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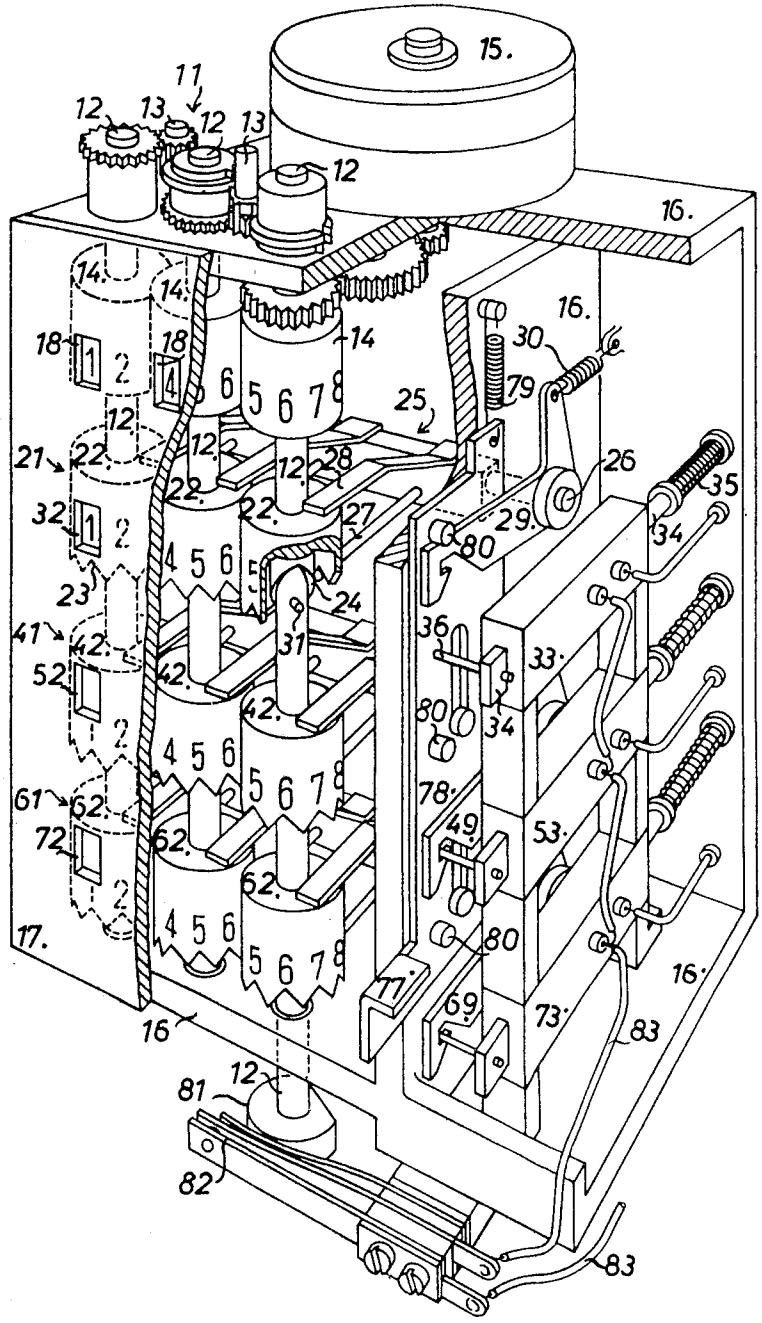

INVENTOR:
Werner Schürmann
BY:
Lawrence E. Laubscher
ATTORNEY

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COUNTER STORAGE AND VISUAL READOUT MEANS

Werner Schürmann, Herrliberg, Switzerland, assignor to Mettler Instrumente AG., Zurich, Switzerland, a corporation of Switzerland

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ABSTRACT OF THE DISCLOSURE

Counter apparatus including improved read-out means, comprising a set of digit-bearing counting cylinders secured to parallel shafts journalled in a frame, and at least one set of digit-bearing storage cylinders mounted for free rotational and sliding movement on the shafts. The invention is characterized in that the storage cylinders normally have a retracted position relative to the frame in which said storage cylinders are coupled with the shafts at the same orientation as said counting cylinders, respectively, displacement means being provided for shifting said set of storage cylinders axially relative to the frame to a read-out position in which the storage cylinders are decoupled from the shafts. The displacement means include arrester means for preventing rotation of the storage cylinders when in the decoupled read-out position.

