United States Patent [19]

Kirby

[11] **3,789,194**

[45] **Jan. 29, 1974**

[54] **RELATING TO COUNTING MACHINES**

[75] Inventor: **John Kirby,** Manchester, England

[73] Assignee: **Kirby Lester Electronics Limited,** Oldham, Lancashire, England

[22] Filed: **Sept. 8, 1971**

[21] Appl. No.: **178,571**

[30] **Foreign Application Priority Data**

Sept. 8, 1970 Great Britain 42867/70

[52] **U.S. Cl.** ..... **235/92 PK,** 235/92 R, 235/92 V, 235/98 C

[51] **Int. Cl.** **G06m 1/272**

[58] **Field of Search** 235/92 V, 92 PC, 92 PK, 98 C; 193/2 R

[56] **References Cited**

UNITED STATES PATENTS

2,632,588 3/1953 Hoar ..... 235/92 PE

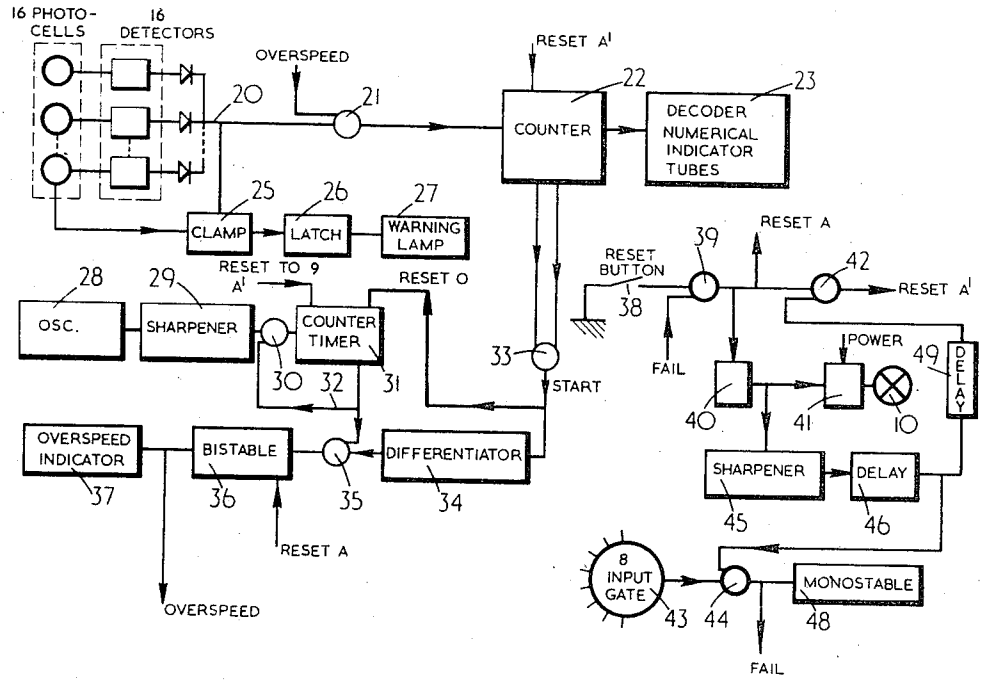
1,047,316 12/1912 Sicka ..... 193/2 R

Primary Examiner—Paul J. Henon
Assistant Examiner—Robert F. Gnuse
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

A machine for counting articles, comprising means for dispersing a flow of articles to be counted into separate streams, means for providing a substantially even flow of articles to the dispersing means, a detector associated with each stream for detecting each article in that stream and counting means fed by the outputs from all detectors for counting the total number of articles in all the stream.

