

Sept. 9, 1958

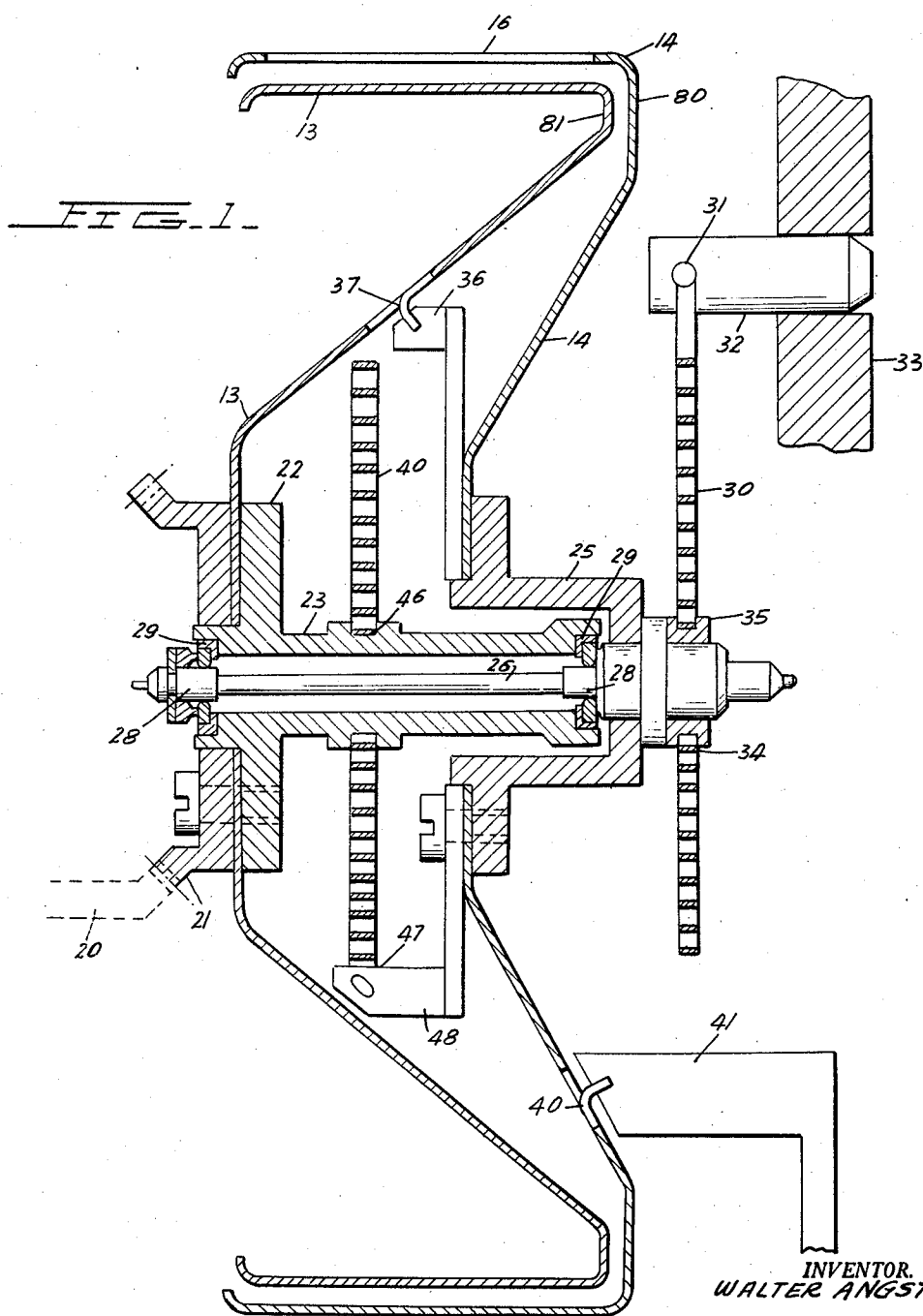
W. ANGST

2,851,002

AIRCRAFT INSTRUMENT-DUAL DRUM SCALE

Filed July 25, 1956

3 Sheets-Sheet 1



INVENTOR.
WALTER ANGST

