is moved into the notch 82, the idler gear 68 is in mesh with a stop member 83 which prevents the idler gear 68 and consequently the auxiliary drive shaft 52 from turning.

The second elongated opening 80 contains ten notches 84 at the level of the gears 10 to 19, respectively, so that the idler gear 70 of the range lever 33 may be engaged selectively with these gears.

To provide indicating means for indicating the

setting of the range levers, the range lever 32 extends through an elongated opening 85 in a rack 86 which is provided with a guide plate 87, the guide plate being slidably mounted for vertical movement in the casing 21. The teeth 88 and 88R at the ends of the rack 86 engage pinions 89 and 89R, respectively, on the price wheels 41 and 41R, respectively. Accordingly, as the range lever 32 is moved from position to position with respect to the cone gear 20, the rack moves vertically therewith and thus the position is indicated on the price wheels 41 and 41R which have indicia running from "0" to "9" on the periphery thereof. When the range lever is in the lowermost notch 74 with its idler gear 69 in mesh with gear 9, the cipher will appear at the windows 43 and 43R; when moved to the next notch, the integer "1" appears; and this relationship continues until the integer "9" appears in the windows when the range lever is in the uppermost notch at which time idler gear 69 is in mesh with gear 18. Inasmuch as the price wheels 41 and 41R are the one-cent member wheels, the range lever 32 will be referred to hereinafter as the one-cent lever.

The range lever 31 is similarly engaged with a rack 90 which, in turn, sets the price wheels 40 and 40R. The rack 90 meshes directly with a pinion 91 on the price wheel 40 and also with a pinion 92 fixed to a shaft 93 to which the price wheel 40R is fixed. The price wheels 41R and 42R also are mounted on the shaft 93 but are freely rotatable thereon, and accordingly will not turn therewith. The price wheels 40 and 40R are provided with indicia ranging from "1" to "4" in the sequence 2, 1, 3, 4. When the range lever 31 is in the uppermost notch 81 positioning the idler gear 68 in mesh with gear 9, the numeral 2 appears in the windows 43 and 43R. When the range lever 31 is in the lock-out position (notch 32) with the idler gear 68 held in stationary position by the stop member 83, the figure "1" appears in the windows. In the next two positions of the range lever 31 (with idler gear 68 in mesh with gears 50 and 51, respectively) the readings are "3" and "4," respectively. As the setting of the range lever 31 thus determines the first figure of the cost reading, it is hereinafter referred to as the ten-cent wheel.

The range lever 33 is similarly connected with a rack 94 which in turn engages the pinion 95 on the price wheel 42R and with a pinion 96 fixed to a shaft 97 to which the price wheel 42 is fixed. The remaining price wheels 40 and 41 which also are mounted on shaft 97 are freely rotatable thereon and are not turned thereby. The price wheels 42 and 42R are provided with indicia indicating a fraction of the unit of money in which the cost of the liquid is measured, in this case, a tenth of a cent. Accordingly, the range lever 33 will be referred to hereinafter as the tenths cent lever. When the range lever 33 is in its lowermost position with its idler gear 70 in mesh with gear 10, the reading on the cost wheels 42 and 42R is zero. At the next higher setting (idler gear 70 in mesh with gear 11) the reading is $\frac{1}{10}$ cent, and so forth until the uppermost setting (idler gear 70 in mesh with gear 19) when the reading is $\frac{9}{10}$ cent.

It will be apparent from the foregoing that the highest total setting of the specific embodiment of the variator shown will be 49.9 cents per gallon and the lowest will be 10.0 cents per gallon, with all amounts therebetween in steps of $\frac{1}{10}$ cent being obtainable by selectively setting

the range levers 31, 32 and 33. If desired, suitable indicia (not shown in the drawings) may be placed alongside the various notches (74 etc.) to facilitate setting of the range levers in the proper positions.

The outputs of auxiliary shafts 52, 53 and 54 are combined for driving the cost bevel gear 30 at a rate relative to the gallonage bevel gear 26 which is proportional to the cost per unit shown on the price wheels 40 etc. and 40R etc. This may be accomplished by the gear train described immediately below.