9 Claims, 7 Drawing Figures



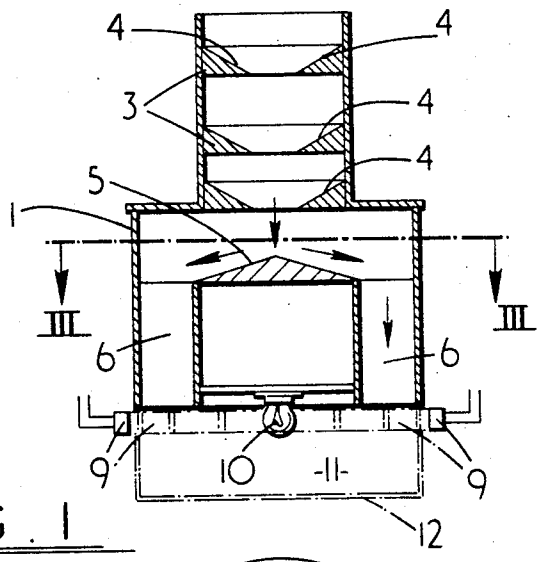


FIG. 1

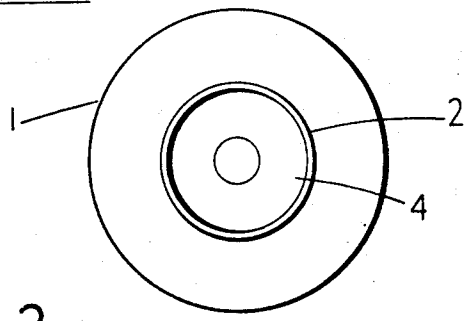


FIG. 2

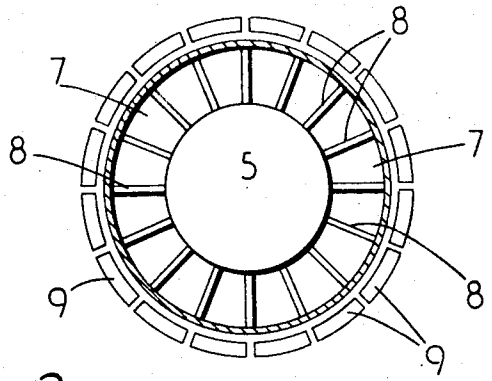


FIG. 3

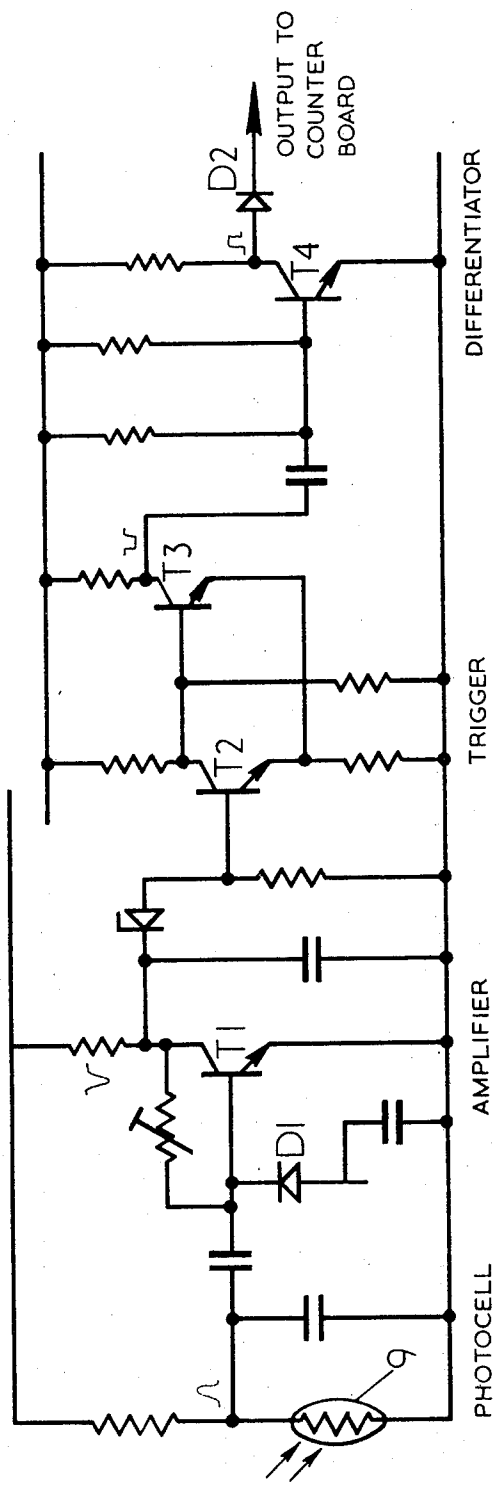

OUTPUT TO COUNTER BOARD
D2
T4
DIFFERENTIATOR
T3
T2
TRIGGER
T1
D1
AMPLIFIER
PHOTOCELL

FIG. 4

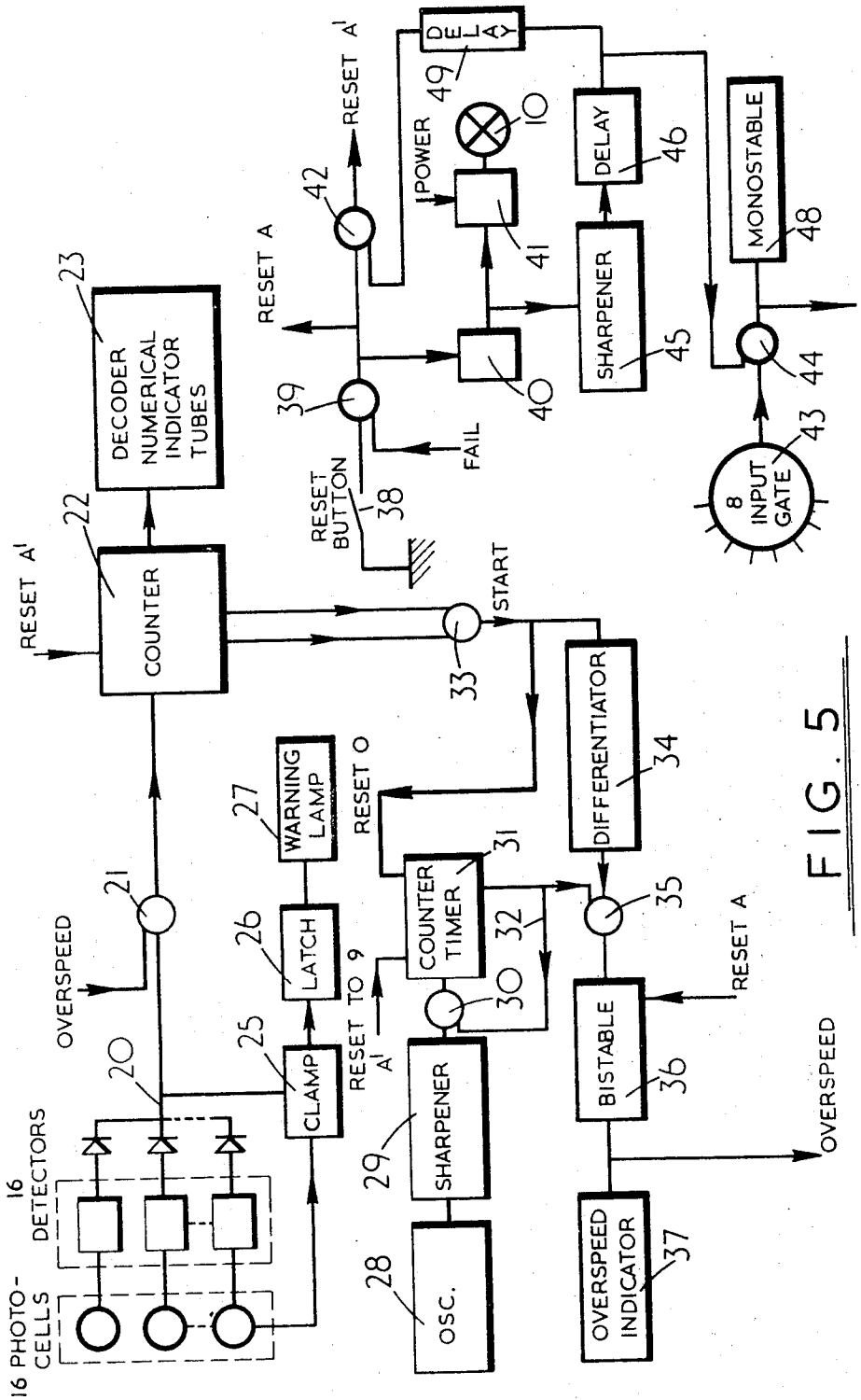

16 PHOTO-CELLS
16 DETECTORS
OVERSPEED
20
21
22
23
DECODER NUMERICAL INDICATOR TUBES
COUNTER
RESET A'
25
CLAMP
26
LATCH
27
WARNING LAMP
RESET TO 9
A'
28
OSC.
29
SHARPENER
30
COUNTER TIMER
31
32
RESET 0
33
START
34
DIFFERENTIATOR
35
BISTABLE
36
RESET A
OVERSPEED
OVERSPEED INDICATOR
37
RESET BUTTON
38
39
FAIL
RESET A
40
41
42
RESET A'
POWER
49
DELAY
10
46
SHARPENER
45
MONOSTABLE
48
FAIL
44
8 INPUT GATE
43