BY *Ostrander Fisher,
Carl L. Saffer.*

ATTORNEYS

Sept. 9, 1958

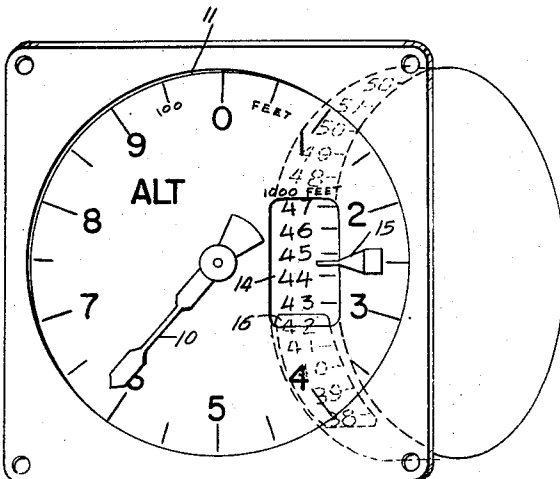
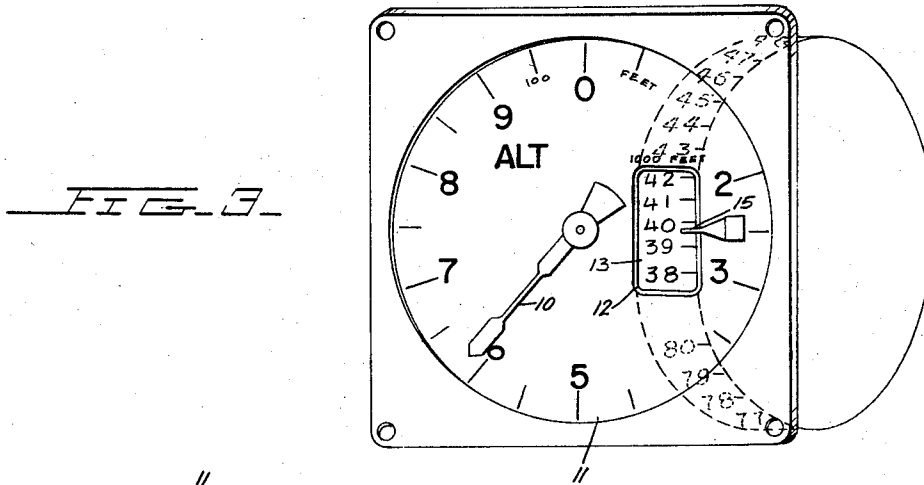
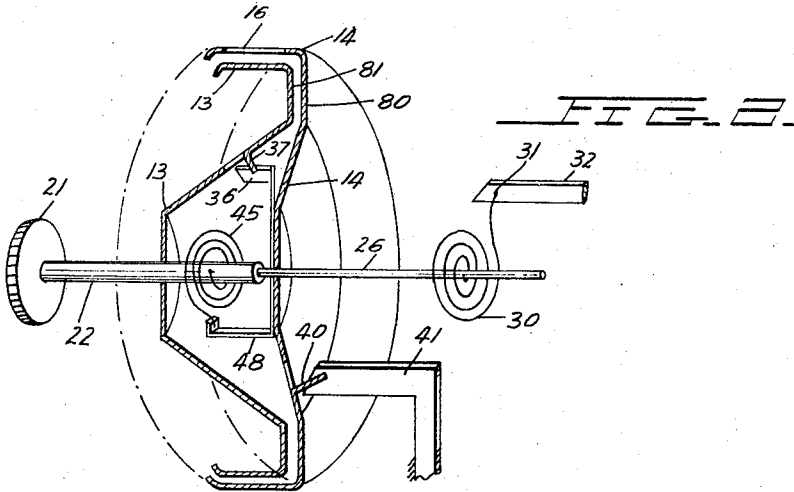
W. ANGST