The auxiliary drive shaft 52, which is the tencent shaft, has fixed thereto a pinion gear 100 which rotates therewith. The pinion gear 100 is in mesh with a plurality of epicyclic gears 101 (shown two) rotatably mounted on the spur gear 102 which in turn is freely and rotatably mounted on the shaft 52. Fixed to each of the gears 101 is a smaller gear 103 which is in mesh with the gear 104 formed on the shank 105 of the cost bevel gear 30 which also is freely mounted on the shaft 52. In the specific embodiment shown, the relation of the size of the gears 100, 101, 103 and 104 is such that the speed or amount of rotation of bevel gear 30 is $\frac{4}{9}$ of the speed or amount of rotation of the shaft 52, assuming, for the moment, that the gear 102 is held in stationary position. However, if the spur gear 102 also is rotated and in the same direction, there will be an additive effect of $\frac{5}{9}$ times the speed or amount of rotation of gear 102. As described hereafter, the gear 102 is arranged to be driven by the one-cent and tenths-cent drive shafts 53 and 54. In the specific embodiment shown, all of the auxiliary shafts are driven in the same direction and the output of these shafts is additive. It is to be understood, however, that if desired one or more of the shafts may be driven in the reverse direction in certain settings to obtain a subtractive effect, if necessary, to obtain a combined output corresponding to the setting of the price wheels.

The spur gear 102 is connected through an idler gear 106 with a spur gear 107 to which is fixed a small pinion gear 108. The gears 107 and 108 are freely mounted on the auxiliary drive shaft 53. The pinion gear 108 is driven by epicyclic gears 109 (shown two) which are mounted on a spur gear 112 which also is freely mounted on the auxiliary drive shaft 53. Fixed to the gears 109 are larger gears 110 meshing with a pinion gear 113 fixed to the drive shaft 53. Assuming that the spur gear 112 is held in fixed position, rotation of the auxiliary drive shaft 53 causes rotation of the gears 110 and 109 which drives gears 108 and 107 which, in turn, are connected to the spur gear 102 mounted on the drive shaft 52. The size of the gears 108, 109, 110 and 113 are such that, when the spur gear 112 is stationary, the speed or amount of rotation of the spur gear 107 is $\frac{9}{10}$ of the speed or amount of rotation of shaft 53. The relationship of size of the spur gears 107 and 102 is such that the rate or amount of rotation of gear 102 is $\frac{4}{5}$ of the rate or amount of rotation of gear 107. Accordingly, the effect upon bevel gear 30 of rotating gear 107 ($\frac{4}{5}\times\frac{5}{9}$) is the same as is the rotation of the auxiliary shaft 52 ($\frac{4}{9}$).

If the spur gear 112 is rotated in the same direction as auxiliary shaft 53, an additional drive is imparted to the gear 107 which, because of the gear ratio mentioned, will have the effect of multiplying the speed or amount of rotation of the gear 112 by $\frac{1}{10}$. The spur gear 112 is connected to a spur gear 115 fixed to the auxiliary

drive shaft 54 through an idler gear 114. The gear ratio between spur gear 115 and spur gear 112 is such that the rate or amount of rotation of auxiliary shaft 54 is multiplied by $\frac{9}{10}$.

To more clearly set forth the particular gear ratios employed in the specific embodiment shown, assume that each of the idler gears 68, 69 and 70 is in mesh with a gear on the drive shaft 22 having eighteen teeth and that the driven gears 65, 67 and 68 each are provided with twelve teeth. In the present embodiment, the pitch diameters of the teeth of all gears utilized are the same. The output of the bevel gear 30 derived through the ten-cent shaft 31 would be $\frac{18}{12}$ (ratio of the cone gear and driven gear) times $\frac{4}{9}$ (the gear ratio provided by the gears 100, 101, 103 and 104) or a total of $\frac{2}{3}$, i. e. $\frac{100}{150}$.