FIG. 5

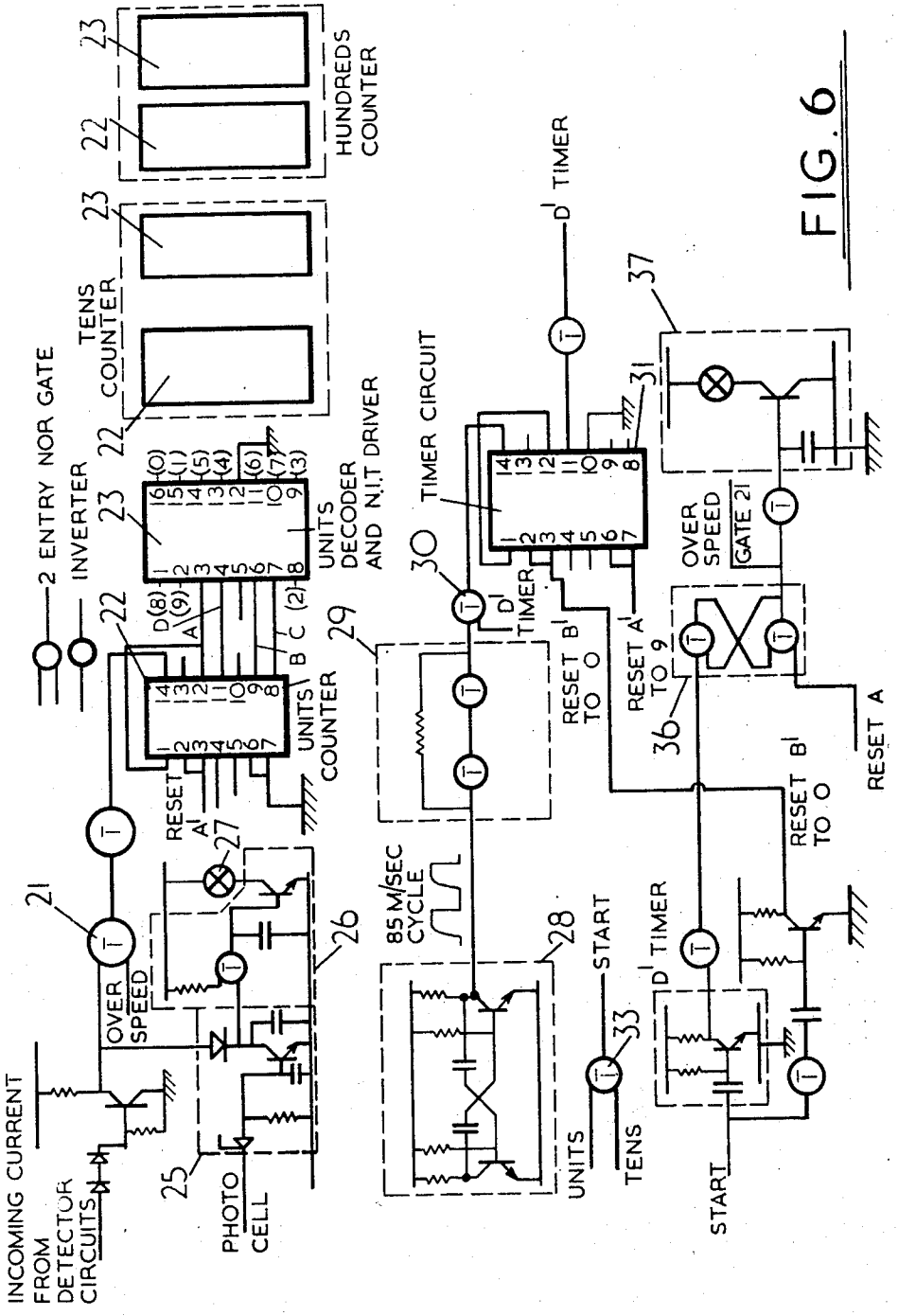

INCOMING CURRENT FROM DETECTOR CIRCUITS
PHOTO CELL
OVER SPEED
RESET A'
UNITS COUNTER
UNITS DECODER AND N.I.T DRIVER
2 ENTRY NOR GATE
INVERTER
TENS COUNTER
HUNDREDS COUNTER
85 M/SEC CYCLE
TIMER CIRCUIT
D' TIMER
RESET B' TO 0
RESET A' TO 9
GATE 21
START
UNITS
TENS
RESET A
RESET B'
21
22
23
25
26
27
28
29
30
31
33
36
37