This invention relates to a counter apparatus for numerically indicating measurements given by an input device. Such a counter apparatus comprises a frame and a plurality of digit-bearing counting cylinders rotatably mounted in said frame and adapted to display multi-place figures. The counting cylinder representing the lowest-value decimal place is driven by said input device and tens-transfer mechanisms are provided to act between said counting cylinders in a manner to advance a given counting cylinder by the adjacent counting cylinder representing the next lower-value decimal place.

The main object of this invention is to provide in a counter apparatus of the kind outlined simple and reliable means for storing measurements which are displayed at given moments without stopping the counter apparatus for this purpose. To this end the said counter apparatus in addition comprises a plurality of shafts rotatably mounted in said frame, each of said shafts having but one of said digit-bearing counting cylinders fastened to it and extending in a direction transverse to the direction in which said multi-place figures are read-off said counting cylinders; at least one set of digit-bearing storage cylinders, each of which being mounted on one of said shafts to be axially movable between two limit positions in one of which it is coupled to the respective shaft and in the other of which it is decoupled from said shaft; coupling means which bring the digit shown by each of said storage cylinders automatically into agreement with the digit shown by the counting cylinder sitting on the same shaft when said storage cylinder is in said coupled position; arresting means for preventing a rotation of each of said storage cylinders when the same is in said uncoupled position; and a displacement device mounted in said frame and associated with each of said storage sets for the simultaneous axial displacement of all the storage cylinders belonging to said set.

These and other objects and adavntages of the invention will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing in which is illustrated a

simplified perspective view of a counter apparatus with partly-fragmented front elevations of certain parts.

The counter apparatus illustrated in the drawing has a three-place decimal counter **11** with counter shafts **12** extending vertically. The tens-transfer mechanisms each have a toothed intermediate spindle **13**, which spindles are also vertical. On each of the three shafts **12** is fastened a digit-bearing counting cylinder **14**, and the counting cylinders **14** of the counter set are juxtaposed in a horizontal direction. The shaft **12** on the extreme right is driven through an intermediate gearing by an input device **15**; this may, for example, be an electrically actuated step-by-step motor but is not shown in detail in the drawing. The shafts **12** and the intermediate spindles **13** are mounted in the frame **16** of the apparatus; the input device **15** may also be attached to the frame. The frame **16** further has a front plate **17** containing a series of windows **18** through which the digits on the display surfaces of the counting cylinders **14** can be successively seen. In the drawing the counting cylinders **14** display the decimal figure "145."

The counter apparatus further has a first set **21** of three digit-bearing storage cylinders **22** which are each mounted for axial displacement on one of the associated shafts **12**. Each of the three storage cylinders **22** has a rim **23** with ten teeth. It also has a cam **24** which surrounds the associated shaft **12** and extends axially of the latter, as can be seen in the case of the storage cylinder **22** on the extreme right of the set **21**. The cylinders **22** are moved axially with the aid of a displacement device **25** associated with the storage set **21**. This device **25** includes a shaft **26** pivotally mounted in the frame **16** with a ratchet **29** fixed to one end. The shaft **26** also has attached to it a pin shaped arresting member **27** and a leaf spring **28** for each of the storage cylinders **22**, the leaf spring **28** sliding over one flat surface of the associated storage cylinder **22** and endeavouring to move it towards the arresting member **27**. The ratchet **29** is engaged by a tension spring **30** which raises the free ends of the ratchet **29**, arresting members **27** and leaf springs **28**, and thus the storage cylinders **22**. In the uppermost position of the displacement device **25** and of the storage cylinders **22** of the set **21** the arresting members **27** engage in the toothed rims **23** on the storage cylinders **22** and prevent them from rotating, but since the shafts **12** go on turning, the storage cylinders **22** have to be uncoupled therefrom in this uppermost limit position. For this purpose a pin **31** extending radially from each shaft **12** is provided at a level such that it can go on turning below the cam **24** of the appropriate storage cylinder **22**.