The output of the bevel gear 30 derived through the one-cent shaft 32 would be $\frac{18}{12}$ times $\frac{4}{9}$ (the combined effect of gears 107 and 102 with gears 100, 101, 103 and 104) times $\frac{9}{10}$ (the gear ratio provided by gears 108, 109, 110 and 113) or a total of $\frac{3}{5}$, i. e. $\frac{90}{150}$.

The output of the bevel gear 30 derived through the tenths-cent shaft 33 would be $\frac{18}{12}$ times $\frac{4}{9}$ times $\frac{9}{10}$ (the gear ratio provided by spur gears 112 and 115) times $\frac{1}{10}$ (the gear ratio provided by gears 108, 109, 110 and 112) or a total of $\frac{3}{50}$ i. e. $\frac{9}{150}$.

Assuming the same setting for each idler gear, therefor, the output of the ten-cent, one-cent and tenths-cent shafts is thus in the ratio of 100 to 90 to 9.

To illustrate how the foregoing gear train accurately combines the output of shafts 52, 53 and 54, as indicated on the price wheels 40 etc. and 40R etc., let it be assumed that the range lever 33 is in its lowermost position with its idler gear engaging gear 10 of the cone of gears. Range lever 32 is also in its lowermost position, which means that its idler gear is in engagement with gear 9, and range lever 31 is in its uppermost position with its idler gear in mesh with gear 9. This setting would be indicated on the price wheels as 20.0 cents.

Assuming that the driven gears 65, 67 and 68 carried by each of the shafts 31, 32 and 33 is formed with twelve teeth, the output of bevel gear 30 as a result of the rotation of the auxiliary drive shaft 31 will be $\frac{9}{12}$ (the ratio of gear 9 and the driven gear 65) times $\frac{4}{9}$, the gear ratio produced by the gears 100, 101, 103 and 104, as previously described. This is a total of $\frac{10}{20}$.

The output derived from the one-cent shaft 53 may be calculated by multiplying the fractions $\frac{9}{12}$ (for the gear ratio between the gear 9 and the driven gear 66) by the fraction $\frac{9}{10}$ (which is the gear ratio provided by the epicyclical gear train consisting of gears 108, 109, 110 and 113) and by the fraction $\frac{4}{9}$ (which is the combined result of the gear ratio of gears 107 and 102 with the gear ratio of the epicyclical gear train consisting of gears 100, 101, 103 and 104). This is a total of $\frac{9}{30}$.

The effect of the auxiliary drive shaft 54 may be calculated by multiplying the fraction $\frac{1}{2}$ (the ratio of gear 10 to the driven gear 65) by $\frac{1}{10}$ (the gear ratio provided by the epicyclical gear train 108, 109, 110 and 112) by $\frac{9}{10}$ (the gear ratio provided by spur gears 112 and 115) and finally by $\frac{4}{9}$ (the gear ratio provided by the combination of spur gears 102 and 107 and epicyclical gear train 100, 101, 103 and 104). This combined fraction is equal to $\frac{1}{30}$.

The total drive of the bevel gear 30 in the specific example given is, therefore, $\frac{20}{30}$ of the speed or amount of rotation of the central drive shaft 22, this being the total of the $\frac{10}{30}$ from the ten-cent shaft 52, $\frac{9}{30}$ from the one-cent shaft 53 and $\frac{1}{30}$ from the tenths-cent shaft 54. As this rate of rotation is to provide a drive proportional to the 20.0 cents reading on the price wheels, it will be apparent that a 10¢ portion ($\frac{10}{20}$) thereof is derived from the ten-cent shaft, a 9¢ portion ($\frac{9}{20}$) thereof from the one-cent shaft and a 1¢ portion ($\frac{1}{20}$) from the tenths-cent shaft.

It will be appreciated that as the range lever 31 (on the ten-cent shaft) is moved from notch to notch, the input to the spur gear will vary in steps of ten cents from zero to thirty cents. Movement of the range lever 32 (on the one-cent shaft) from notch to notch changes the input in steps of one cent from nine to eighteen cents. Changing of the position of the range lever 33 (on the tenths-cent shaft) varies the input in steps of $\frac{1}{10}$ cent from 1 to 1.9 cents.

