Sept. 11, 1962 H. B. VROOM 3,053,441

COUNTER

Filed July 24, 1958 3 Sheets-Sheet 1

FIG. 1

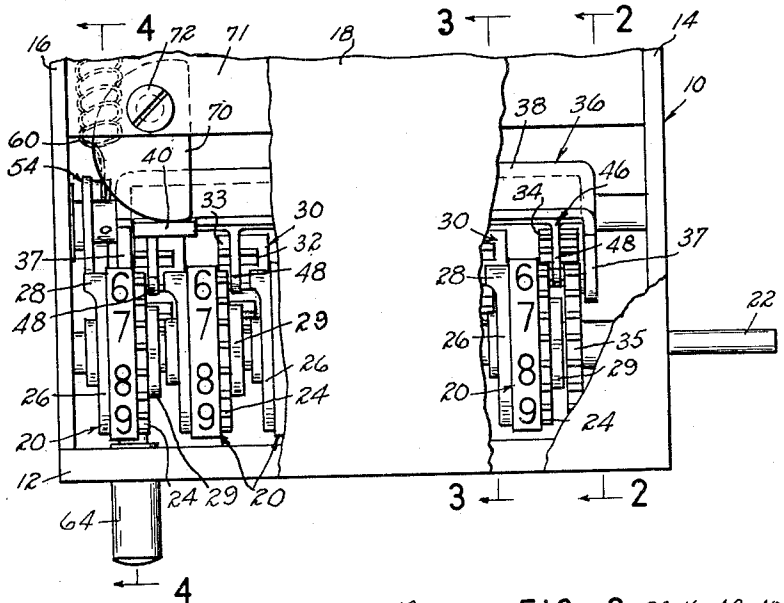


FIG. 2

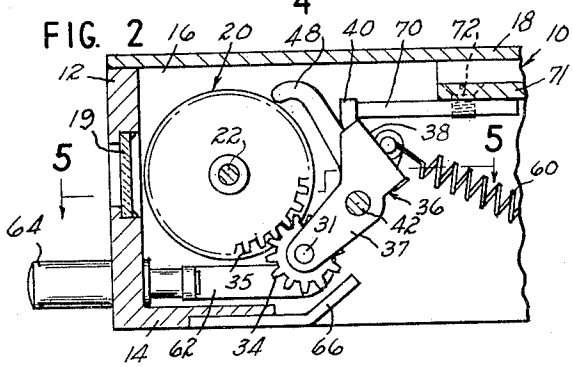


FIG. 3

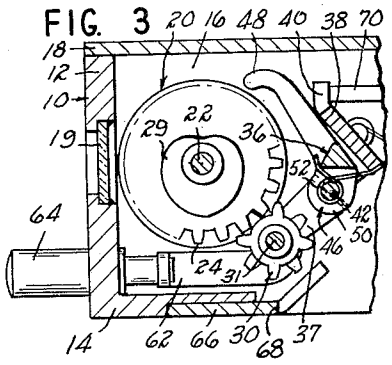
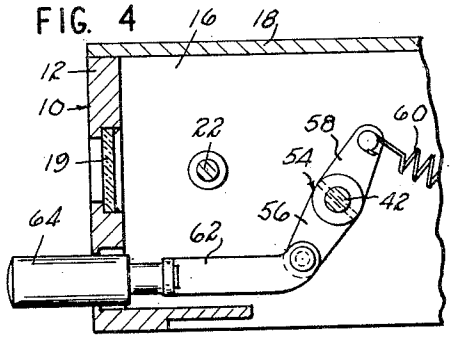


FIG. 4



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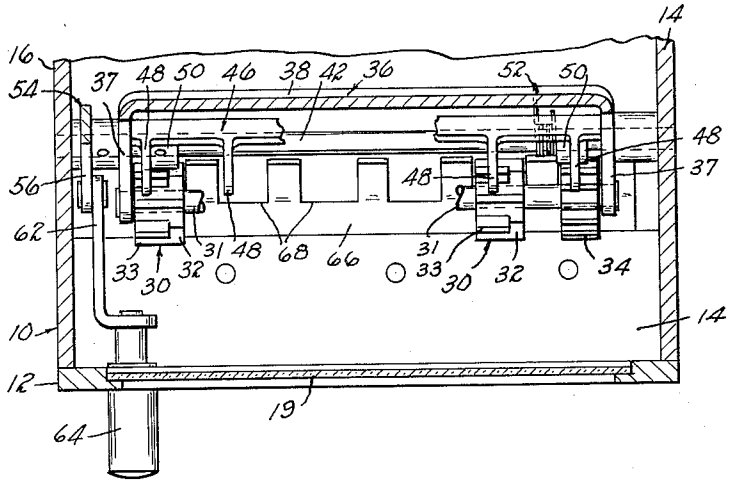
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COUNTER

