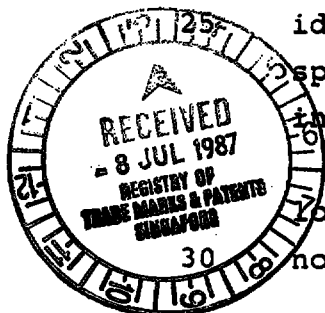


1 COUNTING INSTRUMENTS SPECIFICATION

5 This invention relates to counting instruments,
and is particularly concerned with counting instruments
which are designed to be partially or entirely hand-held.

 There is a need in a number of areas for a
counting instrument which will enable the user more
10 easily to count inventory items, lines of script, words,
rows and/or columns of print characters, etc. It is
possible for example to carry out a counting operation
on rows of typescript or printing just by scanning the
sheet and performing mental addition. Alternatively,
15 one can use a marked scale with appropriately
graduated divisions, but these have to be of fixed
length and do not allow for variations in the spacing
between lines, such as can occur when a sheet of
printing is photocopied. Counters are also known which
20 are designed to be manually operated and which incorporate
a button which can be depressed by finger or thumb
to increase the displayed count state. This class of
counter which requires an action by the operator
separate from and in addition to that involved in the
identification of the elements to be counted is
specifically excluded from the scope of the present
invention.

 Calendar/clock/alarm instruments designed to
look like pens or pencils are known, but these are
not designed to count individual elements presented to



1 the user of the device.

Digital voltmeter pens are also known which display a voltage reading when the pen tip is placed in contact with a voltage source. Here again, there is no provision in this known device for incremental counting in accordance
5 with elements identified by the user; such devices simply provide a single value display of a parameter of the system which is being monitored.

It is an object of the present invention to provide a counting instrument which overcomes the aforesaid
10 problems and disadvantages of conventional counting devices as outlined above.

It is another object of the present invention to provide a counting instrument which can monitor and/or record a count of individual items or elements presented
15 to an operator in a manner that requires human intervention. It is an object of the invention to provide a counting instrument in which each count which is registered is as a direct consequence of the physical action performed by the operator in identifying the particular element to be counted.

20 In accordance with the present invention there is provided a counting instrument comprising counting means; display means to indicate the count state; sensor means arranged to generate or modify an electrical signal to be supplied to the counting means in response solely to
25 movement of the instrument by an operator to identify individual elements to be counted; and an output transducer arranged to provide an output indication, additional to the display, in response to the identification by the operator of each element and/or of a predetermined number
30 of such elements; the display means, the counting means, the sensor means and the output transducer being mounted within or assembled as part of an elongate housing having the sensor means at one end thereof.

The movement by the operator of the instrument on
35 or over each element to be counted is converted directly

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1 or indirectly to produce an electrical signal internally
of the instrument for the purpose of incrementing or
decrementing the count state. No separate action is
required to press a button or move a lever to alter the
count state. Accuracy is therefore improved.

5 The housing can be designed to resemble a pen or
pencil. Provision can also be made for the instrument
simultaneously to mark each counted element as it is
identified by the operator as an element to be counted.

10 The sensor means preferably comprises an input
transducer arranged either to generate electrical pulses
or to modify electrical signals in response to each
identification by the operator of an element to be
counted. The sensor means can provide signals to the
counting means either directly or indirectly. The use of
15 piezo-electric transducers is particularly advantageous.

The counting instrument may also be provided with
means to connect the instrument to an external tote
display and/or an information processing system for the
transfer of information to and/or from the counting
20 instrument.