2,851,002

AIRCRAFT INSTRUMENT-DUAL DRUM SCALE

Filed July 25, 1956

3 Sheets-Sheet 2



INVENTOR.
WALTER ANGST
BY *Detrolomk, Faley,
Gerb & Soffen*
ATTORNEYS

Sept. 9, 1958

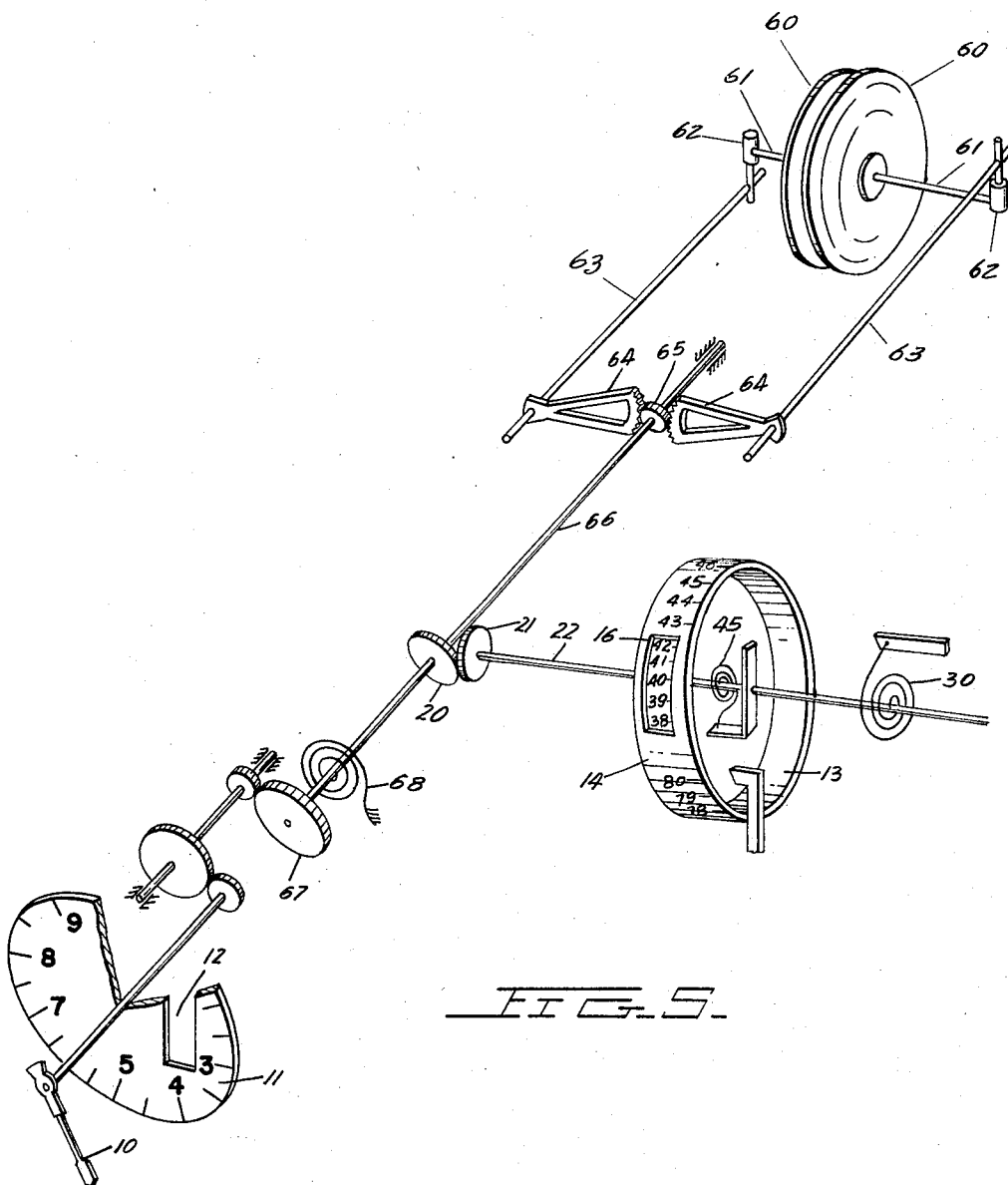
W. ANGST

2,851,002

AIRCRAFT INSTRUMENT-DUAL DRUM SCALE

Filed July 25, 1956

3 Sheets-Sheet 3



INVENTOR.
WALTER ANGST
BY *Patricia C. Fisher*
Carl E. Soffen
ATTORNEYS

1

2,851,002

AIRCRAFT INSTRUMENT-DUAL DRUM SCALE

Walter Angst, Douglaston, N. Y., assignor to Kollsman Instrument Corporation, Elmhurst, N. Y., a corporation of New York

Application July 25, 1956, Serial No. 599,973

7 Claims. (Cl. 116—129)

My present invention relates to drum scales for aircraft instruments and more particularly to compound drum scales adapted to provide visually accurate readings of relatively large indicia especially in those instances where the diameter of the drum must be maintained at a relatively small dimension. That is, in those instances when the number of indicia required on the drum surface is large, the size of the individual indicia must be reduced so that all desired indicia may appear on the drum surface. The size of the individual indicia is obviously limited to the drum circumference divided by the total number of indicia appearing thereon less the appropriate spacing between indicia.

My invention has for its object the provision of a multiple concentric drum arrangement wherein each of the outer drums is provided with an opening through which the indicia on the next inner drum are visible; as the innermost drum completes one revolution, it picks up the next outer drum and moves the same to provide additional indicia; the latter drum then picks up the next outer drum; each outer drum is arranged so that it will follow the next inner drum in either direction after it is picked up for movement thereby while, at the same time, no additional load is imposed on the driving mechanism. Also, the reverse operation may occur where the outer drum is carried by the next inner drum until the outer drum engages a stop while the inner drum continues to move and is read through the window in the outer drum.

