

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) MECHANICAL IMPULSE COUNTER

(71) We, ENGLISH NUMBERING MACHINES LIMITED, of Millbank Tower, Millbank, London, S.W.1., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to counters for counting events and displaying the number of such events counted. The invention is particularly useful in an aerosol dispenser and the embodiment described below is so used, but the invention is not limited to such an application.

Many devices such as aerosol dispensers are operated by manual depression of a button. It is often desirable to have a count of the number of operations.

An object of this invention is to provide a counter, actuated by such a movement, which is suitable for incorporation in a small hand-held device.

Accordingly, the present invention provides a counter arranged about an axis for actuation by an actuating member movable along said axis, comprising a support, a number wheel movable relative to the support by rotation about said axis, detent means mounted on the support and engaging the number wheel to permit rotation of the number wheel in only one direction, a first ratchet secured to the number wheel, a ratchet engaging member arranged adjacent and biased into engagement with the ratchet, and motion transfer means mounted on the support and arranged to be engaged by said actuating member when moved axially and to transmit the motion as rotational motion to the ratchet engaging member.

Preferably, the motion transfer means comprises a bell-crank having one arm engageable by said member and a second arm engaging the ratchet engaging member, the pivotal axis of the bell-crank lying radially to said axis.

Preferably also, the ratchet engaging mem-

ber is a ring carrying a second ratchet which overlies the first ratchet.

The ring may be biased into engagement with the first ratchet by leaf springs mounted on the support and bearing on a face of the ring.

Suitably, the support is a plastics moulding with which the springs are integral.

Preferably, the support comprises an inter-fitting base member and housing, the base member being substantially perpendicular to said axis and the housing extending axially therefrom, the number wheel and ratchet engaging member being arranged for rotary movement on the housing.

The detent means may comprise a third ratchet, on the base member, which co-operates with a fourth ratchet on the number wheel.

Preferably also, the housing is push-fitted into a bore in the base whereby in use in an appliance the first movement of said actuating member pushes the housing to a position in the bore suitable for the particular actuating member of that appliance.

The interfitting part of the housing may be resilient and have a corrugated surface.

The counter preferably includes a reset member one part of which is arranged for external actuation, and having a pawl arranged for engagement when moved in one direction with at least one element on the number wheel, the or each such element being associated with a given digit on the number wheel, so that movement of the reset member in said one direction causes the number wheel to be rotated to indicate said given number.

The invention further provides a device for fitting over the valve of an aerosol can and having a counter according to the invention as defined above disposed therein so that the member operating the valve acts as the actuating member for the counter.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is an exploded perspective view of

a counter according to the present invention;

Fig. 2 is a detail elevation on an enlarged scale and partly in section of part of the counter of Fig. 1; and

Figs. 3a and 3b are respectively front and side elevations of a bronchial inhaler incorporating the counter. The counter shown in Figs. 1 and 2 is designed to fit inside a bronchial inhaler 10 (Fig. 3) which comprises essentially a cylinder open at one end 11 to receive an aerosol can or vial 12 containing for example a compound of the relief of asthma, and at the other end having a mouthpiece 13. The inhaler 10 is operated by depressing the vial 12. This causes the valve (not shown) of the vial 12 to be opened by a member connected thereto abutting a stop in the inhaler. Depression of the vial actuates the counter, as will be described, and causes the number displayed in a window 14 in the inhaler 10 to step one digit. The counter may operate in a count-down fashion so that the displayed number indicates the dosage remaining, but in this embodiment is constructed to count up to show doses used.

Turning now to Fig. 1, the counter has a circular base 15 having a bore 16 for receiving a housing 17. The housing 17 is radially located in the bore 16 by co-operating shoulders 18 and slots 19.

A number wheel 20 is arranged for rotation on the base 15, and over the number wheel 20 is fitted a drive member 21 which can move in a rotary manner on the housing 17. The extent of this movement is limited by slots 22 in the drive member 21 co-operating with shoulders 23 on the housing 17, the slots 22 being wider than the shoulders 23.

The number wheel 20 is formed with an integral ratchet 24 facing the drive member 21 and co-operating with a ratchet 25 formed in the drive member 21, and also with a further integral ratchet 26 arranged to co-operate with a detent ratchet 27 formed in the outer circumference of the base 15. The housing 17 is moulded from a resilient plastics material and includes integral leaf springs 28 which bear on lands 29 of the drive member 20 to bias the drive member 21, the number wheel 20, and the base 15 (and thus also the respective ratchets) into engagement.

The housing 17 carries two bell cranks 30 mounted for pivotal movement on pins 31 adjacent the top surface 32 of the housing 17. Each bell crank 30 comprises an upper arm 33 biased so that its free end occupies a rest position above the surface 32, by means of a further respective leaf spring 34 integral with the housing 17. Each crank 30 also comprises a lower arm 35 which engages a respective recess in the drive member 21, as seen also in Fig. 2.

The operation of the counter is as follows.

