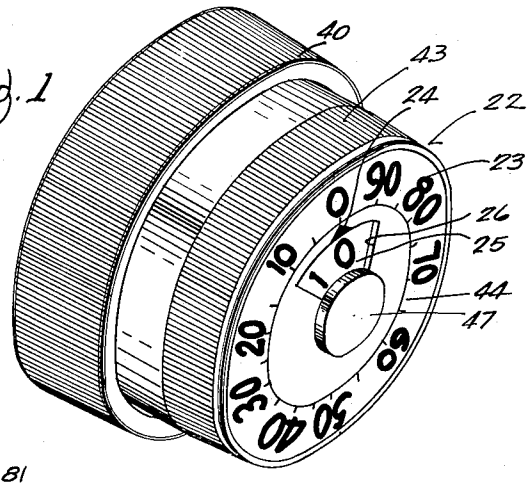
June 9, 1964 J. J. ARNOLD ETAL 3,136,294

COUNTING DIAL

Filed March 2, 1962 3 Sheets-Sheet 1

Fig. 1



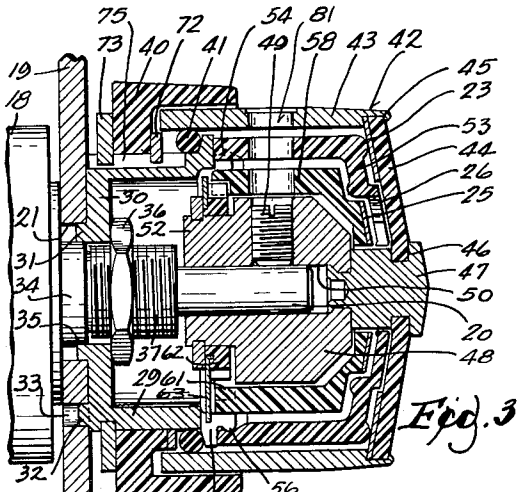


Fig. 3

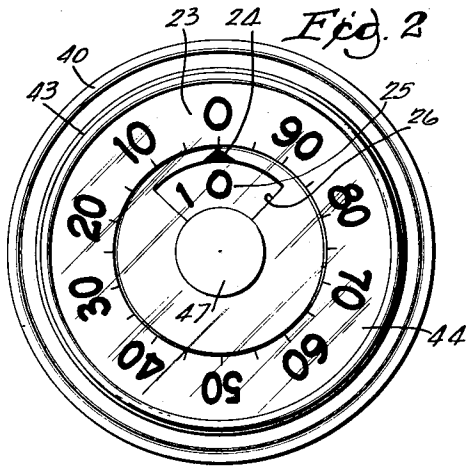


Fig. 2

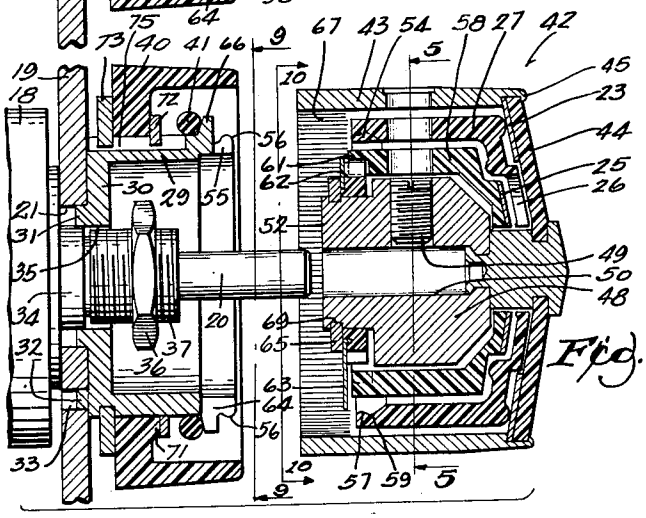


Fig. 4

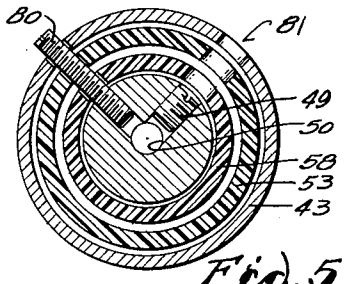


Fig. 5

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COUNTING DIAL

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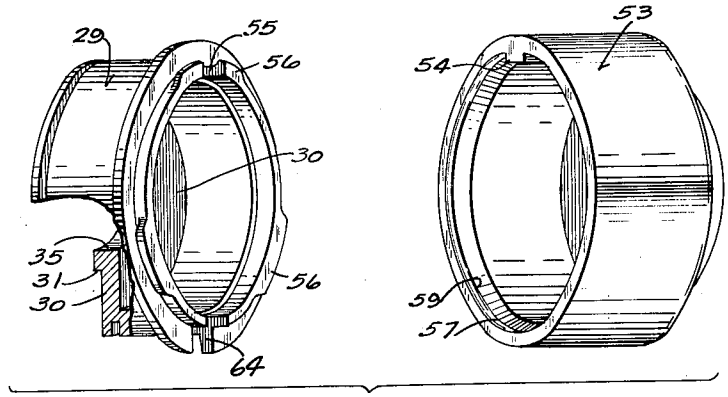