In a multiple drum arrangement, the innermost drum will be read through the aligned windows of all the outer drums; as an intermediate drum moves, its indicia will be read through the window or windows of any outer drums.

A further object of my invention, therefore, is the provision of a dual drum arrangement wherein the load on the driving mechanism remains substantially constant over the range of operation of both drums.

In instruments, the problem often arises of presenting additional or intermediate indicia of appropriate size without increasing the size of the casing or other elements of the instrument. My novel dual drum arrangement makes it possible to present substantially more than half again as many indicia without requiring reduction in size of the indicia and without requiring increase in size of the drum elements.

An important object of the present invention is the arrangement of the loading or tensioning springs for each drum so that they operate sequentially and not together so that the load on the drive mechanism remains substantially constant throughout the range of the instrument.

The foregoing and many other objects of the invention will become apparent in the following description and drawings in which:

Figure 1 is a side cross-sectional view partly in cross-section of my novel dual drum arrangement.

Figure 2 is a schematic perspective view which is partially in cross-section of the dual drum arrangement of Figure 1.

2

Figure 3 is a front view of an instrument dial showing the operation of the dual drum arrangement for presentation of indicia of one range on the inner drum.

Figure 4 is a view corresponding to that of Figure 3 showing the operation of the dual drum arrangement beyond the range of the inner drum, with the indicia of the outer drum being presented to view.

Figure 5 is a schematic perspective view of an altimeter which may make use of my novel dual drum arrangement.

Referring first to Figures 3, 4 and 5, I have here shown an instrument, in this case an altimeter, having a pointer 10 moving over a dial face 11 to indicate altitude in hundreds of feet. The dial 10 is provided with a window 12 through which indicia on the inner drum 13 and the outer drum 14 may be viewed to provide indicia of thousands of feet against the marker 15.