Depression of the vial 12 causes the valve end (not shown) of the vial to engage the upper arms 33 of the bell cranks 30. Further depression swings the upper arms 33 downwards about the pins 31, and thus the lower arms 35 move circumferentially of the housing 17 and cause the drive member 21 to rotate. The degree of movement of the cranks 30 is determined by the abutment of keyhole slots 45 therein against corresponding projections 46 on the housing 17. The drive member ratchet 25 engages the upper number wheel ratchet 24 and the number wheel is thus rotated: the degree of rotation is limited to one digit on the number wheel 20 by means of the slots 45 and projections 46, and may also be limited by the shoulders 23 limiting the rotation of the drive member 21. When the vial is released, the springs 34 return the bell cranks 30 to their rest position, thus also returning the drive member 21 to its original position, axial movement of the member 21 against the bias of the springs 28 allowing its ratchet 25 to ride over the ratchet 24. It will be apparent that the number wheel is maintained in position at this time by means of the detent ratchet 27. It will also be apparent that when being driven to register a count the number wheel 20, and thus also the drive member 21, moves axially against the springs 28 to move over the detent ratchet 27.

A feature of this embodiment is that the housing 17 is a push fit in the bore 16 of the base 15. Thus when the vial is depressed for the first time, after moving the upper arms 33 of the bell cranks 30 through the required distance the end of the vial engages the top surface 32 of the housing 17. Further depression of the vial pushes the housing 17 further into the bore 16. This feature allows the counter to accommodate low tolerances in the distance between the end surface of the vial and its valve member which abuts the stop in the inhaler. To assist in this action, the interfitting part of the housing 17 which enters the bore 16 is provided with corrugations 37.

A further feature of this embodiment is the provision of a resetting means to return the number wheel at will to its base position. In this embodiment, the number wheel 20 indicates a count from 25 to zero, and is provided with four scales each giving such a count and occupying one quarter of the circumference. A reset slide 38 is mounted for sliding movement around the base 15 and is provided with a finger piece 39 which projects from the inhaler 10 through a slot therein. A pawl 40 is mounted on the end of the slide distant from the finger piece 39 and projects through a slot 41 in the base 15 to lie inside the number wheel 20. A spring wire 42 biases the pawl against the inner face of the number wheel 20. The inner

face of the number wheel 20 carries four stops 43 for co-operation with the pawl 40 and each aligned with a respective zero (or 25) position on the number wheel.

5 To reset the counter, the slide 38 is moved to the left as seen in Fig. 1, causing the pawl 40 to ride over one of the stops 43. The slide 38 is then returned fully to the right, and the pawl 40 engages the appropriate stop 10 43 thus moving the number wheel 20 to a zero indicating position.

In a modification of this resetting mechanism (not shown in the drawings), the spring wire 42 is arranged so that when the reset 15 slide 38 is out of use the finger piece 39 is urged through a suitably widened portion of the slot in the inhaler 10, thus biasing the pawl 40 towards the axis of the counter, clear of the stops 43. This prevents any 20 sluggishness of the counting action due to contact of the sloping faces of the pawl 40 and stops 43. To reset the counter, the finger piece 39 is first pushed inwardly, bringing the pawl 40 against the inner face of the 25 number wheel 20, after which the operation proceeds as above.

The invention thus provides a counter which counts impulses applied along an axis on a number wheel rotating about that axis, 30 in a very compact form suitable for incorporation in small hand-held devices.

#### WHAT WE CLAIM IS:—

1. A counter arranged about an axis for actuation by an actuating member move- 35 able along said axis, comprising a support, a number wheel moveable relative to the support by rotation about said axis, detent means mounted on the support and engaging the number wheel to permit rotation of the num- 40 ber wheel in only one direction, a first ratchet secured to the number wheel, a ratchet engaging member arranged adjacent and biased into engagement with the ratchet, and motion transfer means mounted on the support and 45 arranged to be engaged by said actuating member when moved axially and to transmit the motion as rotational motion to the ratchet engaging member.

2. A counter as claimed in claim 1, in 50 which the motion transfer means comprises a bell-crank having one arm engageable by said member and a second arm engaging the ratchet engaging member, the pivotal axis of the bell-crank lying radially to said axis.

55 3. A counter as claimed in claim 1 or claim

2, in which the ratchet engaging member is a ring carrying a second ratchet which overlies the first ratchet.

4. A counter as claimed in claim 3, in 60 which the ring is biased into engagement with the first ratchet by leaf springs mounted on the support and bearing on a face of the ring.

5. A counter as claimed in claim 4, in 65 which the support is a plastics moulding with which the springs are integral.

6. A counter as claimed in any preceding claim, in which the support comprises an interfitting base member and housing, the base member being substantially perpendicular to said axis and the housing extending axially therefrom, the number wheel and the ratchet engaging member being arranged for rotary movement on the housing. 70

7. A counter as claimed in claim 6, in 75 which the detent means comprises a third ratchet, on the base member, which co-operates with a fourth ratchet, on the number wheel.

8. A counter as claimed in claim 6 or 80 claim 7, in which the housing is push-fitted into a bore in the base whereby in use in an appliance the first movement of said actuating member pushes the housing to a position in the bore suitable for the particular actu- 85 ating member of that appliance.

9. A counter as claimed in claim 8, in which the interfitting part of the housing is resilient and has a corrugated surface.

10. A counter as claimed in any preceding 90 claim, including a reset member one part of which is arranged for external actuation, and having a pawl arranged for engagement when moved in one direction with at least one element on the number wheel, the or each 95 such element being associated with a given digit on the number wheel, so that movement of the reset member in said one direction causes the number wheel to be rotated to indicate said given number. 100

11. A counter substantially as hereinbefore described with reference to the accompanying drawings.

12. A device for fitting over the valve of 105 an aerosol can and having a counter according to any preceding claim disposed therein so that the member operating the valve acts as the actuating member for the counter.

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