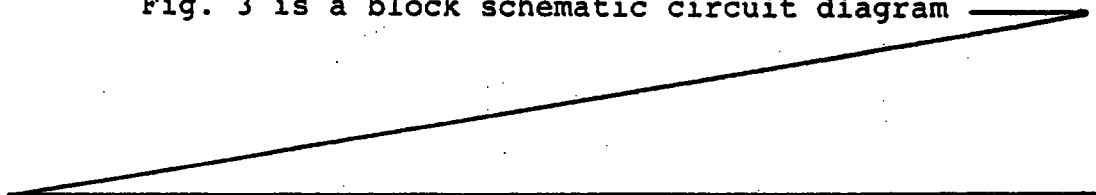
In order that the invention may be fully understood,
one presently preferred embodiment of counting instrument
in accordance with the invention will now be described by
way of example and with reference to the accompanying
25 drawings, in which:

Fig. 1 is a schematic illustration of the counting
instrument produced in the form of a pen;

30 Fig. 2 is a schematic illustration of a slightly
modified embodiment of instrument, again designed as a
pen;

Fig. 3 is a block schematic circuit diagram

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1 illustrating the method of operation of the counting
instrument and;

Fig.4 shows a typical display provided by the
counting instrument.

5 Figs. 1 and 2 show two ways in which the counting
instrument of the present invention can be designed to
resemble a pen. In each case the instrument comprises
a head assembly 10 and a barrel assembly 12. At the
end of the barrel assembly there is a tip 14. The
10 head assembly 10 comprises a clip 16, a display window
18 and a grille 20 behind which is a sound-generating
device.

In the case of the instrument shown in Fig.1,
the free end of the head assembly is provided with a
15 reset button 22 by means of which the count displayed
can be returned to an original figure, for example to
zero. In the embodiment shown in Fig.2, the head
assembly is provided with a plurality of buttons 24
which are connected to internal switches and which enable
20 full implementation of a plurality of functions and modes
of operation of the counting instrument as will be
described later. It will also be appreciated that in
the embodiment shown in Fig.2 the head assembly is not
circular but has a flat, generally rectangular
25 configuration. This shape allows a more ergonomic
arrangement of the function buttons 24, and also ensures
that the display window 18 remains facing upwards when
the pen is placed upon a flat surface. The head assembly
of the instrument shown in Fig.2 is also provided with
30 a connecting socket 26 which can be used to connect the
instrument to an external device for the transfer of
data to and/or from the counting instrument, as will be
described hereinafter.

Referring to Fig.3, this shows the circuitry of
35 the instrument within the housing. The instrument tip

1 14, indicated by a broken line, comprises a sensor
30. The sensor 30 comprises an input transducer which
either generates an electrical signal in response to
the operator's action in isolating or otherwise
5 identifying a particular element to be counted, or
modifies an electrical signal in response to such action.
The input transducer may operate by direct energy
transfer, whether mechanical, electrical, pneumatic
or chemical in origin. Alternatively, the input
10 transducer may operate indirectly, for example by causing
an interruption in the path of some form of conducted
or radiated energy, a field phenomenon, or some other
detectable change in any physical property introduced
by proximity of the sensor to the object which is to be
15 counted. One simple form of sensor 30 can be a stylus
coupled to a switch which is operated by pressure
exerted on the stylus.

The instrument tip 14 may also include an output
transducer 32. This output transducer 32 is arranged to
20 produce an output which is additional to the display
in the window 18, and typically is designed to produce
a physical sensation for the operator which does not
require his direct attention. Typically, an acoustic
output device is used as a telltale or warning indicator.
25 Each count is confirmed by one particular sound and
a different sound is used for warning the operator of
impending overflow or underflow in the counter. It will
be appreciated that it is possible to combine the input
transducer 30 and the output transducer 32 into one
30 component.

Advantageously, one can use piezo-electric
transducers both as input transducers and output trans-
ducers. The physical requirements for good coupling of
the sensor to acceleration and stress deformation of the
35 instrument body differ from the optimum coupling

1 conditions in the case of the output transducer 32.
This output transducer 32 must couple to the surrounding
air in a manner conducive to the efficient production
of acoustic pressure waves. At the expense of
5 greater complexity in the input processing, a miniature
ceramic piezo-electric buzzer may be used as a combined
transducer. The counter can then be entirely self-
contained within the head assembly, requiring no passive
mechanical moving parts or modification of the barrel
10 assembly. If a compromise over coupling is difficult
to achieve, then a better signal and count sensitivity
can be obtained by using a separate sensor of polyvinyl-
iden fluoride film with a mechanically tight coupling
to the instrument body.