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FIG. 5



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COUNTER

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FIG. 6

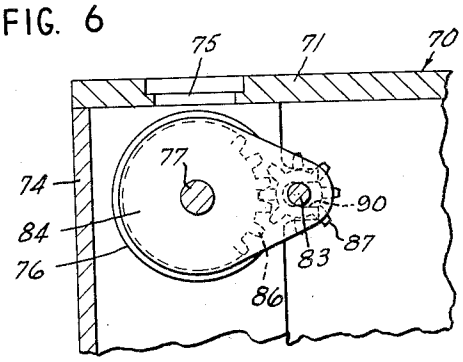
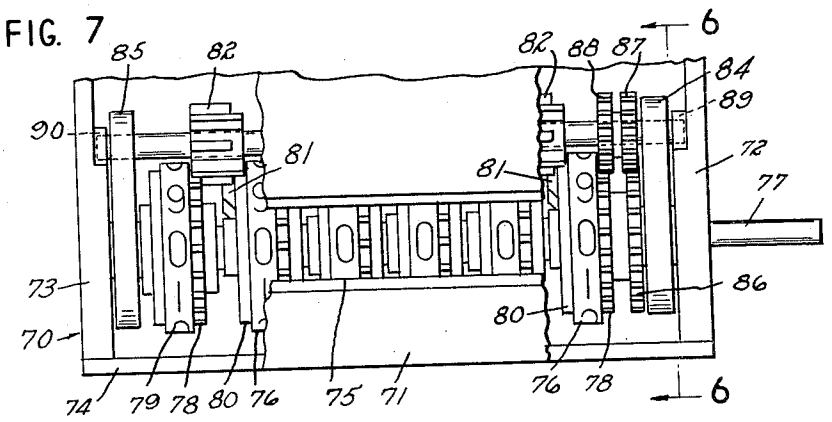


FIG. 7



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3,053,441

COUNTER

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Filed July 24, 1958, Ser. No. 751,105
14 Claims. (Cl. 235—1)

This invention relates to counters and more particularly to a novel and improved means to control the engagement of the transfer mechanism between number wheels of a counter responsive to ambient temperature and relative humidity. This application is a continuation in part of my prior copending application Serial No. 674,171, filed July 25, 1957, now abandoned, entitled "Counter" and assigned to the assignee of the present application.

Where number wheels, transfer pinions or both are fabricated of a non-metallic material, such as nylon, and having a relatively high coefficient of thermal expansion and relatively high hygroscopic coefficient are utilized in a counter in an environment subject to substantial changes in ambient temperature and relative humidity, the growth or expansion of the number wheels as well as of the transfer pinions operatively connecting next adjacent pairs of number wheels tends to result in improper meshing of the transfer mechanism which may result in binding at one extreme of temperature and humidity or in looseness at the opposite extreme, all leading to inaccurate and undependable operation. In resettable counters of the type wherein the transfer pinion is moved out of engagement with the number wheels during resetting of the counter, excessive expansion of the elements of the transfer mechanism may seriously interfere with the proper operation of the throw-out mechanism used to disengage and engage the transfer pinions.

Accordingly, it is the object of this invention to provide in a counter of the type having a transfer pinion operatively connecting next adjacent pairs of number wheels, novel and improved means to control the relative position of the number wheels and transfer pinions in response to changes in ambient conditions such as temperature and relative humidity so as to preclude binding or excessive clearance of the transfer mechanism as the result of change in size of the number wheels and pinions resulting from the ambient condition change.