The minimum total output from the three shafts, accordingly, will be ten cents, all of which is derived from the cent shaft (9.0¢) and tenths-cent shaft alone (1.0¢), the ten-cent shaft being in locked out position. The maximum total output, in the specific embodiment shown, will be 49.9 cents, this being the total of 30.0 cents from the ten-cent shaft, 18.0 cents from the one-cent shaft, and 1.9 cents from the tenths-cent shaft.

Inasmuch as the total output of the cent shaft and ten-cent shaft can never be below ten cents and the maximum cannot be more than ten cents, the price wheels 40 and 40R can be properly set by the range lever 31 on the ten-cent shaft merely by adding one integer to the actual output of the ten-cent shaft.

Similarly, the price wheels 41 and 41R can be properly set by the range lever 32 on the one-cent shaft by substracting nine cents from the actual output of the one-cent shaft. This is because the minimum and maximum outputs of the tenths-cent shaft are 1.0 cent and 1.9 cents, respectively, so that 1.0 cent must be added when setting price wheels 41 and 41R by the range lever 32 to compensate for the output of the tenths-cent shaft and 10 must be subtracted to compensate for the setting of price wheels 40 and 40R by the ten-cent shaft, or a net deduction of 9.0 cents.

As will be apparent from the above, 1.0 cent is deducted from the output of the tenths-cent shaft for the purpose of properly setting the price wheels 42 and 42R by the range lever 33.

For convenience, the above relationship between the output of the three auxiliary shafts and setting of the price wheels by the three range levers associated therewith, in the specific embodiment shown, may be tabulated as follows:

10¢ range

Marked	10	20	30	40
Geared	0	10	20	30

1¢ range

Marked	0 to 9
Geared	9 to 18

$\frac{1}{10}$¢ range

Marked	$\frac{0}{10}$ to $\frac{9}{10}$
Geared	1.0 to 1.9

As described above, the proper relationship of the cost wheels 40 etc. and 40R etc. and the output of the bevel gear 30 has been provided for, and all steps between ten cents and 49.9 cents is

obtainable without any need for a long cone of gears whose number of teeth vary in arithmetical progression.

The advantage of the device of the present invention exemplified by the foregoing description of a specific embodiment thereof is that by utilizing a cone of gears in which the gears have teeth varying in numerical progression it is possible to set the price wheels through a desired range in steps of one or one-tenths cents mechanically in response to positioning of the driven gears on the auxiliary shafts utilized and to derive a total output therefrom commensurate with the value shown on the price wheels although the output of each individual shaft is at variance with the amount set on the price wheels by the positioning of the driven gear on that particular shaft.

It thus will be seen, in view of the above disclosure, that an improved variator has been provided which is of greatly simplified and of correspondingly more compact design, of light weight and utilizing less material. The device may be readily fabricated and assembled in a much smaller space than that utilized heretofore and, at the same time, the device is efficient in operation and will not malfunction.

In light of the above remarks, it will be apparent that one skilled in the art will be able to modify and vary the embodiment of the invention without departing from the scope thereof, and all such modifications and variations are intended to be included within the scope of the following claims.

I claim as my invention:

1. In a speed variating device adapted to be used with a register, the combination comprising a first shaft, means for driving said shaft, a series of gears of varying size fixed to said shaft including one gear having a multiple of ten teeth and at least nine additional gears having teeth which differ in number from the number of teeth of said one gear by one through nine teeth, respectively, a plurality of rotatable auxiliary shafts parallel to said first shaft, a driven gear on each of said auxiliary shafts longitudinally slidable but non-rotatably mounted thereon, means for driving each of said driven gears by one of said series of gears selectively, means for combining the output of said auxiliary shafts in a predetermined ratio, a price indicator corresponding to each auxiliary shaft, and means for setting said price indicators responsive to the positions of the gears of said series which are selected to drive said driven gears, respectively, said price indicators including indicia representing the combined output of said auxiliary shafts as distinct from the actual output of each individual shaft.