In this case, by way of example, it is desired to provide 80 separate indicia where the desired size and spacing of indicia and the limited circumference permitted to either drum 13 or 14 would provide room for only about 42 indicia.

The outer drum 14 is arranged so that it is stationary until all of the indicia on the inner drum 13 have traversed pointer 15 (in this case, outer drum 14 is stationary until the 42 indicia on inner drum 13 have traversed the pointer 15). In order that the indicia on drum 13 may be viewed, an opening 16 (see also Figures 1 and 2 as well as Figures 4 and 5) is provided in drum 14, which opening 16 will register with the window 12 of the dial 11 through which the indicia are viewed.

The drums 13 and 14 are so arranged that, as indicia 42 on the inner drum 13 passes the upper edge of window 12 and the upper edge of opening 16, drum 13 picks up drum 14 and moves drum 14 with it (compare Figures 3 and 4) so that the indicia on outer drum 14 become progressively visible as an apparent continuation of the indicia on drum 13 to provide a continuity of successive visual indicia over the entire range of the instrument.

In operation (refer to Figures 1 and 2), the inner drum 13 is locked into a gear system and rotates as a function of the instrument with which it is integral such as an altimeter (as shown in the above example), airspeed indicator, pressure indicator or other devices requiring the presentation of a plurality of successive indicia.

Thus, the drive mechanism, such as that shown in Figure 5, drives the gear 20 (refer especially to Figure 1) which in turn meshes with and drives gear 21 which is secured to the hub 22 and hollow shaft 23. Hub 22 of shaft 23 carries the inner drum 13. Outer drum 14 is carried by hub 25 on shaft 26. Shaft 26 is concentric with shaft 23 extending through the hollow center of shaft 23. Shafts 23 and 26 are freely rotatable with respect to each other, shaft 26 being supplied with appropriate bearings 28, which rotate in appropriate friction reducing members 29, which are carried by shaft 23.

The outer drum 14 is provided with the hairspring 30, anchored at one end 31 to the anchor post 32 on stationary frame 33 and anchored at the other end 34 on hub member 35 which is keyed to bearing 28 and hub 25 of outer drum 14. The bias of spring 30 is such that it tends to rotate the front face (Figures 3, 4 and 5) of drum 14 downward or that it tends to rotate the upper portion of the cross-section of drum 14 of Figure 1 up out of the paper.

This bias brings the stop member 36 on hub 25 of outer drum 14 against tab 37 on inner drum 13 so that the outer drum 14 will follow the movement of inner drum 13. As the outer drum 14 follows the movement of inner drum 13 from, for instance, maximum indicia, such as an indication of 80,000 feet altitude down to the position when the opening 16 in outer drum 14 coincides with window 12 of dial 10, then the stop 40 on

outer drum 14 (moving in a direction into the paper with respect to the cross-sectional view of Figure 1) strikes the stationary stop member 41 carried by the frame and the outer drum 14 is prevented from having further movement in a direction of downwardly descending indicia and opening 16 of outer drum 14 remains in registry with window 12.

The inner drum 13 is connected to the outer drum 14 by intermediate hairspring 45 which is anchored at 46 to inner drum shaft 23 and at 47 to extension 48 of outer drum hub 25. Further movement of inner drum 13 in the direction of downwardly descending indicia (in a direction where stop tab 37 moves out of the paper with respect to Figure 1) will now tension intermediate spring 45 between the inner drum 13 and outer drum 14 while at the same time drum 14 remains stationary as above described. When the indicia are rising, the tension of intermediate spring 45 applies until stop 37 of drum 13 picks up stop 36 of drum 14; then stop 40 of drum 14 moves off stationary stop 41, the drum 14 begins to rotate and tension or the load on the drive mechanism is transferred from spring 45 to spring 30. Similarly, as the indicia descend, then when drum 14 reaches its stop, the tension or load exerted by main spring 30 is transferred to intermediate spring 45. Thus, when the outer drum is picked up or released, there is no doubling of the load since the springs 45 and 30 operate sequentially, each in its own range, and never operate together.