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:

FIG. 1 is a fragmentary top view of a counter incorporating the present invention with a portion of the counter cover plate cut away;

FIG. 2 is a fragmentary cross-sectional view substantially along the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view substantially along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary cross-sectional view substantially along the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary cross-sectional view substantially along the line 5—5 of FIG. 2;

FIG. 6 is a fragmentary cross-sectional view taken substantially along the line 6—6 of FIG. 7; and

FIG. 7 is a fragmentary top view of a counter incorporating another embodiment of the present invention with a portion of the counter cover plates cut away.

With reference to FIGS. 1 through 5, a counter of a

type with which a preferred embodiment of this invention is concerned is generally indicated at 10 and comprises a frame including a front plate 12 having an inwardly directed flange 14 at the bottom thereof, a pair of side plates 14 and 16, and a cover plate 18. A window 19 is provided in the front plate 12 to permit viewing of a plurality of coaxially aligned number wheels 20 disposed within the counter and rotatably mounted on a shaft 22 journaled in the side plates 14, 16. Each of the number wheels has mounted on one side thereof for rotation therewith a driven gear 24 and on the other side thereof a locking ring 26 and two-toothed driving gear segment 28. In the specific embodiment, the number wheels and associated gears and locking ring are fabricated of a non-metallic hygroscopic material, such as nylon, having a high coefficient of thermal expansion. Each number wheel also carries for rotation therewith a heart-shaped cam 29.

The driving and driven gears of the number wheels are operatively connected by a plurality of mutilated tooth transfer pinions 30 disposed respectively between adjacent pairs of number wheels and rotatably mounted on a shaft 31 extending parallel to the shaft 22. The pinions are each provided with a mutilated tooth portion 32 engageable with the locking ring and two-toothed gear segment of the adjacent lower order wheel and with a full tooth portion 33 engageable with the driven gear of the adjacent higher order wheel to provide, in a well-known manner, an advance of the higher order wheel by one digit upon one complete revolution of the lower order number wheel. The transfer pinions 30, like the number wheels, are fabricated of a non-metallic hygroscopic material, such as nylon. A pinion 34 is also mounted on the shaft 31 and is engageable with the driven gear of the lowest order wheel and with a drive gear 35 mounted for rotation with the shaft 22 whereby rotation of the shaft 22 will result in rotation of the lowest order number wheel.

A supporting member or yoke 36 is disposed along side the number wheels and comprises a pair of spaced apart arms 37 connected by a web 38 having a projection or ear 40 extending therefrom. The arms 37 of the yoke are pivotally mounted intermediate their ends on a shaft 42 extending parallel to the shaft 22 and journaled at its ends on the side plates 14, 16. The shaft 31 carrying the pinions 30 and 35 is supported by the outer ends of the arms 37 of the yoke so that pinions 30, 35 can be thrown into and out of engagement with the number wheel gears by pivoting movement of the yoke. Disposed between the arms 37 of the yoke is a resetting lever 46 comprising a plurality of arms 48 extending therefrom and engageable respectively with the heart cams 29 on the number wheels. The resetting lever 46 is provided with a pair of spaced apart collars 50 receiving the shaft 42 with one of the collars being pinned to the shaft for rotation of the resetting lever with the shaft. A torsion spring 52 is mounted on the shaft 42 with one end thereof engaged with the resetting lever 46 and with its other end engaged with the web 38 of the yoke so as to urge the yoke toward the resetting lever. Movement of the yoke and resetting lever toward each other is limited, as shown in FIG. 1, by engagement of the arm 48 associated with the highest order number wheel with the ear 40 on the yoke.

Mounted on one end of the shaft 42 for rotation therewith is a crank 54 having a pair of oppositely extending arms 56, 58. A tension spring 60 is connected at one end to the outer end of the crank arm 58 and at the other end to the frame (not shown) so as to urge the shaft 42 in a clockwise direction as viewed in FIG. 4. A link 62 is pivotally mounted at one end of the outer end of the crank arm 56 and at the other end is connected to a plunger 64 slidably mounted in the front plate 12 and extending there-

through. To reset the counter to zero, the plunger 64 is moved inwardly of the counter to pivot the crank 54 and shaft 42 in a counterclockwise direction, as viewed in FIGS. 2 and 4, to pivot the reset lever 46 in a corresponding direction for engagement of the arms 48 with the heart cams 29. The pivoting of the reset lever 46 will, through the spring 52, cause counterclockwise pivoting of the yoke 36 to move the pinions 30 out of number wheel engagement to permit rotation of the number wheels by the reset lever 46 and relative to the pinions. Mounted on the flange 14 of the front plate 12 is a transfer pinion spacer plate 66 having a plurality of notches 68 respectively aligned with the pinions 30. The notches 68 are dimensioned to receive the pinions upon movement of the same out of number wheel engagement to maintain the pinions in alignment with the number wheels while out of engagement therewith to assure proper re-engagement upon release of the plunger 64.