Fig. 6

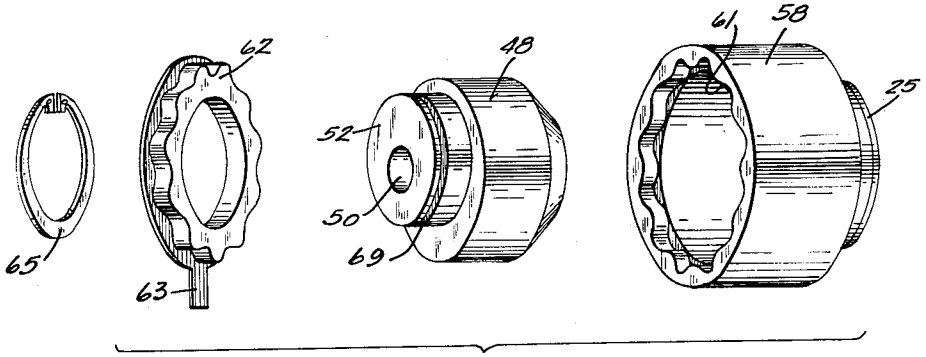

Fig. 7

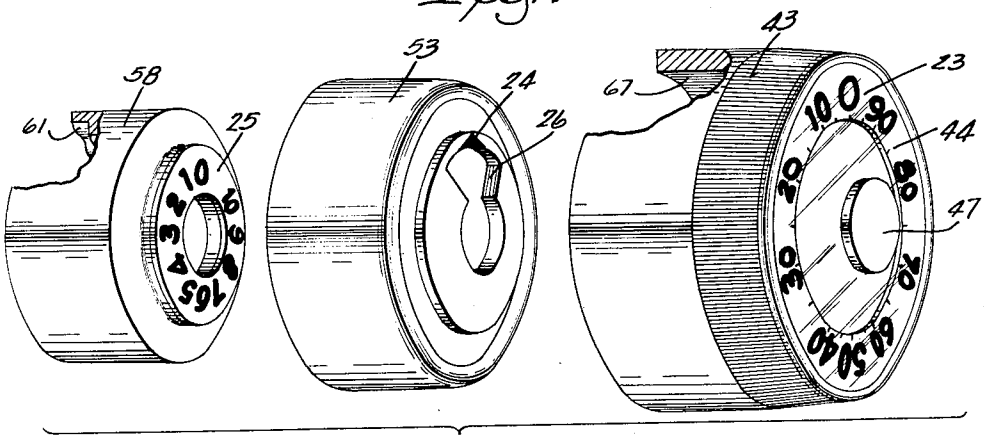

Fig. 8

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COUNTING DIAL

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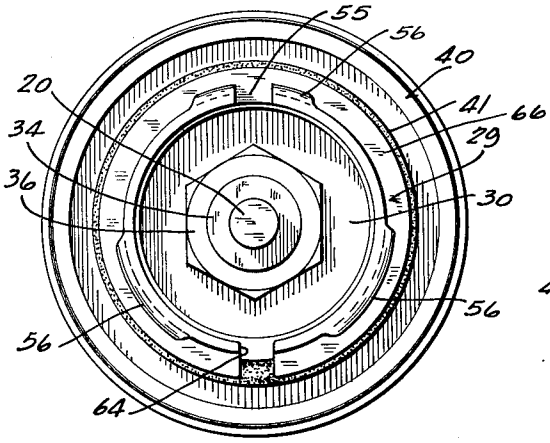

Fig. 9

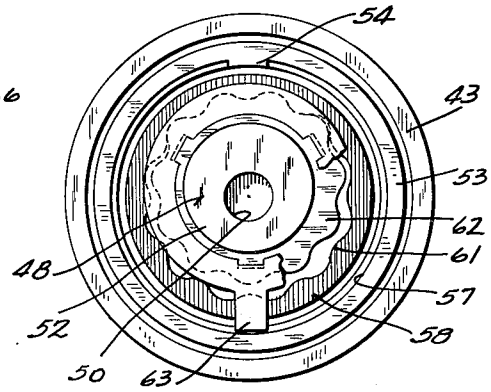

Fig. 10

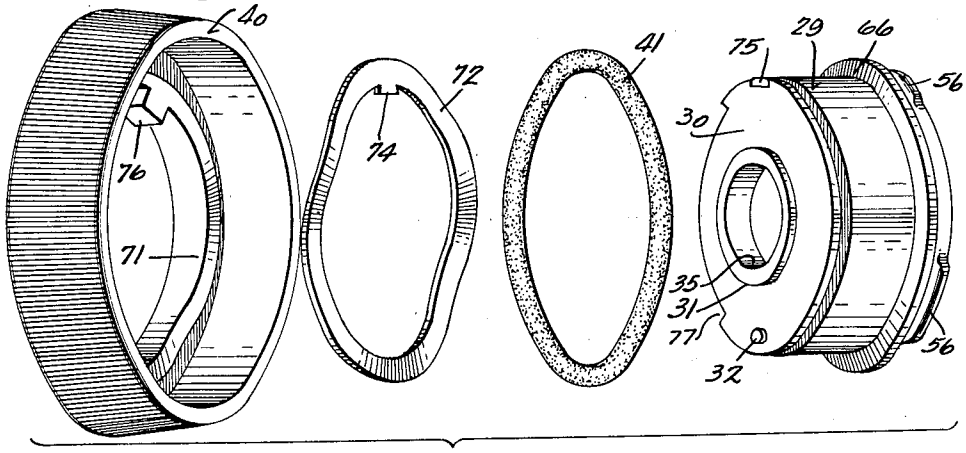

Fig. 11

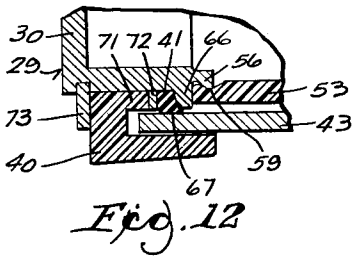

Fig. 12

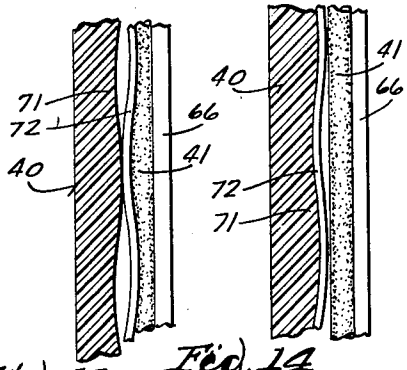

Fig. 13

Fig. 14

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3,136,294

COUNTING DIAL

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Filed Mar. 2, 1962, Ser. No. 177,111
8 Claims. (Cl. 116—115)

This invention relates to an improved counting dial.