The windows **32** in the front plate **17** are positioned so that the digits on the storage cylinders **22** appear in the windows **32** only when these cylinders **22** are in the said uppermost position, in which they are uncoupled from the respective shafts **12**. In the drawing the set **21** is thus shown with its storage cylinders **22** in the uncoupled and uppermost limit position and with the associated displacement device **25** in its corresponding end position.

If on the other hand the ratchet **29** is moved down against the action of the tension spring **30**, the leaf springs **28** will force down the storage cylinders **22** until the pins **31** engage in the top corner of the cams **24** and the arresting members **27** have been disengaged from the toothed rims **23** of the storage cylinders **22**. In the resultant lowermost limit position the storage cylinders **22** are then coupled to the counter shafts **12** in such a way that the front surface of each cylinder **22** shows the same digit as the counting cylinder **14** fixed to the same shaft **12**. If one or more of the storage cylinders **22** should not yet be showing the same digit as the asso-

ciated counting cylinder **14** at the time of the transition from the uncoupled to the coupled position, then the storage cylinder **22** in question will be further rotated by the action of the cam **24** and the pin **31** sliding along it until the pin **31** has engaged in the top corner of the cam **24**. This is a simple and effective way of automatically ensuring that when the storage cylinders **22** are in the coupled position their digits always agree with those on the corresponding counting cylinders **14**.

In the said coupled limit position of the storage cylinders **22** of set **21**, the digits on cylinders **22** are not visible through the windows **32** because of the lowering of the storage cylinders **22**.

The displacement device **25** associated with the storage set **21** has an electro-mechanical relay **33** with a movable armature **34** which is acted on by a compression spring **35**. The spring **35** endeavours to shift the armature **34** forwards when the relay coil is not energized. In this foremost position of the armature **34** the ratchet **29** can engage in the pin **36** on the armature **34** so that the ratchet **29** is then—against the action of the tension spring **30**—kept in its lowermost position in which the storage cylinders **22** are coupled to the shafts. But if the coil of the relay is energized the armature **34** will move back against the compression spring **35** and will release the ratchet **29**. The latter is immediately raised by the spring **30**, resulting in the uncoupling of the storage cylinders **22** from the shafts **12**. Through the windows **32** the storage cylinders **22** then show the digits which the counting cylinders **14** showed through the windows **18** when the relay **33** was energized, thereby producing the desired storage effect.

In addition to the first storage set **21** already explained the illustrated embodiment of the invention has another two storage sets **41** and **61** in which all the associated parts are identical with those in set **21**. Thus the set **41** has digit-bearing storage cylinders **42** an associated displacement device in which the ratchet is shown at **49** and the relay at **53**. The storage set **61** similarly has the storage cylinders **62**, a ratchet **69** and a relay **73**. The ratchets **49** and **69** are shown in their lowermost engaged position, so that the storage cylinders **42** and **62** are each in their coupled limit position, with the result that the digits on them are not visible through the series of windows **52** or **72**. Where three independently operable storage sets **21**, **41** and **61** are used it is possible to store the numerical reading of measurements obtained at the counter **11** at any three predetermined times.