In accordance with the embodiment of the invention illustrated in FIGS. 1 through 5, a stop member 70 is mounted across member 71 of the frame of the counter and is engageable with the ear 40 on the yoke to limit clockwise rotation of the yoke, as viewed in FIG. 2. The stop member 70 is also formed of nylon which is the same material as the number wheels and pinions so as to have the same hygroscopic coefficient and coefficient of thermal expansion. In this specific embodiment, the stop member 70 is substantially semi-circular and has a diameter approximately equal to that of the number wheels. The stop member is eccentrically mounted on the frame by the screw 72 with its curved peripheral portion in engagement with the ear 40 of the yoke.

As a result of the use of the stop member 70 having a relatively high hygroscopic coefficient and relatively high coefficient of thermal expansion, an increase in relative humidity and/or ambient temperature will result in a growth or increase in size of the stop member 70 so as to provide pivoting of the yoke 36 in a counterclockwise direction, as viewed in FIG. 2, against the force of the spring 60 to move the transfer pinions 30 radially outwardly of the number wheels, thus precluding binding of the number wheels and transfer pinions as a result of excessive hydroscopic and/or thermal expansion thereof. Conversely, a drop in relative humidity and/or ambient temperature will result in shrinkage of the stop member precluding looseness or ineffective meshing of the gears. The distance between the axes of the yoke and transfer pinions has, of course, a predetermined relation to the distance between the yoke axis and point of yoke and stop member engagement so that for a given growth of the stop member the pinions will be moved an amount relative to the number wheels which corresponds to the growth of the number wheels. The eccentric mounting of the stop member 70 permits adjustment of the initial relative position of the pinions and number wheels during assembly of the counter so as to eliminate the need for maintaining close manufacturing tolerances with respect to the transfer gearing and mounting therefor.

Referring now to the embodiment illustrated in FIGS. 6 and 7, it is seen that a counter, generally designated as 70, is provided with a front plate 71, a pair of side plates 72 and 73, and a cover plate 74. Window 75 is provided in front plate 71 to permit viewing of a plurality of coaxially mounted number wheels 76 which are rotatably mounted on number wheel shaft 77 journaled in side plates 72 and 73. Each number wheel 76 has a driven gear 78 and a locking ring 80 mounted on one side thereof for rotation therewith. In addition, each number wheel 76, except highest order wheel 79, has a two-tooth driving gear segment 81 mounted on the other side of the number wheel for rotation therewith. In this specific embodiment, number wheel 76, gear 78, locking ring 80 and gear segment 81 are fabricated of a non-metallic hygroscopic material, such as nylon.

The driving and driven gears of number wheels 76 are interconnected by a plurality of mutilated tooth-transfer pinions 82, as in the embodiment illustrated in FIGS. 1 through 5, and their operation to advance the number wheels is the same. Transfer pinions 82 are rotatably supported on pinion shaft 83, which is mounted in brackets 84 and 85 in a position generally parallel to shaft 77. Pinion 86 is secured to shaft 77 so that rotation of shaft 77 will drive the lowest order wheel through driven gears 87 and 88 in a conventional manner.

In the embodiment of FIGS. 6 and 7, brackets 84 and 85 are fabricated of a non-metallic hygroscopic material, such as nylon, and are loosely supported on shaft 77. The ends of shaft 83 extend through brackets 84 and 85 to engage slots 89 and 90 formed in side plates 72 and 73.