Counting dials embodying the present invention are particularly adapted for miniaturization. In miniature counting dials, it is highly desirable that the dial numbers be made as large as possible for ready visibility, even at a distance, and notwithstanding the small size of the dial.

According to the present invention, the dial structure is such that the numbers both of the fractional turn indicating dial face and the full turn indicating dial face are relatively large as compared to miniature dials heretofore commercially available and can easily be seen, even from a distance.

The objectives of the invention are achieved in the claimed structure in which the knob transmits torque to the instrument shaft through one transparent dial face, through which the other dial face is visible. Accordingly, very substantial areas of the front of the dial are adapted to carry the dial indicia numbers and the operating mechanism does not obscure such numbers.

Other features of the invention include the structural organization of parts in which a knob assembly, gear assembly and mounting shell are interlocked in the course of assembling the dial elements on the shaft of the panel mounted controlled instrument, and a novel brake structure by which the knob can be locked in any position of adjustment.

The brake includes a resiliently deformable ring disposed radially between a mounting shell and a cylindrical portion of the knob, and cam elements for releasably expanding the ring radially to clamp concurrently against the knob and mounting shell. Accordingly, all brake motion is radial and application of the brake does not introduce into the structure any rotative movement which would upset the dial setting. Moreover, the brake ring serves additionally as a seal to exclude dust and dirt from the interior of the counting dial, when the brake is applied.

Other objects, features and advantages of the invention will appear from the following disclosure, in which:

FIG. 1 is a perspective view of a counting dial embodying the present invention.

FIG. 2 is a front elevation of the dial shown in FIG. 1.

FIG. 3 is an axial cross section taken through a completely assembled dial embodying the present invention.

FIG. 4 is an axial cross section taken through the dial in the course of its assembly on the shaft of a rotary instrument.

FIG. 5 is a transverse cross section taken along the line 5—5 of FIG. 4.

FIG. 6 is an exploded view in perspective of the index shell and mounting shell.

FIG. 7 is an exploded view in perspective of the orbital gear assembly.

FIG. 8 is an exploded view in perspective of the knob or dial assembly.

FIG. 9 is a view taken along the line 9—9 of FIG. 4.

FIG. 10 is a view taken along the line 10—10 of FIG. 4.

FIG. 11 is an exploded view in perspective of the brake assembly.

FIG. 12 is an enlarged fragmentary detail showing the brake in its braking position.

FIG. 13 is an enlarged fragmentary cross section showing the brake cam in its released position.

FIG. 14 is an enlarged fragmentary cross section showing the brake cam in its releasad position.

The counting dial of the present invention is adapted to count full and fractional turns of a multiple turn potentiometer, such as is shown in United States Patent 2,813,-182, or other like instrument. Such a potentiometer **18** may be mounted on an instrument panel **19** and has a rotatable shaft **20** extending forwardly through aperture **21** in the panel **19**.

The counting dial is calibrated to show various angle positions of the shaft **20** in .1% increments. The counting dial, which is indicated generally by reference character **22**, has a fractional turn indicating dial **23** which rotates with respect to the fixed pointer **24** to indicate fractional parts of a single turn. There is also a full turn indicator dial **25** visible through a window **26** in the index shell **53** and having numbers indicating full turns of the shaft **20**. Where a ten-turn potentiometer **18** is used, dial **25** will be graduated from zero through ten and dial **23** will be graduated from zero through ninety-nine. For every complete turn of dial **23**, dial **25** will abvance 1/12 of a turn. Accordingly, the dial can be read in terms of .1% increments of rotation of the ten-turn full movement of the potentiometer shaft **20**.

The counting dial **22** is mounted on the panel **19** on a mounting shell **29** which is also shown in FIGS. 6 and 9. Shell **29** is cylindrical and has a rear wall **30** with a rearwardly extending annular shoulder **31** which fits into the opening **21** in the panel **19**. For proper orientation of the shell with the panel, it has a rearwardly extending peg **32** receivable in the socket **33** in the panel **19**.