FIG. 6

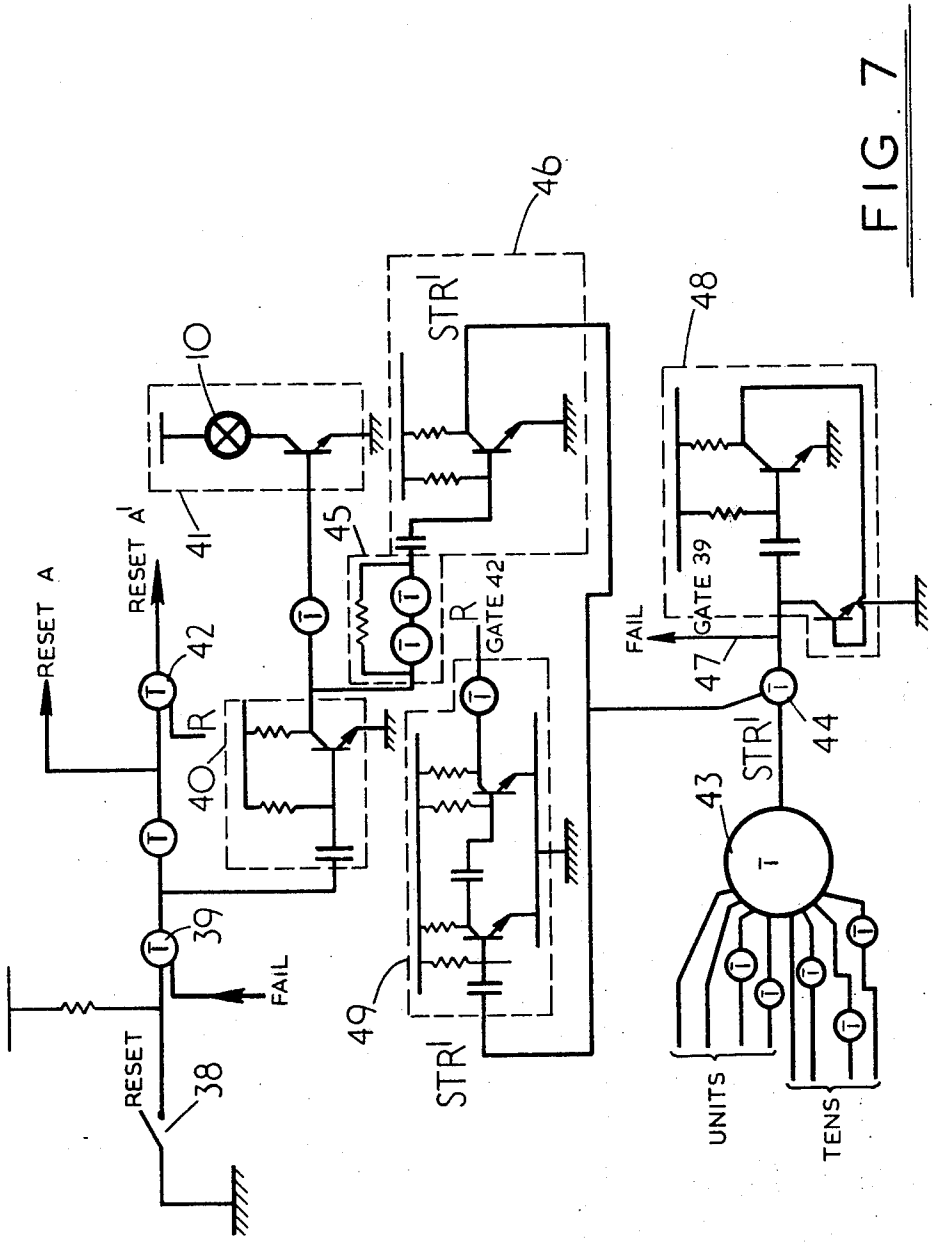

RESET A
RESET A'
RESET
FAIL
FAIL
GATE 42
GATE 39
STR'
STR'
STR'
UNITS
TENS
R
R
10
38
39
40
41
42
43
44
45
46
47
48
49

FIG 7

RELATING TO COUNTING MACHINES

This invention relates to machines for counting articles, for example tablets, pills or capsules.

According to the present invention, there is provided a machine for counting articles, comprising means for dispersing a flow of articles to be counted into separate streams, means for providing a substantially even flow of articles to the dispersing means, a detector associated with each stream for detecting each article in that stream, and counting means fed by the outputs from all detectors for counting the total number of articles in all the streams.

Preferably, a warning system is provided for issuing a warning when the accurate working throughput of the machine is exceeded.

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

FIG. 1 is a vertical section through the mechanical part of the machine,

FIG. 2 is a plan view of the machine shown in FIG. 1,

FIG. 3 is a horizontal section taken at III—III of FIG. 1,

FIG. 4 is a circuit diagram of a photocell and detector circuit,

FIG. 5 is a block schematic diagram of the counter, dust level detector, overspeed warning and self-checking arrangements,

FIG. 6 shows detail circuitry of the counter, dust level detector and overspeed warning arrangements, and

FIG. 7 shows detail circuitry of the self checking arrangement.

The machine shown in FIG. 1, 2 and 3 for counting tablets, pills or capsules comprises a vertically disposed, cylindrical casing 1 of circular cross-section and a vertically disposed, cylindrical inlet passage 2, also of circular cross-section, mounted coaxially on top of the casing.

A series of spaced annuli 3 are secured to the internal wall of the passage and have upper surfaces 4 which taper downwardly and inwardly.

Mounted coaxially in the casing 1 vertically below the annuli 3 is a dispersing cone 5. An annular passage 6 is defined between the periphery of the base of the cone 5 and the internal wall of the casing 1 and is divided into open-bottomed compartments 7 by a series of radial partitions 8.

A photocell 9 is mounted just below the bottom of each compartment 7 adjacent the wall of the casing 1 and a single light source 10 for all the photocells 9 is mounted on the axis of the casing 1 in substantially the same horizontal plane as the photocells 9. The light source is powered by a smoothed D. C. supply.

A collecting chamber 11 and drawer 12 are provided at the bottom of the machine.