2. In a speed variating device adapted to be used with a register, the combination comprising a first shaft, means for driving said shaft, a cone of gears fixed to said shaft comprising one gear having a multiple of ten teeth and at least nine additional gears having teeth which differ in number from the number of teeth of said one gear by one through nine teeth, respectively, a plurality of rotatable auxiliary shafts parallel to said first shaft, a driven gear on each of said auxiliary shafts longitudinally slidable but non-rotatably mounted thereon, means for sliding said driven gears longitudinally on said auxiliary shafts, means for driving each of said driven gears by one of said cone of gears selectively in accordance with the longitudinal position of the

driven gear, a price indicator corresponding to each auxiliary shaft, means for setting one of the price indicators from 0 to 9/10 depending on the longitudinal position of the driven gear on the corresponding auxiliary shafts, means for setting a second of said indicators from 0 to 9 depending on the longitudinal position of the driven gear on the corresponding auxiliary shaft, and means for combining the output of said auxiliary shafts to obtain a sum in proportion to the setting of said price indicators.

3. In a speed variating device adapted to be used with a register, the combination comprising a first shaft, means for driving said shaft, a series of gears fixed to said shaft, said gears having a plurality of teeth in the ratio of 9 to 19 in sequence, a plurality of rotatable auxiliary shafts parallel to said first shaft, a driven gear on each of said auxiliary shafts longitudinally slidable but non-rotatably mounted thereon, setting means for selectively locking a first of said driven gears on the first of said auxiliary shafts against rotation and driving the gear by one of the series of gears, setting means for driving a second of said driven gears on the second auxiliary shaft selectively by the gears of said series having teeth in the ratio of 9–18, setting means for driving a third of said driven gears on the third auxiliary shaft selectively by the gears of said series having teeth in the ratio of 10 to 19, indicating means comprising a series of three price indicators for indicating tenths, units and tens, means for setting the tens indicator at 1 and 2 for each setting of the first of said driven gears, respectively, means for setting the units indicator at 0–9 for each setting of the second driven gear, respectively, means for setting the tenths indicator at 0–9 for each setting of the third driven gear respectively, and means for combining the output of said auxiliary shafts to obtain a total output proportional to the amount shown on said price indicators.

4. In a speed variating device adapted to be used with a register, the combination comprising a first shaft, means for driving said shaft, a plurality of rotatable auxiliary shafts parallel to said first shaft, a driven gear longitudinally slidable but non-rotatably mounted on each of said shafts, a series of gears on said first shaft comprising a base gear having a multiple of ten teeth and a plurality of other gears having teeth varying in number in sequence by 1 through 9 teeth from the number of teeth of the base gear, means for selectively driving each of said driven gears by one of said series of gears, means for combining the output of said auxiliary shafts in the proportion whereby the output of a first of said auxiliary shafts is proportional to a constant equal to a whole number less than ten from 0 to 9/10, plus a variable, the output of a second of said auxiliary shafts is proportional to a second constant equal to a whole number greater than one plus a variable from 0 to 9, said constants totaling a multiple of ten, and the output of the third of said auxiliary shafts is in multiples of ten, and indicating means comprising three number indicating elements, one of said elements being settable by the position of the gear on the first auxiliary shaft to indicate said variable from 0 to 9/10, a second of said elements being settable by the position of the gear on the second auxiliary shaft to indicate said variable from 0 to 9, and a third of said elements being settable by the position of the gear on the

third auxiliary shaft to indicate said multiples of ten plus the total of said constants.

5. In a speed variating device adapted to be used with a register, the combination comprising a first shaft, means for driving said shaft, a series of gears fixed to said shaft, said gears having a plurality of teeth in the ratio of 9 to 19, in sequence, a plurality of rotatable auxiliary shafts parallel to said first shaft, a driven gear on each of said auxiliary shafts longitudinally slidable but non-rotatably mounted thereon, setting means for selectively locking a first of said driven gears on the first of said auxiliary shafts against rotation and driving the gear by one of the series of gears, setting means for driving a second of said driven gears on the second auxiliary shaft selectively by the gears of said series having teeth in the ratio of 9–18, setting means for driving a third of said driven gears on the third auxiliary shaft selectively by the gears of said series having teeth in the ratio of 10–19, indicating means for showing the quantities 10 and 20 for each setting of the first of said driven gears respectively, indicating means for showing the quantities 0 through 9 for each setting of the second driven gear respectively, indicating means for showing the quantities 0 through $\frac{9}{10}$ for each setting of the third driven gear respectively, and means for combining the output of said auxiliary shafts in the ratio of 0 and 10 for the first auxiliary shaft, 9–18 for the second auxiliary shaft, and 1.0–1.9 for the third auxiliary shaft.