The central bearing **34** on the potentiometer **18** and in which the shaft **20** turns extends through the opening **35** in the rear wall **30** of shell **29** and the entire assembly as thus far described is clamped to the panel **19** by the nut **36** which coacts with the threads **37** formed on the outer surface of the bearing **34** to clamp the shell **29** to the panel **19**.

In the course of mounting the counting dial on the panel, the parts aforesaid will be fastened thereto as aforedescribed and as is shown at the left of exploded view FIG. 4. This view also shows the brake knob **40** and brake ring **41** mounted on the mounting shell **29**. Specific description of these parts will be deferred until later on in this description.

To the mounting shell **29** as shown at the left of FIG. 4 is then connected the complete dial and gear assembly **42** as shown at the right in exploded view FIG. 4. This assembly **42** includes both the knob assembly shown in FIG. 8 and the gear assembly shown in FIG. 7, the latter inside the former, as shown at the right in FIG. 4.

The knob assembly, as shown in FIG. 8, consists of cylindrical knob shell **43**, index shell **53** and dial shell **58**. Knob shell **43** has a transparent front face **44** rigidly fixed at its periphery in an annular groove **45** formed in the forward edge of the knob **43**. Transparent face **44** is desirably made of a transparent material such as "Lucite." It has a central opening, the margin of which is rigidly fastened in a groove **46** formed in a central plug **47**, which is in turn rigidly fastened to the hub **48** which has a set screw **49** by which the hub **48** is securely fastened to shaft **20** which extends through hub bore **50**, as shown in FIG. 3.

Hub **48** has a rearwardly extending eccentric cam portion **52** as is also shown in FIG. 7 and for the purpose of actuating the gear assembly which is also shown in FIG. 7. Cam portion **52** has a circular periphery eccentric with respect to the axis of hub bore **50**.

Fastened to the inside face of transparent dial face **44**, with cement or the like, is the annular numbered dial ring **23**.

From the foregoing, it is clear that knob **43**, dial ring

23, transparent dial face 44, plug 47 and hub 48 are integrally connected for unitary rotation on the axis of shaft 20. Accordingly, when hub 48 is connected to shaft 20, there will be a one-to-one turn ratio between knob 43 and shaft 20.

Concentrically within the knob shell 43 is index shell 53, which is also shown in FIG. 6. Shell 53 has on its front face the index pointer 24. Its rearwardly open rim is provided with a locking lug 54 which interlocks in a locking groove 55 formed in one of the locking dogs 56 on the front face of mounting shell 29. Shell 29 is provided with three such locking dogs 56, only one of which is interrupted by the groove 55. These dogs 56 snap over the rib 57 on the rear periphery of the index shell 53 and into the groove 59 behind the rib 57 when the parts are closed in the course of their assembly from their position shown in FIG. 4 to their position shown in FIG. 3.

The interlocked engagement of index shell 53 with mounting shell 29 is such that index shell 53 is fast with respect to the panel 19. Axial displacement is normally precluded by the interengagement of dogs 56 in groove 59 and rotational displacement is precluded by interengagement of lug 54 in groove 55. Accordingly, pointer 24 remains fixed during rotation of the knob 43.

To record full turns of the shaft 20, there is provided a concentric full turn indicating dial 25, which is mounted on the forward face of the shell 58, as is also shown in FIGS. 7 and 8. Shell 58 is free to rotate with respect to the index shell 53 under torque developed in its twelve-tooth gear 61, which is integrally formed thereon. Twelve-tooth gear 61 meshes with eleven-tooth orbital gear 62 which has projecting radially therefrom a tang 63, which is received within the groove 64 on the mounting shell 29. Tang 63 holds the gear 62 against rotation.

As best shown in FIGS. 3 and 4, the eleven-tooth orbital gear 62 is journalled for orbital or wobble movement on the eccentric cam 52 of the hub 48 and is held against axial displacement therefrom by the snap ring 65 which snaps into groove 69 on the cam 52. As hub 48 rotates with knob 43, eccentric cam 52 will rotate to orbit gear 62 which meshes with the teeth 61 on shell 58 of the full turn indicating dial 25. For every complete rotation of knob 43, shell 58 and dial 25 will rotate 1/12 of a turn by reason of the interaction of the respective wobble gears 61, 62. Tang 63 will move slightly radially in slot 64 in shell 29 in the course of gear interaction, and will prevent rotation of gear 62.