In use, tablets to be counted enter the top of the inlet passage 2 and fall downwardly into the casing 1. The tapered annuli 3 in the inlet passage 2 serve to break up any bunched group of tablets to provide an even flow of tablets and also to concentrate the flow of tablets along vertical axis of the casing 1. The tablets enter the casing 1 and strike the cone 5 at or adjacent its apex to be dispersed outwardly into the compartments 7 around the outside of the cone 5. The tablets fall through the compartments 7, are detected by the photocells 9 and finally pass into the collecting chamber 11 and drawer 12.

Referring to FIG. 4, each photocell 9 is included in a separate detecting circuit which also includes an amplifying circuit (based on transistor T_1) which amplifies the photocell output, a trigger circuit (based on transistors T_2 and T_3) which triggers with each falling ball of current caused by modulation of the light on the photocell, resulting from the passage of a tablet, and a differentiating circuit (based on transistor T_4) which differentiates each trigger pulse to provide a short duration impulse (approximately 2 microseconds). These impulses are fed via a diode D2 and in parallel with impulses from the other detecting circuits to a suitably fast counting circuit shown in FIG. 5. The output of the counting circuit feeds circuits for numeral indicator tubes which digitally display the number of tablets counted.

Referring now to FIG. 5, the outputs of the sixteen detector circuits pass through respective diodes to line 20, through a NOR gate 21 to the counter 22. The output of counter 22 is fed to a decoder and drive unit 23 for displaying the count on numerical indicator tubes.

The machine is intended to be cleaned regularly to avoid the photoelectric ells and the lamp from becoming obscured by dust from, for example, uncoated tablets. To prevent the machine from operating when the photocells and/or lamp are obscured by dust the output of one of the photocells is taken on line 24 to a clamp circuit 25. In clamp circuit 25, as will be apparent from FIG. 6, there is a voltage reference didode in series with the photocell output voltage. When the voltage of the cell rises above the reference voltage current is passed to the base of transistor T_5 so that this transistor becomes conductive and clamps line 20 so that the impulses from the counting circuits are unable to reach the counter. Thus, when the dust level exceeds a predetermined value the counter is inhibited. At the same time a signal is passed from clamp 25 to a latch 26 which becomes conductive and operates a warning lamp 27 to give warning that counting has stopped as a result of a high dust level.

A warning circuit is also provided which indicates if a predetermined count rate representing the maximum accurate working throughput of the machine, is exceeded. The warning circuit comprises an oscillator 28, the output of which passes through a pulse sharpener 29 and a gate 30 to a counter timer 31. When the counted pulses from the oscillator reaches a predetermined count an output is provided on line 32 to a second input of the gate 30 and thus the further count of pulses is inhibited. By this means, a time interval is provided with corresponds to a predetermined count of oscillator pulses. The warning circuit also comprises a gate 33 which takes inputs from the units and tens counters of counter 22 and provides an output at certain counts (e.g. 18, 38, 58, 78 and 98). Each output of gate 33 provides a start signal which resets counter timer 31 to zero so that a counting interval can commence. The start signal also passes to a differentiator 34 so that sharp pulses are provided at the input of a gate 35. Gate 35 has a second input which receives a pulse from counter timer 31 corresponding with the end of the timed period. If the timing period had not expired before the start signal at the output of gate 33 reoccurs (due to excessive speed of count) then gate 35

provides an output which trips a bistable circuit 36, thus providing a signal which activates an overspeed indicator 37 and which also passes to gate 21 and thereby inhibits the further counting of tablets. Provided that the timed period expires before the occurrence of the next start signal from gate 33 no overspeed indication is given and the gate 21 is not inhibited.

The apparatus has sixteen separate photocells and detecting circuits and it is important that the apparatus should be rendered inoperative if any one or more of the detecting circuits becomes faulty. A self checking circuit is therefore provided by making the machine check itself every time the reset button 38 is pressed and released. On release of button 38 the gate 39 provides an output which is fed into the circuit 40 which produces a pulse of about 8 milliseconds duration. This pulse is fed to a transistor switch 41 which reduces the power supplied to lamp 10 so that a count of sixteen should be produced in counter 22, i.e. a count from each photocell, the counter 22 having already been set to zero by the output of gate 39 passing to gate 42 to given an output at reset A'. Bistable circuit 36 is also reset by the output of gate 39.