6. In a speed variating device adapted to be used with a cost register, the combination comprising a shaft adapted to be driven by a meter, a series of gears fixed to said shaft including one gear having a multiple of ten teeth and nine additional gears having teeth which differ in number from the number of teeth of said one gear by one through nine teeth, respectively, a plurality of rotatable auxiliary shafts parallel to said driven shaft, shiftable gear means on one of said auxiliary shafts for driving said one shaft selectively by the said one gear and the said nine additional gears, shiftable gear means on a second of said auxiliary shafts for driving said second shaft selectively by said series of gears, an output shaft, means for driving the output shaft by the first and second auxiliary shafts in the ratio of one to ten respectively, whereby the tenths output of the output shaft may be varied in steps of $\frac{1}{10}$ by varying the position of the shiftable gear means on the said one auxiliary shaft and the units output may be varied in steps of one by varying the position of the shiftable gear means on said second auxiliary shaft, a first indicating means for indicating the position of the shiftable gear means on the said one auxiliary shaft including indicia marked 0 through $\frac{9}{10}$ in sequence in steps of $\frac{1}{10}$ and a second indicating means for indicating the position of the shiftable gear means on the second auxiliary shaft including indicia varying in steps of 1, said indicia of the first and second indicating means providing, in combination, a reading equal to the algebraic sum of the units and tenth output of the first and second auxiliary shafts, but unequal, individually, to the outputs of the auxiliary shafts with which they are respectively associated.

7. In a speed variating device adapted to be used with a cost register, the combination comprising a shaft adapted to be driven by a meter, a series of gears fixed to said shaft including one gear having a multiple of ten teeth and nine additional gears having teeth which differ in number from the number of teeth of said one gear by one through nine teeth, respectively, a plurality of rotatable auxiliary shafts parallel to said driven shaft, shiftable gear means on one of said auxiliary shafts for driving said one shaft selectively by said one gear and the said nine additional gears, means for indicating the position of said shiftable gear means including indicia from 0 through $\frac{9}{10}$ in steps of $\frac{1}{10}$, shiftable gear means on a second of said auxiliary shafts for driving the second shaft selectively by gears of the series of gears, means for combining the outputs of the first and second auxiliary shafts in the ratio of one to ten respectively, and means for indicating the position of said shiftable gear means on the second auxiliary shaft including indicia varying in steps of one to represent the first whole digit of the algebraic sum of the outputs of the first and second auxiliary shafts as distinct from the actual output of the second auxiliary shaft.

8. In a speed variating device adapted to be used with a cost register, the combination comprising a shaft adapted to be driven by a meter, a series of gears fixed to said shaft including one gear having a multiple of ten teeth, nine other gears having from one through nine additional teeth, respectively, and a smaller number of additional gears having progressively fewer teeth than said one gear in steps of one tooth, a plurality of rotatable auxiliary shafts parallel to said driven shaft, shiftable gear means on a first of said auxiliary shafts for driving said first auxiliary shaft selectively by the said one gear and said nine other gears, shiftable gear means on a second of said auxiliary shafts for driving said second auxiliary shaft selectively by ten gears of said series in sequence including said one gear and said additional gears, means for combining the outputs of said first and second auxiliary shafts in the ratio of one and ten respectively, means for indicating the position of the shiftable gear means on the first auxiliary shaft having indicia ranging from 0 through $\frac{9}{10}$ in steps of $\frac{1}{10}$ and means for indicating the position of the shiftable gear means on the second auxiliary shaft having indicia ranging from 0 through 9 in steps of one, said indicating means being utilized to show the combined output of said shafts as distinct from the outputs of the individual auxiliary shafts.

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