In Figure 5 I have shown schematically one form of instrument in connection with which my novel drum arrangement may be used. This instrument is an altimeter in which the aneroid capsules 60, 60 are provided with linkages 61, 61 each operating the crank arms 62, 62 of rocking shafts 63, 63 to rotate sector gears 64, 64 in the same peripheral direction with respect to pinion 65 on indicator shaft 66. The drum drive is coupled to shaft 66 by gears 20, 21 as previously described. The drive for pointer 10 is coupled to shaft 66 by gear train 67 as is well known in the art. Spring 68 is provided for appropriate loading and to take up back-lash.

While I have shown how my novel drum arrangement may be used in connection with an altimeter, it will be obvious that the take-off for the drum drive at gears 20, 21 from any instrument output shaft (with the gears at the appropriate ratio) may be used to drive the dual drums without any variation in the basic principle of operation. Thus, the same dual drum arrangement, with appropriate indicia markings, may be used for any instrument having an output which may be converted into rotary motion to drive drum shaft 23.

It will also be obvious that while the drums are here shown as concentrically bent to provide concentric cylinders, the same principle may be used with parallel discs in which areas 30 and 31 of drums 14 and 13 may be extended to carry indicia and with member 14 provided with an appropriate opening; also, the indicia bearing surfaces may be at any appropriate angle (not necessarily normal) to the plane of the discs.

In the foregoing the invention has been described solely in connection with specific illustrative embodiments thereof. Since many variations and modifications of the invention will now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosures herein contained but only by the appended claims.

I claim:

1. A multiple rotary indicating device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof; said device comprising an inner rotatable member and an outer rotatable member; a plurality of indicia at the periphery of each of said members; said outer member having an opening aligned with the indicia thereon; the indicia on said inner member being viewable through said opening; the indicia on the outer member following in succession the indicia on the inner member; means for driving one of said rotatable

members; connecting means carried by one of said rotatable members and operable on completion of a predetermined angular rotation of said driven rotatable member to operatively connect said driving means to drive the other of said rotatable members; biasing means connected between said rotatable members for driving one of said rotatable members toward a predetermined position with respect to the other of said rotatable members; and additional biasing means connected between said last mentioned other rotatable member and a stationary point for driving said other member toward a fixed position with respect to a stop; said first mentioned biasing means coming into operation when said second mentioned biasing means completes its operation.

2. A dual rotary indicating device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof; said device comprising an inner rotatable member and an outer rotatable member; a plurality of indicia at the periphery of each of said members; said outer member having an opening aligned with the indicia thereon; the indicia on said inner member being viewable through said opening; the indicia on said outer member following in succession the indicia on said inner member; means for driving said inner member; a stop on said inner member and a stop on said outer member; said stops being arranged for engagement when the indicia of said inner member reach a point where they may be followed in sequence by the indicia of said outer member; said inner member driving said outer member when said stops engage; a first biasing means engaging said outer member to hold its said stop against said stop of said inner member when said outer member is driven by said inner member; a second biasing means between said outer member and said inner member and a third stop for said outer member positioned to provide an anchor for said second biasing means to tend to drive said inner member against said driving means of said inner member; said outer member being moved away from its said stop when said first mentioned stops are engaged.