A gate 43 having eight inputs is connected to the counter so that a count of 16 there is a signal on each of the eight inputs. When the count of sixteen is present a charge of output is fed to a gate 44. At the end of the lamp dipping pulse from the circuit 40, a pulse is produced by pulse sharpener 45 which after being delayed in delay circuit 46 provides a strobe pulse STR'. This strobe pulse is passed to gate 44 and if the count of 16 is not indicated on the other input of gate 44 then an output is provided on line 47 showing that the self-checking has failed. Monostable circuit 48 provides that the fail signal is given a predetermined duration. This fail signal is passed to a second input of gate 39 so that gate 39 gives an output corresponding to that of pressing the reset button so that the rechecking operation is repeated until such times that a satisfactory count is obtained. If the right answer never comes, the machine will be found to be unusable by the operator because it will be totally occupied in this self-checking operation. When a satisfactory check is obtained the machine becomes usable and so that the tablet count should commence from zero the strobe pulse output of delay circuit 46 passes to a further delay circuit 49 before passing to gate 42 which causes a reset pulse on reset A', thus reseting the counter to zero.

FIGS. 5 and 6 show detail of the circuitry in the various blocks of FIG. 5, the various sections of the circuit being identified by similar reference numerals.

What is claimed is:

1. A machine for counting small, discrete articles, comprising a cone having a vertical axis with its apex upwardly directed for dispersing a flow of articles to be counted into separate falling streams, said streams being divided by vertical partitions radially arranged in an annular space around the base of the cone, means for feeding a substantially even flow of articles to the dispersing means comprising a plurality of spaced annuli having upper surfaces which taper downwardly and inwardly, the annuli being arranged one above another and all above the cone on an axis substantially coinciding with the axis of the cone, a plurality of detectors individually associated with each stream for detecting each article in each falling stream, and counting means fed by the outputs from all of the detectors for counting the total number of articles in all of the streams.

2. A machine as claimed in claim 1, wherein the detecting means for each stream includes a photocell, the photocells being arranged on a circle about a central illuminating lamp so that articles passing down each stream interrupt the path of light from the lamp to the respective photocell.

3. A machine for counting small, discrete articles, comprising a cone having a vertical axis with its apex upwardly directed for dispersing a flow of articles to be counted into separate falling streams, means for feeding a substantialy even flow of articles to the dispersing means, a plurality of detectors individually associated with each stream for detecting each article in each falling stream, counting means fed by the outputs from all of the detectors for counting the total number of articles in all of the streams, means responsive to said counting for determining the article counting rate, and a warning system responsive to said means for determining for issuing a warning when a predetermined article counting rate of the machine is exceeded.

4. A machine as claimed in claim 3, wherein the warning system also inhibits the continued counting of the machine when the predetermined throughput is exceeded and until the machine is reset.

5. A machine as claimed in claim 3, wherein a signal is produced at predetermined counts of equal intervals, timer means being provided to establish predetermined intervals of time, and means for providing a warning signal when an interval of count takes place within an interval of time.

6. A machine as claimed in claim 5, wherein the timer means comprises a pulse generator and a counter which counts the pulses to a predetermined number to establish the predetermined interval of time.

7. A machine as claimed in claim 3, wherein the satisfactory operation of all the article detectors is obtained by simulating the passing of an article at each detector and recording that the total count of the counting means corresponds with the number of detectors.

8. A machine as claimed in claim 7 wherein the detecting means for each stream includes a photocell, the photocells being arranged on a circle about a central illuminating lamp so that articles passing down each stream interrupt the path of light from the lamp to the respective photocell, and wherein the simulation is provided by dimming the lamp once.

9. A machine as claimed in claim 7, wherein the counter is set to zero after each simulation and count and if an unsatisfactory count is obtained re-simulation takes place until a satisfactory count is obtained, thereby preventing the machine from being used if failure of one or more of the detectors has occurred.

* * * * *