From the foregoing description, it is apparent that expansion and contraction of number wheels 76 and transfer pinions 82 will be accompanied by similar expansion and contraction of brackets 84 and 85 so as to slide shaft 83 in slots 89 and 90, thereby varying the distance between shafts 77 and 83 to keep transfer pinions 82 in proper engagement with driven gears 78 and two-tooth segments 81. By so varying the spacing of the shafts, binding as well as excessive looseness between the gear surfaces is effectively prevented.

It can thus be seen that there has been provided a novel and improved arrangement for controlling the relative position of the number wheel shaft of a counter with respect to the transfer pinion shaft operatively connected thereto and that this arrangement is responsive to ambient temperature and relative humidity. It is also seen that this arrangement can be adapted for use in counters of the type wherein the transfer pinions are moved out of engagement with the number wheels during a resetting operation. While this invention has particular utility in the counters described, it is also applicable to other types of counters, and it is intended that the variations and the embodiments which could be made by one skilled in the art are to be included within the scope of this invention.

I claim:

1. In a counter, a frame, a number wheel shaft supported by said frame, a pair of number wheels rotatably supported on said shaft, said number wheels being formed of a non-metallic material expansible in response to changes in ambient conditions, a pinion shaft, means supporting said pinion shaft for movement relative to said number wheel shaft, a transfer pinion supported by said shaft to provide a driving connection between said number wheels, and means to position said number wheel shaft relative to said pinion shaft, said last named means including a member formed of a non-metallic material expansible in response to changes in ambient conditions to vary the spacing between said number wheel shaft and said pinion shaft, said member being independent of said frame and the means supporting said pinion shaft.

2. In a counter, a frame, a number wheel shaft supported on said frame, a pair of coaxially arranged rotatable number wheels supported on said number wheel shaft, said wheels being formed of a hygroscopic material, a pinion shaft, means mounting said pinion shaft for movement relative to said number wheel shaft, a transfer pinion rotatably mounted on said pinion shaft and interconnecting said number wheels, and means independent of said frame and the pinion shaft mounting means interconnecting said number wheel shaft and said pinion shaft, said means including a member formed of hygroscopic material whereby the spacing between said shafts is varied with ambient conditions.

3. In a counter, a frame, a number wheel shaft supported on said frame, a pair of coaxially arranged rotatable number wheels supported on said number wheel shaft, said wheels being formed of a hygroscopic material, a pinion shaft, a transfer pinion rotatably mounted on said pinion shaft, means supporting said transfer shaft for

limited free movement relative to said number wheel shaft, and means including a member parallel to said number wheels and engaging each of said shafts, said member being formed of a hygroscopic material thereby to change relative shaft position with changing ambient conditions.

4. In a counter, a frame, a pair of number wheels formed of a non-metallic material expansible in response to changes in ambient conditions rotatably supported on the frame, a rotatable transfer member engageable with the number wheels to provide a driving connection therebetween, means mounting said transfer member on the frame for movement toward and away from the number wheels, and a stop member formed of a non-metallic material expansible in response to changes in ambient conditions supported on the frame and engageable with the transfer member mounting means to limit movement of the transfer member toward the number wheels.

5. In a counter, a frame, a pair of number wheels formed of a hygroscopic material rotatably supported on the frame, a rotatable transfer member engageable with the number wheels to provide a driving connection therebetween, means mounting the transfer member for movement toward and away from the number wheels, and a stop member formed of hygroscopic material supported on the frame and engageable with the transfer member mounting means to limit movement of the transfer member toward the number wheels.

6. In a counter, a frame, a pair of number wheels formed of a plastic having a relatively high coefficient of thermal expansion rotatably supported on said frame, a rotatable transfer member engageable with said number wheels to provide a driving connection therebetween, means mounting said transfer member on said frame for movement toward and away from said number wheels, and a stop member formed of a plastic having a relatively high coefficient of thermal expansion supported on said frame and engageable with said transfer member mounting means to limit movement of said transfer member toward said number wheels.

7. In a counter, a frame, a pair of number wheels formed of a hygroscopic material rotatably supported on said frame, a support member movably mounted on said frame for movement toward and away from said number wheels, a transfer member rotatably mounted on said support member and engageable with said number wheels to provide a driving connection therebetween, means urging said transfer member toward said number wheels, and a stop member formed of hygroscopic material supported on said frame and engageable with said support member to limit movement of said transfer member toward said number wheels and to provide movement of said transfer member relative to said number wheels in response to changes in relative humidity.