3. A dual rotary indicating device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof; said device comprising an inner rotatable member and an outer rotatable member; a plurality of indicia at the periphery of each of said members; said outer member having an opening aligned with the indicia thereon; the indicia on said inner member being viewable through said opening; the indicia on said outer member following in succession the indicia on said inner member; means for driving said inner member; a stop on said inner member and a stop on said outer member; said stops being arranged for engagement when the indicia of said inner member reach a point where they may be followed in sequence by the indicia of said outer member; said inner member driving said outer member when said stops engage; a first biasing means engaging said outer member to hold its said stop against the said stop of said inner member when said outer member is driven by said inner member; a second biasing means between said outer member and said inner member and a third stop for said outer member positioned to provide an anchor for said second biasing means to tend to drive said inner member against said driving means of said inner member; said outer member being moved away from its said stop when said first mentioned stops are engaged; said first biasing means between said inner and outer members imposing its load on the drive for said inner member when said stops between said outer and inner members are disengaged; said second biasing means for said outer member imposing its load on the drive means for said inner member when said stops between said outer and inner members are engaged.

4. A dual rotary indicating device for presenting indicia with respect to a marker cooperating with a pe-

5

ripheral portion thereof; said device comprising an inner rotatable member and an outer rotatable member; a plurality of indicia at the periphery of each of said members; said outer member having an opening aligned with the indicia thereon; the indicia on said inner member being viewable through said opening; the indicia on said outer member following in succession the indicia on the inner member; means for driving said inner member; a stop on said inner member and a stop on said outer member; said stops being arranged for engagement when the indicia of said inner member reach a point where they may be followed in sequence by the indicia of said outer member; said inner member driving said outer member when said stops engage; a first biasing means engaging said outer member to hold its said stop against the said stop of said inner member when said outer member is driven by said inner member; a second biasing means between said outer member and said inner member and a third stop for said outer member positioned to provide an anchor for said second biasing means to tend to drive said inner member against said driving means of said inner member; said outer member being moved away from its said stop when said first mentioned stops are engaged; said first biasing means between said inner and outer members imposing no load on the drive for said inner member when said stops between said outer and inner members are engaged; said second biasing means for said outer member imposing no load on the drive for said inner member when said stops between said outer and inner members are engaged.

5. A multiple drum device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof comprising: an inner drum and a concentric outer drum; said outer drum having an opening through which a portion of said inner drum may be viewed; means for rotating said inner drum; means carried by said outer and inner drums for interconnecting said outer and inner drum after the inner drum has been rotated through a predetermined angle, said outer drum thereafter being driven by said inner drum; means biasing said outer drum to bring its said opening to a predetermined angular position when said outer drum is disengaged from said interconnecting means; and a second biasing means connected between

6

said outer and inner drums for driving said inner drum counter to the means for rotating the inner drum.

6. A dual drum device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof comprising: an inner drum and a concentric outer drum; said outer drum having an opening through which a portion of said inner drum may be viewed; means for rotating said inner drum; means carried by said outer and inner drums for interconnecting said outer and inner drum after the inner drum has been rotated through a predetermined angle, said outer drum thereafter being driven by said inner drum; means biasing said outer drum to bring its said opening to a predetermined angular position when said outer drum is disengaged from said interconnecting means; and a second biasing means connected between said outer and inner drums for driving said inner drum counter to the means for rotating the inner drum; said biasing means for said outer drum providing no load on said means for rotating said inner drum when said outer drum is at said predetermined angular position; said second biasing means between said inner and outer drums providing no load on said means for rotating said inner drum when the outer drum is moved away from said predetermined angular position.

7. A dual drum device for presenting indicia with respect to a marker cooperating with a peripheral portion thereof comprising: an inner drum and a concentric outer drum; said outer drum having an opening through which a portion of said inner drum may be viewed; means for rotating said inner drum; means carried by said inner and outer drums for interconnecting said outer and inner drum after the inner drum has been rotated through a predetermined angle, said outer drum being thereafter rotated from said inner drum; means biasing said outer drum to bring its said opening to a predetermined angular position when said outer drum is disengaged from said interconnecting means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,208,728	Menzer	July 23, 1940
2,279,551	Bossi	Apr. 14, 1942
2,351,814	Holzner	June 20, 1944