15 The electrical signals from the input transducer
30 are fed to an input processing unit 34. Linear
and/or digital circuitry is used to match and process
the signals from the input transducer into a signal
pulse of suitable character to be passed to an internal
20 counter 36.

A suitable number of switches 38 are provided,
linked to the actuating buttons 24 (Fig.2) to activate
or access a particular operating mode of the instrument.
If the available space or ergonomics preclude a dedicated
25 switch for each function, then time and/or sequence coded
combinations of switches can be used.

The switches 38 are connected to a switch debounce
and control logic circuit 40. This additional logic
circuitry is required in order to condition switch input
30 signals, decode those inputs, and obtain the necessary
control over and coordination between the various
components of the counting instrument.

In the counter 36 the current count will be
35 incremented or decremented in response to each electrical

1 pulse received from the input processing unit 34.
The counter 36 may use any or all of the functions
normally attributed to the operation of counting.
This includes the ability to count up, to count down,
5 and to be preset directly or from storage. The counter
may operate with any desired counting base, for example
decimal, hexadecimal, or octal. The counter 36

may also be provided with means to perform
arithmetical computations with operators and operands
10 derived from the switch input or from store. Any number
of significant digits may be used, although normally
the display will be limited to four or five digits,
supported by an overflow/underflow indication.

The counter 36 provides an output to a display
15 unit 42. This provides a visible indication of the
current count state, and of any particular operating
mode of the instrument. The display may be produced
either directly by light emitting devices, or indirectly
by light modifying devices. The latter method offers
20 lower power consumption, and can conveniently be
accomplished by the use of a liquid crystal display
modifying either transmitted or reflected light.

Fig.4 shows a typical form of display. The
display comprises a number of digits, here four digits,
25 each in a seven segment format, together with a "half
digit". Flags indicating particular functions are also
present; a legend around the periphery of the display
will guide a cursor obtained by a particular switch code.
Further single operations of a switch move the cursor
30 around successive positions until the desired function is
reached, another switch or switch code then being used to
select that function. Following selection, the appropriate
flag will appear on the display. Other methods may
alternatively be used to access functions, depending upon
the number of available switches and the functions in



1 any particular implementation.

The flags may be divided into two categories, internal and external. The operation of the flags of the external class of functions has been described above. The functions themselves may consist of data in, data out, reset, preset, count up, count down, add, subtract, multiply, divide. The internal flags are "overflow/underflow" and "battery low". The battery low flag is driven by a precision micro-power voltage comparator, and is activated whenever the voltage of the battery drops below a preset level.

Referring back to Fig.3, this shows two optional units which may be associated with the counting instrument. The first of these is a memory unit 44 which is connected both to the switch debounce and control logic circuit 40 and to the counter 36. The memory unit 44 consists of a number of individually accessible memories which can be used to store and recover numbers separately and independently of the current displayed count, and with the means to store or modify the current displayed count if required.

The other optional unit is an external tote display 46 which is connected to the counter 36 by an appropriate connecting means 48. A counting instrument in accordance with the invention which is convenient to be held in the hand will necessarily have a display of limited size and resolution. The external tote display 46 provides a facility whereby a dedicated or computer-driven device external to the counter instrument can communicate with the counting instrument using a temporary connection to effect data transfer by direct or indirect means. Electrical or electro-magnetic signals guided by wire or fibre-optic cable are examples of direct connection. Indirect connection by some form of radiated energy has

1 the advantage of not requiring a physical link between
the devices. The use of the external tote display
means that a larger display of the current count and of
any stored counts may be obtained. Where the external
5 tote device is computer driven and forms a part of
an information retrieval or processing system to which
the count is ultimately to be directed, data transfer
can be direct and human error further reduced.