The device can be utilized without the brake structure shown more specifically in FIGS. 9–14, the same being optionally used where desired. The brake consists of an O-ring 41 which is concentric with the mounting shell 29 and normally lays snugly against the annular rib 66 formed thereon. The O-ring 41 is made of rubber or like resilient material and is radially expandable to clamp against the serrations 67 formed inside the otherwise open margin of the knob shell 43. Axial pressure is exerted on the O-ring 41 by the brake knob 40, which, as best shown in FIGS. 11, 13 and 14, has an annular cam shoulder 71 which bears on an annular cam follower ring 72 pursuant to rotation of the knob 40. Ring 72 has a radial lug 74 axially slidably interlocked in slot 75 in shell 29. This holds ring 72 against rotation, but permits axial movement thereof.

The knob 40 is retained on mounting shell 29 by snap ring 73. Knob 40 has a radial lug 76 which slidably interlocks in the axial and circumferential slot or relieved peripheral portion 77 of shell 29. Slot 77 is relieved through about 110° of the arcuate extent of the shell periphery, thus to permit rotation of the brake knob 40 through about 110°. Both cam shoulder 71 and cam follower ring 73 have complementary axially extending undulations which coact when the knob 40 is turned to squeeze the O-ring 41 axially against the mounting shell rib 66 to expand the ring radially and against the serrations 67 on the inner surface of the knob 43, thus to lock the knob in any position to which it has been adjusted.

FIG. 14 shows the knob 40 in brake release position and in which its axial undulations match those on the ring 72. Rotation of the knob 40 to the extent permitted by interengagement of its lug 76 with the slot 77 will misalign the undulations aforesaid and produce axial pressure of the ring 72 against the O-ring 41, as shown in FIGS. 12 and 13. Ring 72 is held against rotation by the interlocking of its lug 74 with the slot 75. Rotation of the brake knob 40 with respect thereto will axially cam the ring 72 against the O-ring 41. The radial deformation of the O-ring 41 also hermetically seals the interior of the knob against entrance of dust, etc.

As best shown in FIGS. 3, 4 and 5, the mounting shell 29 and brake assembly is first mounted on the panel 19, as illustrated at the left in FIG. 4. The knob assembly shown in FIG. 8 is then integrated with the gear assembly of FIG. 7, as shown at the right in FIG. 4. These parts are temporarily held together in registry (desirably with all dials at zero position) by a long set screw 80 which passes through a series of aligned holes in the respective shells 43, 53, 58, 52.

The assembly 42 is then advanced axially over the instrument shaft 20 (also desirably set at zero position) until the respective ribs 56, 57 of the mounting shell 29 and the index shell 53 interlock as shown in FIG. 3, thus fixing the index shell 53 with respect to the panel 19 and providing a support for the assembly 42. A screw driver is now passed through aligned holes in the various shells, etc., these being indicated generally by reference character 81 in FIGS. 4 and 5, to tighten set screw 49 against the shaft 20. Set screw 80 is now removed from the assembly and the counting dial is now in readiness for use with the instrument 18 to count full and fractional turns of the shaft 20.

What is claimed is:

1. A counting dial adapted for connection to the shaft of a rotary instrument and comprising:
   - (a) a shaft connectable hub,
   - (b) a first numbered counting dial,
   - (c) a second numbered counting dial comprising:
     - (1) a transparent face in front of the first dial and through which numbers on said first dial are visible,
     - (2) a knob comprising a shell which encloses said hub and connects at one end to the periphery of said face,
     - (3) means at the center of said face for connecting the face to the hub to transmit torque from the knob through the face to the hub, and
   - (d) a speed changing transmission between said first and second dials.