It is desirable for the counter apparatus described to have a resetting key **77** to move one or more of the storage sets **21**, **41**, **61** from the uncoupled end position of the storage cylinders back to the coupled end position thereof so that the storage sets in question can be made ready for further storing action. For this purpose the key **77** is fixed to a slide **78** which is guided parallel in the frame **16** and kept in a raised position by means of a tension spring **79**. The slide **78** has pegs **80** with which the ratchets **29**, **49**, **69** can be brought into contact from below as shown in the case of the ratchet **29**. By temporarily depressing the key **77** it is possible to lower all the ratchets (e.g. **29**) which are in contact with the pegs **80** so that they come into engagement as illustrated in the case of ratchets **49** and **69**.

The shaft **12** at the extreme right, which is driven by the input device **15**, has a cam plate **81** fixed to it. In a given angular position the cam plate **81** opens an electric contact **82** in the line **83** leading jointly to relays **33**, **53** and **73**. This angular position of the cam plate **81** is such that the contact **82** is open whenever the shaft **12** carries over a ten-transfer, i.e. wherever more than one of the counting cylinders **14** is simultaneously advanced one step. The opening of contact **82** thus prevents one of the storage sets **21**, **41** or **61** from being transferred from the coupled to the uncoupled position just when a ten-transfer is being carried over. One of the storage sets **21**, **41** or **61** can thus respond and store a figure or value only before or after the carrying over of a ten-transfer. This prevents any erroneous storage, particularly in the higher-value decimal places of the figure to be stored.

In practice the counter apparatus can be used as follows:

The current value of a measurement received from the input device **15** is indicated by means of the counting cylinders **14** of the counter **11** and this value usually alters in the course of time. The purpose is to store the current value of the measurement at three predetermined times so that these values can be read off later as required. The times for storing the measurements may, for example, be determined by a time switch or can even be made dependent on the occurrence of a given event. Relays **33**, **53**, and **73** are connected to the appropriate circuits including the comon lead **83**, which thus act as control circuits and may bring the various storage sets **21**, **41** and **61** into action. The key **77** is first depressed so as to bring the storage cylinders of all three storage sets into the coupled position as already illustrated in the case of sets **41** and **61**. In this position the storage cylinders show the same digits as the cylinders of the counter **11** which are on the same shaft **12**. If the storage cylinders of one of the storage sets were still in the uncoupled uppermost position and showing a stored figure different from the figure shown on the counting cylinders of the counter **11** before the key **77** is depressed, the depression of key **77** will, owing to the action of cams **24** and pins **31**, brings the digits into agreement on coupling without any further measures being taken.

Once the key **77** has been depressed the digits of all the digit-bearing cylinders mounted on the same shaft **12** in any case coincide, so that the digit-bearing cylinders in each storage set can join in all the movements of the counting cylinders **14** of the counter **11**. If, for example, relay **33** is energized, then because of the backward movement of the armature **34** the ratchet **29** will snap upwards, thereby bringing the storage cylinders **22** of the storage set **21** into the uppermost uncoupled position, in which the figure "145" appears in the windows **32** because when the relay **33** was energized the counting cylinders **14** of the counter **11** also showed the figure "145" through the windows **18**. Similarly the storage sets **41** and **61** will store the figures indicated by the counting cylinders **14** when the relays **53** and **73** are energized. When the storage sets **21**, **41**, **61** have responded once the stored figures will be retained and remain visible in the windows **32**, **52**, **72** until the key **77** is depressed once more.

The counter apparatus is particularly suitable for laboratory work, in carrying out measurements which can be automated and which extend over long or indefinite periods of time as may, for example, be the case when determining the melting points of series of different samples. The counter cylinders **14** of the counter **11** can indicate the furnace temperature, which may possibly be varied according to a test program, the assumption being that all the samples are in the same furnace. The melting process is investigated photoelectrically and separately for each sample, and one of relays **33**, **53**, **73** will be associated with each sample. The relay in question may be connected, possibly by an electronic intermediate amplifier, to the photoelectric cell belonging to the sample in such a way that it responds as soon as the sample begins to melt. By the response of the storage set associated with the sample the melting temperature of the latter is then immediately indicated and stored.

There are a large number of other possible applications of the counter apparatus in carrying out a plurality of similar measurements without any supervision.