8. In a counter, a frame, a pair of number wheels formed of a plastic having a relatively high coefficient of thermal expansion rotatably supported on said frame, a support member movably mounted on said frame for movement toward and away from said number wheels, a transfer member engageable with said number wheels to provide a driving connection therebetween, said transfer member being rotatably mounted on said support member for movement therewith relative to said number wheels, means urging said transfer member toward said number wheels, and a stop member formed of a plastic having a relatively high coefficient of thermal expansion supported on said frame and engageable with said support member to limit movement of said transfer member toward said number wheels and to provide movement of said transfer member relative to said number wheels in response to a change in ambient temperature.

9. In a counter, a frame, a pair of coaxially arranged rotatable number wheels supported on said frame, said wheels being formed of a hygroscopic material, a support member pivotally supported on said frame for movement about an axis parallel with the number wheel axis, a transfer pinion rotatably supported by said support member and engageable with said number wheels to provide a driving connection therebetween, means urging said transfer pinion toward said number wheels, and a stop member formed of a hygroscopic material eccentrically and adjustably supported on said frame for engagement with said support member to limit movement of said transfer pinion toward said number wheels.

10. In a counter, a frame, a pair of coaxially arranged rotatable number wheels supported on the frame, said wheels being formed of a plastic having a relatively high coefficient of thermal expansion, a support member pivotally mounted on said frame for movement about an axis parallel to the number wheel axis, a transfer pinion rotatably supported by said support member and engageable with said number wheels to provide a driving connection therebetween, means urging said transfer pinion toward number wheel engagement, and a stop member formed of a plastic having a relatively high coefficient of thermal expansion eccentrically and adjustably supported on said frame for engagement with said support member to limit movement of said transfer pinion toward said number wheels.

11. In a counter, a frame, a pair of coaxially arranged rotatable number wheels supported on said frame, said wheels being formed of a hygroscopic material having a relatively high coefficient of thermal expansion, a support member pivotally mounted on said frame for movement about an axis parallel to the number wheel axis, a transfer pinion rotatably supported by said support member and engageable with said number wheels to provide a driving connection therebetween, a spring urging said transfer pinion toward number wheel engagement, and a generally semi-circular stop member of the hygroscopic material having a relatively high coefficient of thermal expansion, said stop member having a diameter substantially the same as one of said number wheels and being eccentrically and adjustably supported on said frame with the curved peripheral portion thereof engageable with said support member to limit movement of said transfer pinion toward said number wheels.

12. In a counter, a frame, a pair of coaxially aligned rotatable number wheels supported on said frame, said wheels being formed of a hygroscopic plastic having a relatively high coefficient of thermal expansion, a heart cam mounted for rotation with each of said number wheels, a resetting member pivotally supported on said frame for movement about an axis parallel to the number wheel axis and having a pair of arms extending therefrom engageable respectively with the heart cams on said number wheels, a support member mounted for pivotal movement coaxially with said resetting member, a transfer pinion engageable with said number wheels to operatively connect the cams supported on a support member for rotation about an axis spaced from and parallel to said number wheel axis, a driving connection between said resetting member and said support member, and a stop member of the same material as said number wheels eccentrically supported on said frame for selective adjustment relative to said frame, said stop member having a curved peripheral portion engageable with said support member to control the relative position of said number wheels and said pinion in accordance with ambient temperature and relative humidity.

13. In a counter, a frame, a number wheel shaft fixedly support on said frame, a pair of coaxially arranged rotatable number wheels supported on said number wheel shaft, said wheels being formed of a hydroscopic material, a pinion shaft, a transfer pinion mounted on said pinion shaft, parallel slots in said frame, one on each end thereof, supporting said transfer shaft for limited free movement relative to said number wheel shaft and a member formed of hydroscopic material arranged parallel to said number wheels and engaging the transfer shaft and pinion shaft adjacent each end thereof, said members and num-

ber wheels being formed of a material having substantially identical hydroscopic and temperature characteristics.

14. The counter as set forth in claim 13 wherein each member is a disc with the portion thereof engaging said number wheel shaft being larger in radial dimension than the portion engaging said pinion shaft.

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