Referring again to Figs. 1 and 2, it will be
10 appreciated that the barrel assembly 10 can be a
modification of the type of barrel currently used in
retractable ballpoint or cartridge ink pens. The
cartridge is moved to and from a position where the
nib is retracted by a twisting or reciprocating action
15 of the head assembly against a connecting sleeve on the
barrel. If the cartridge and tip 14 are arranged to
float against a return spring connected to the barrel,
then the top of the cartridge can be used to actuate
switch contacts. In order to convey electrical signals
20 between the barrel and the head assembly, a metal pen
shell could be used, together with a pressure contact
set into and electrically insulated from a cartridge
retaining plug screwed into the top of the barrel. The
use of a simple switch for the sensor has two advantages.
25 A positive "click" action would replace the output
transducer except for warning indications, and input
processing would be simplified to switch debounce only,
this being entirely digital and having a low power
requirement. In practice, one could provide a range of
different sensor tips connectable to and detachable from
a common counter module located within the head assembly,
in order to suit particular applications.

Where the instrument tip 14 is a stylus, it may
have the ability also to leave a mark on any element
35 to be counted simultaneously with and as an integral part



1 of the action by the operator to effect the counting
of that element.

5 The integrated circuits and components within the
head assembly are mounted on a circuit board. CMOS
integrated circuits are preferred.

Although the counting instrument described herein
has been referred to and illustrated as embodied within
what would be thought of as a pen or pencil, it should
be clearly understood that the counting instrument can
10 be made in any desired form or configuration within the
scope of the present invention. The configuration of
functions, the means to access those functions, and the
configuration of the instrument itself may take any
desired form, as determined by any particular application.

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1 CLAIMS:

1. A counting instrument comprising counting means; display means to indicate the count state; sensor means arranged to generate or modify an electrical signal to be
5 supplied to the counting means in response solely to movement of the instrument by an operator to identify individual elements to be counted; and an output transducer arranged to provide an output indication, additional to
10 the display, in response to the identification by the operator of each element and/or of a predetermined number of such elements; the display means, the counting means, the sensor means and the output transducer being mounted within or assembled as part of an elongate housing having the sensor means at one end thereof.

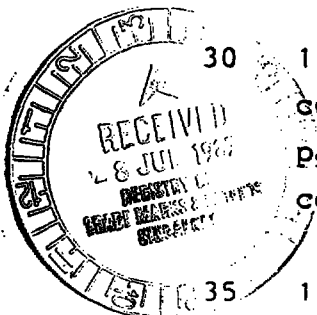
15 2. A counting instrument according to claim 1, in which the housing comprises a two-part assembly, one part carrying said counting means and said display means and the other part carrying the sensor means and being detachable from said one part.

20 3. A counting instrument according to claim 1 or 2, in which the sensor means comprises an input transducer arranged to generate an electrical pulse in response to each identification by the operator of an element to be counted.

25 4. A counting instrument according to any preceding claim, in which the sensor means provides signals to the counting means by direct mechanical, electrical, pneumatic or chemical energy transfer.

30 5. A counting instrument according to any of claims 1 to 3, in which the sensor means provides signals to the counting means indirectly by inducing a change in a parameter of the instrument each time an element to be counted is identified by the operator.

35 6. A counting instrument according to any of claims 1 to 3, in which the sensor means comprises a stylus and





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1 switch means actuated by pressure on the stylus.

7. A counting instrument according to any of claims
1 to 3, in which the sensor means comprises a piezoelectric
transducer.

5 8. A counting instrument according to any preceding
claim, in which the output transducer provides an acoustic
output signal.

9. A counting instrument according to any preceding
claim, which includes means simultaneously to mark each
counted element as it is identified by the operator as an
10 element to be counted.

10. A counting instrument according to any preceding
claim, which includes means to connect the instrument to
an external tote display and/or information processing
system for the transfer of information to and/or from the
15 counting instrument.

11. A counting instrument according to any preceding
claim, in which the display means comprises a liquid
crystal display indicating both the count state and any
particular operating mode of the instrument.

20 12. A counting instrument substantially as hereinbefore
described with reference to the accompanying drawings.

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