The counter **11** and thus the set of the counting cylinders **14** may have any desired number of decimal places, and the same applies to the storage sets. The number of storage sets may also be increased without any difficulty depending on requirements.

Also each storage cylinder is shown as having a cam **24** cooperating with a pin **31** carried by its respective shaft, it is also feasible to mount the cam on the shaft and arrange for a pin or equivalent member to project from the storage cylinder in question.

These and other modifications which may occur to those familiar with the art fall within the spirit and scope of the invention.

I claim:

1. Counter apparatus, comprising:

a frame **(16)**;

counting means including a plurality of parallel shafts **(12)** journalled in said frame, a set of digit-bearing counting cylinders **(14)** secured to said shafts, respectively, and tens-transfer means **(13)** connecting said shafts to cause said counting cylinders to display a multi-place decade number;

input means **(15)** for rotatably driving an input one of said shafts;

storage and visual readout means including at least one set of digit-bearing storage cylinders **(22)** mounted for free rotational and sliding movement on said shafts, respectively;

coupling means **(24, 31)** operable when said set of storage cylinders has a retracted coupled position relative to said frame for coupling said cylinders with said shafts at the identical orientation as the corresponding counting cylinders, respectively;

displacement means **(25)** for simultaneously displacing said set of storage cylinders axially relative to said frame to a read-out position in which said storage cylinders are decoupled from said shafts, respectively, said displacement means including arresting means **(27)** for preventing rotation of said storage cylinders when said cylinders are in the decoupled read-out position; and

means **(29, 36)** normally maintaining said set of storage cylinders in the coupled position during said driving of said input shaft.

2. Apparatus as defined in claim **1**, wherein said coupling means comprises for each of said storage cylinders a cam member **(24)** having a cam face surrounding and extending axially of the corresponding shaft, and a pin member **(31)** extending radially of said shaft, one of said members being mounted on said storage cylinder and the other of said members being mounted on said shaft.

3. Apparatus as defined in claim **1**, wherein said arresting means comprises for each of said storage cylinders a toothed rim portion **(23)** on said storage cylinder, and a pin-shaped arresting member **(27)** connected with said frame for engaging said rim portion when said storage cylinder is in the decoupled read-out position.

4. Apparatus as defined in claim **1**, wherein said displacement means comprises a displacement member **(26)** rotatably connected with said frame for movement about a transverse axis contained in a plane normal to said shafts, means including said arresting means for connecting said displacement member with said set of storage cylinders, and spring means **(30)** normally biasing said displacement member in a direction to shift said storage cylinders toward the read-out position; and further wherein said means for normally retaining said set of storage cylinders in the coupled position comprises latch means including a ratchet **(29)** connected with said displacement member.

5. Apparatus as defined in claim **4**, wherein said latch means further includes a latch pin **(36)**, and solenoid means **(33)** connected with said frame and including an armature **(34)** for operating said latch pin between locked and unlocked positions relative to said ratchet.

6. Apparatus as defined in claim **4**, and further including means **(81, 82)** operable during the period of tens transfer for preventing movement of said ratchet when said storage cylinders are in the coupled position.

7. Apparatus as defined in claim **1**, wherein said frame includes an apertured panel containing a first set of apertures arranged to afford continuous view of the digits on said counting cylinders, said panel containing a second set of apertures affording view of said storage cylinders only when said set of storage cylinders are in the read-out position relative to the frame.

8. Apparatus as defined in claim **1**, and further including at least one second set of storage cylinders **(41, 61)** mounted for sliding and rotational movement on said shafts, respectively;

coupling means for coupling said second set of storage cylinders to said shafts when said second storage cylinders are in a retracted position relative to said frame; and

second displacement means for simultaneously displacing said second set of storage cylinders axially relative to said frame to a read-out position in which said second storage cylinders are decoupled from said shafts, respectively.

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MAYNARD R. WILBUR, Primary Examiner

J. M. THESZ, JR., Assistant Examiner

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