2. A counting dial adapted for connection to the shaft of a rotary instrument and comprising:
   - (a) a shaft connectable hub,
   - (b) a first numbered counting dial,
   - (c) a second numbered counting dial,
   - (d) a knob connected to said second dial for imparting rotary motion thereto,
   - (e) a speed changing transmission between said first and second dials,
   - (f) said second dial having a transparent face in front of the first dial and through which numbers on said first dial are visible,
   - (g) said transparent face being connected to said hub to transmit torque from the knob to the hub,
   - (h) a mounting shell adapted to be mounted on a panel,
   - (i) said knob having a cylindrical portion overhanging said mounting shell,
   - (j) and a brake adapted to selectively interlock the knob and shell and comprising:
     - (1) a resiliently deformable brake ring between the knob and shell and

(2) means for releasably expanding said ring radially to resiliently engage the ring concurrently against the knob and shell.

3. The counting dial of claim 1 in which said speed changing transmission comprises a gear assembly including an orbital gear,

(*e*) said hub having an eccentric portion in motion transmitting connection with the orbital gear,

(*f*) said first dial having a gear in mesh with said orbital gear for rotation of said second dial in predetermined timed relation to the rotation of said second dial.

4. A counting dial adapted for connection to the shaft of a rotary instrument which is mounted on a panel and comprising:

(*a*) a shaft connectable hub,

(*b*) a first numbered counting dial,

(*c*) a second numbered counting dial,

(*d*) a knob connected to said second dial for imparting rotary motion thereto,

(*e*) a speed changing transmission between said first and second dials,

(*f*) said second dial having a transparent face in front of the first dial and through which numbers on said first dial are visible,

(*g*) said transparent face being connected to said hub to transmit torque from the knob to the hub,

(*h*) a mounting shell having panel mounting means by which the shell is fixed to the panel,

(*i*) an index shell in assembled relation to said first and second dials, knob and speed changing transmission,

(*j*) means by switch the mounting shell and index shell are releasably interlocked to fix the index shell with respect to the panel and support the index shell assembly therefrom.

5. A counting dial adapted for connection to the shaft of a panel mounted rotary instrument and comprising:

(*a*) a mounting shell concentric with said shaft and having panel mounting means by which the shell is fixed to the panel,

(*b*) an assembly consisting of first and second dials, a speed changing transmission therebetween and an index shell with respect to which said dials are rotatable,

(*c*) and means by which the mounting shell and index shell are releasably interlocked to fix the index shell with respect to the panel and support said assembly therefrom.

6. The counting dial of claim 5 which further comprises a brake adapted to selectively lock the said assembly with respect to the mounting shell, said brake comprising:

(*d*) a brake knob rotatably mounted on said mounting shell,

(*e*) said assembly having a cylindrical portion overhanging said mounting shell,

(*f*) a resiliently deformable brake ring between said shell and cylindrical portion,

(*g*) and means for releasably expanding said ring radially to resiliently engage said ring concurrently against the shell and cylindrical portion as a consequence of rotation of the brake knob.

7. A counting dial of the character described and comprising:

(*a*) a relatively fixed mounting shell having an annular rib,

(*b*) a relatively rotatable counting dial knob having a cylindrical portion overhanging said shell,

(*c*) a brake adapted to selectively interlock the dial knob and shell and comprising:

(1) a resiliently deformable brake ring between the dial knob and shell,

(2) a brake knob rotatable on the shell

(3) cam means to press the brake ring axially against said shell rib on rotation of the brake knob and expand said ring radially to resiliently engage the ring concurrently against the dial knob and shell.

8. The counting dial of claim 7 in which said cam means comprises:

(*d*) an axially undulating cam shoulder on said brake knob,

(*e*) an axially undulating cam follower ring between said shoulder and said deformable brake ring,

(*f*) and means to hold said cam follower ring against rotation whereby rotation of said brake knob will misalign the undulation on its shoulder and those on the cam follower ring to press the cam follower ring axially against said brake ring.

References Cited in the file of this patent

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2,370,992	Perry et al.	Mar. 6, 1945

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,136,294 June 9, 1964

John J. Arnold, et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 22, for "abvance" read -- advance --; column 5, line 33, for "switch" read -- which --.

Signed and sealed this 13th day of October 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents