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(54) **COUNTER**

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(57) **ABSTRACT**

Power train for amphibious vehicle comprises engine aligned with longitudinal vehicle axis, transmission, and power take off mounted between engine and transmission. At least one marine propulsion unit mounted at the rear of the vehicle, is driven by shaft which runs alongside the transmission. Either transmission is offset to axis, and marine propulsion unit is on axis; or transmission is on axis, and the marine propulsion units are offset to axis. The driven road wheels may be the front wheels, the rear wheels, or all four. The engine may be at the front of the vehicle and the transmission at the back. Alternatively, the transmission may drive forward to a differential mounted adjacent to the engine sump, with wheel drive shaft passing through said pump.

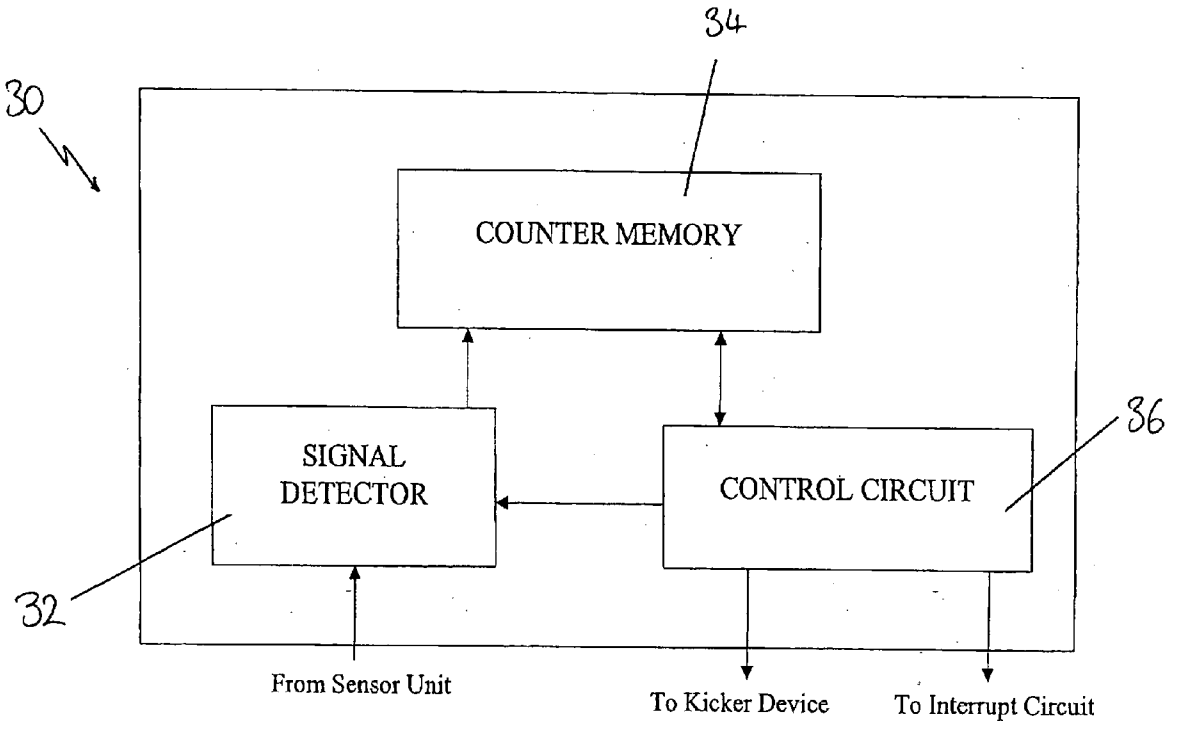


Figure 1

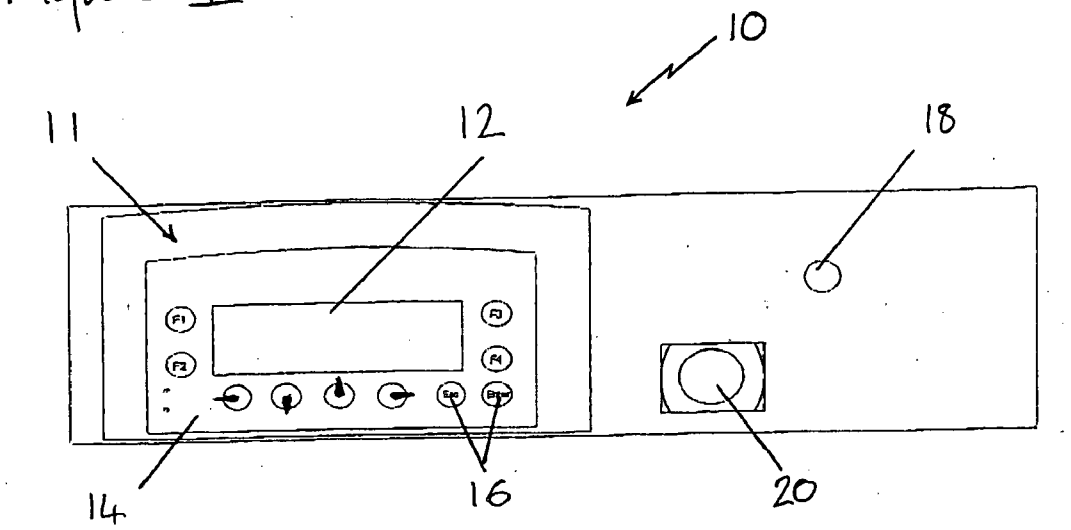
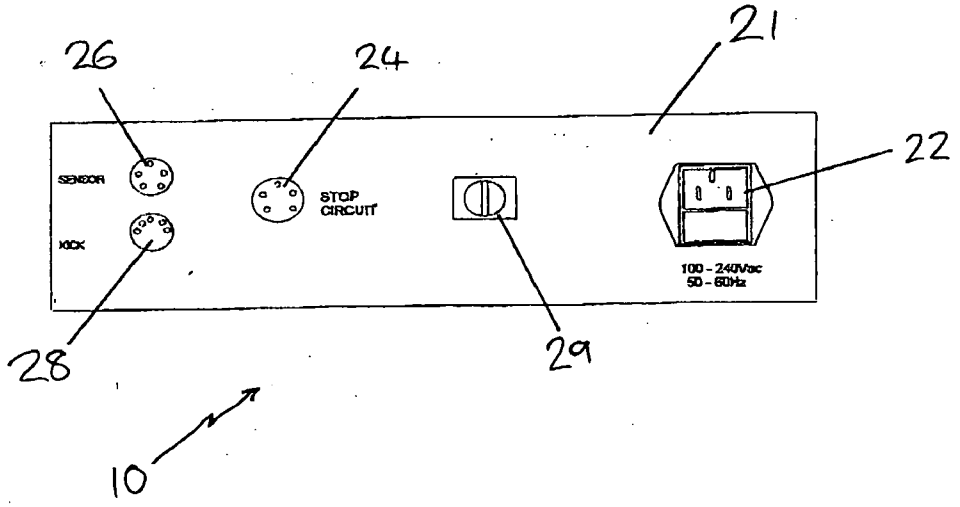


Figure 2



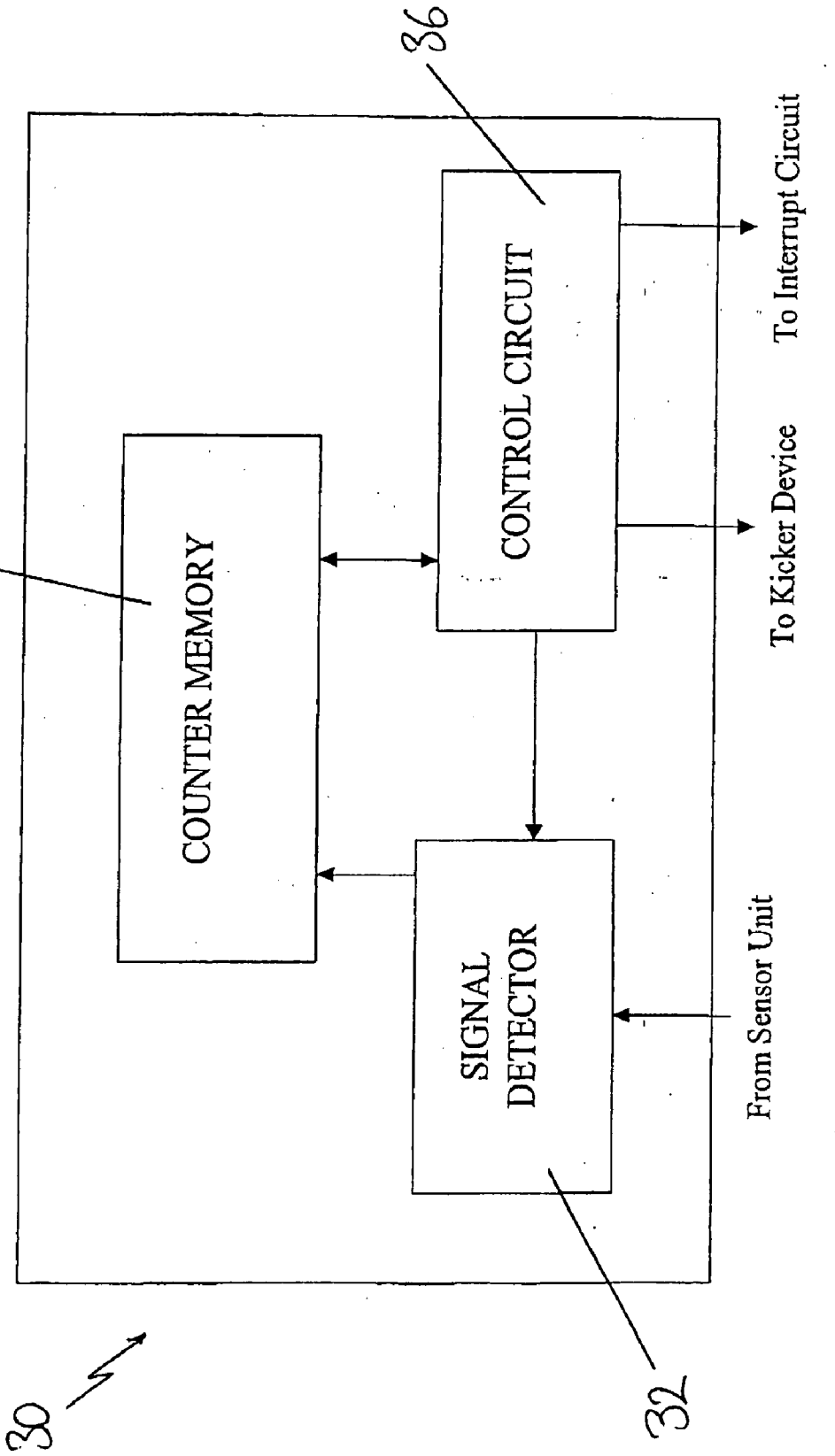

30
32
34
36
COUNTER MEMORY
CONTROL CIRCUIT
SIGNAL DETECTOR
To Interrupt Circuit
To Kicker Device
From Sensor Unit

Figure 3

Figure 4

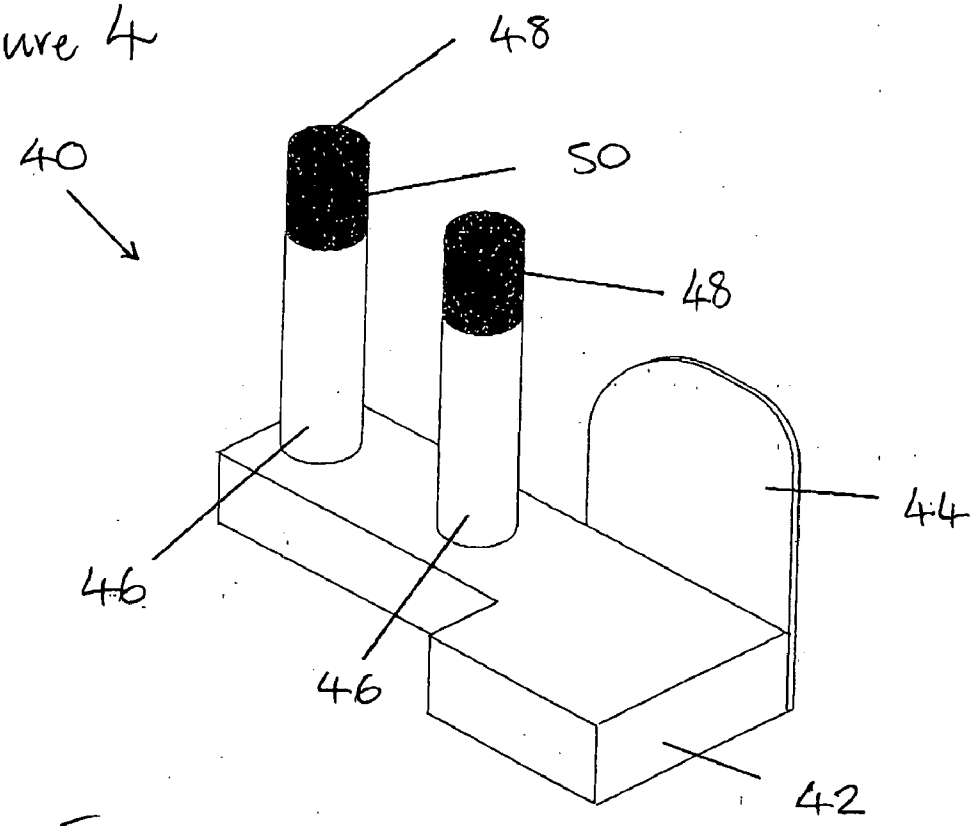


Figure 5

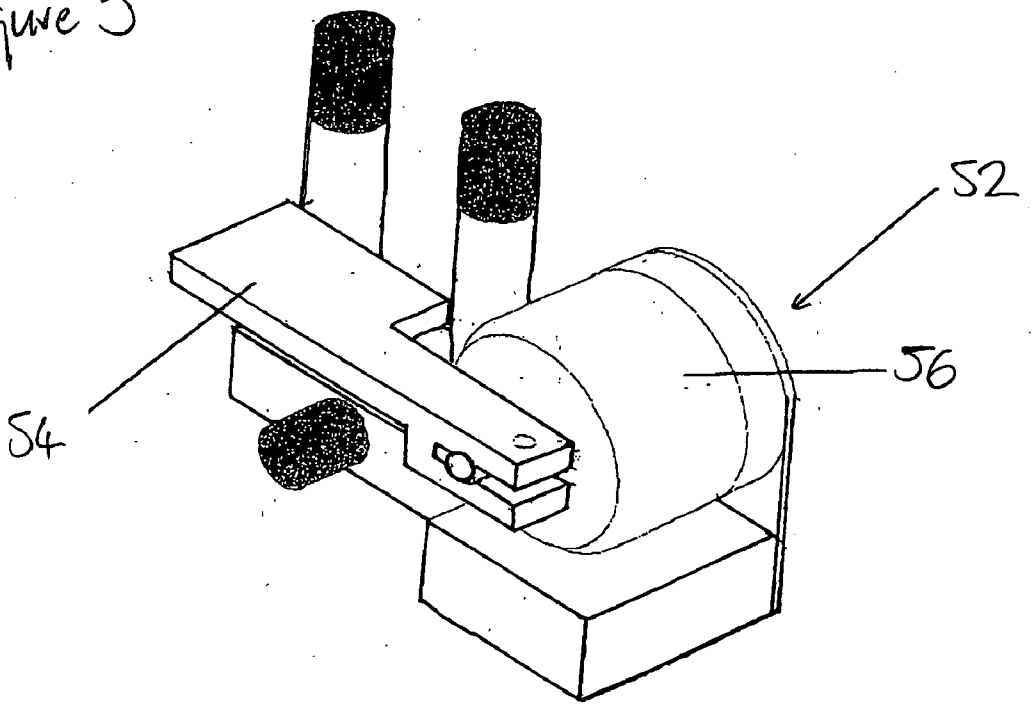
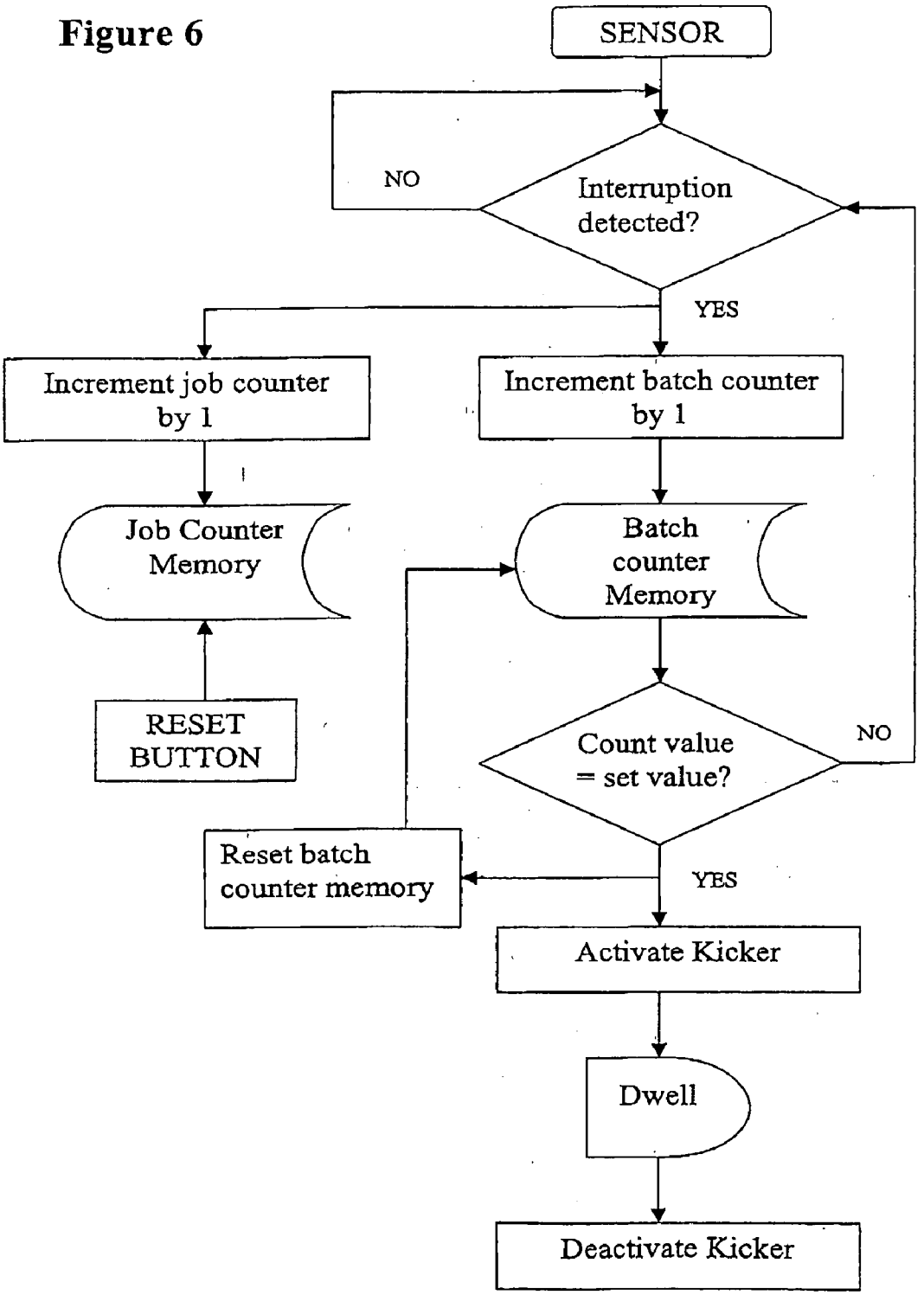


Figure 6


SENSOR
NO
Interruption detected?
YES
Increment job counter by 1
Increment batch counter by 1
Job Counter Memory
Batch counter Memory
RESET BUTTON
Count value = set value?
NO
Reset batch counter memory
YES
Activate Kicker
Dwell
Deactivate Kicker

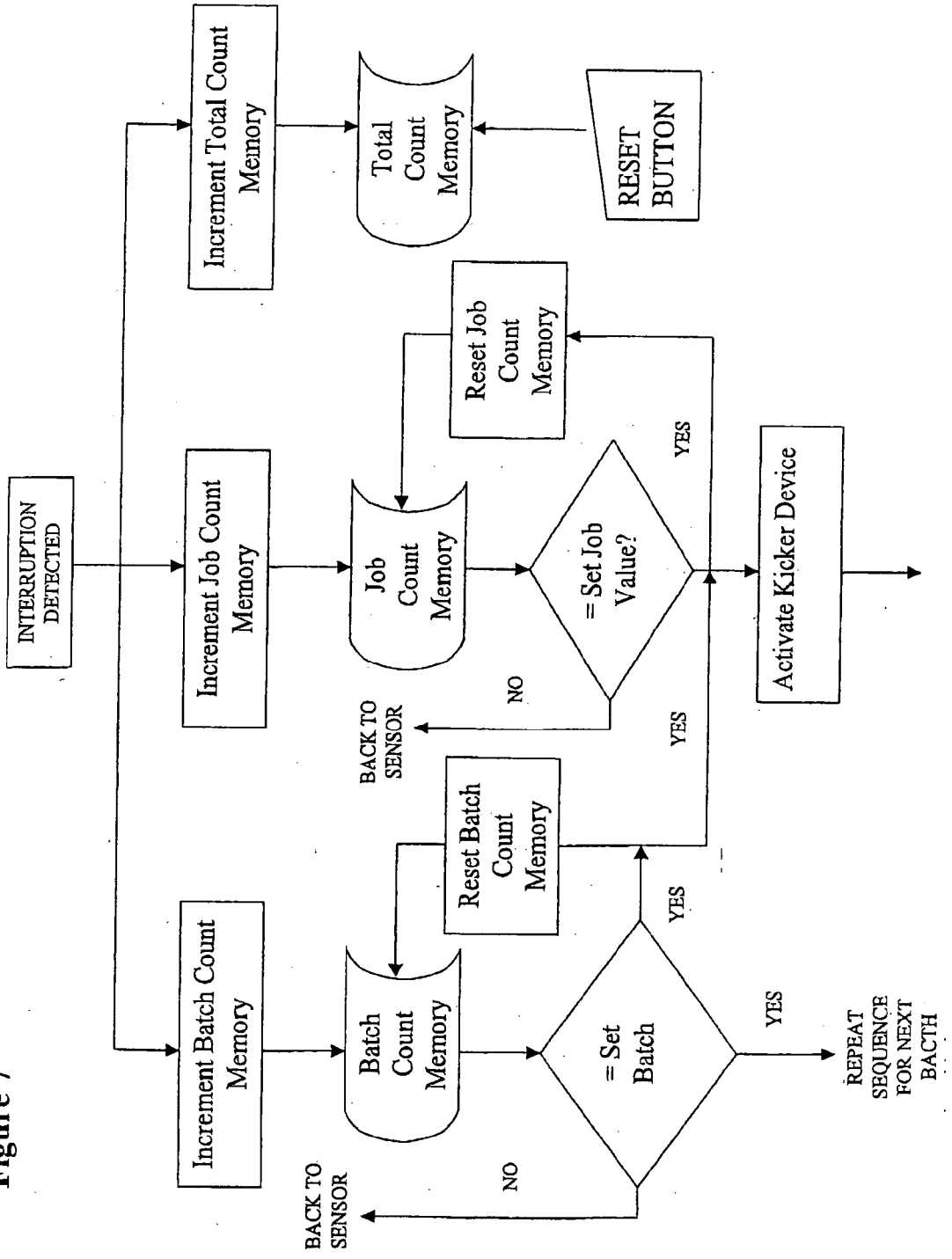

INTERRUPTION DETECTED
Increment Total Count Memory
Total Count Memory
RESET BUTTON
Increment Job Count Memory
Job Count Memory
Reset Job Count Memory
= Set Job Value?
YES
NO
BACK TO SENSOR
Activate Kicker Device
Increment Batch Count Memory
Batch Count Memory
Reset Batch Count Memory
= Set Batch
YES
NO
BACK TO SENSOR
REPEAT SEQUENCE FOR NEXT BACTH

Figure 7

COUNTER

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a counter, more particularly to an electronic batch counter for use on paper feed devices, such as paper finishing machines.

[0002] It is common for a feed device, such as a paper folding or paper finishing machine, to be provided with a counter for counting product passing through the feed device, for example at the discharge or output stage of processing.

[0003] Conventional counters operate using a mechanical counting device configured for detecting and recording the passage of product being processed. In addition, the mechanical counter will typically include or operate in conjunction with a means for identifying when a desired quantity or 'batch' of product has been counted.

[0004] For example, it is known to incorporate a mechanical device, often referred to as a knocker or kicker, for identifying individual batches of processed product. The knocker or kicker is usually arranged adjacent the process pathway of the product passing through the feed device, and is adapted for offsetting the position of a counted product 'n' as it passes through the feed device, wherein product 'n' represents the last product in a desired batch quantity, e.g. every 50^{th} product. The use of a knocker or kicker enables individual batches of processed product to be visually identified.

[0005] As an alternative to mechanical kickers, it is also known to use electronic means such as an electronic interrupt circuit, to operate as part of or in conjunction with the counter. An interrupt circuit is typically programmed to interrupt the feed of product being counted after the passage of a pre-determined batch quantity, for example after every 50^{th} product. The interruption creates a gap between each batch quantity, which enables individual batches to be easily identified.

SUMMARY OF THE INVENTION

[0006] It is an object of the invention to provide an improved counter for a paper feed device.

[0007] According to the broadest aspect of the invention, there is provided a counter for a paper feed device, for counting product being processed by the paper feed device, the counter comprising electronic counter means for accumulating count data indicative of the number of items of processed product, in which the counter means operates to record an incremental count value in response to signals transmitted to counter means via sensor means, each signal being indicative of product detected by the sensor means, and in which the counter includes control means adapted to indicate when a desired batch quantity of product has been counted.

[0008] Conveniently, the control means is adapted to produce an interrupt signal when a desired batch quantity has been counted.

[0009] Preferably, the counter includes interrupt means for interrupting the passage of product to be counted after a predetermined batch quantity has been counted.

[0010] In a preferred embodiment, the interrupt means is in the form of a solenoid activated device comprising a member movable to prevent the passage of product to be counted. The interrupt means may comprise a swing arm adapted to be moved between an operative position in which the passage of product to be counted is prevented, and an inoperative position in which product is free to pass beyond the interrupt means.

[0011] Alternatively, the interrupt means is in the form of an electrical interrupt circuit, adapted to selectively interrupt the processing of product to be counted.

[0012] Preferably, the counter includes sensor means for detecting the passage of product to be counted.

[0013] In a preferred embodiment, the counter includes sensor means, which includes two sensor heads arranged for passage of product to be counted therebetween, and wherein a count signal is generated every time a product to be counted passes between the sensor heads.

[0014] Conveniently, the interrupt means and the sensor means comprise a single unit.

[0015] In a preferred embodiment, the control means includes a variable count mode, adapted to enable a first predetermined number of selected batch values to be counted, followed by at least a second predetermined number of selected batch values to be counted.

[0016] The invention provides an improved alternative to conventional counter for paper feed devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

[0018] **FIG. 1** is a schematic view of the front of a counter unit for use in a preferred embodiment of the invention;

[0019] **FIG. 2** is a schematic view of the rear of the counter unit shown in **FIG. 1**;

[0020] **FIG. 3** is a diagrammatic view of the control and counter circuitry of the unit shown in **FIG. 1**;

[0021] **FIG. 4** is a schematic perspective view of a sensor unit for use with the unit shown in **FIG. 1**;

[0022] **FIG. 5** is a schematic perspective view of a kicker device mounted on the sensor unit shown in **FIG. 4**;

[0023] **FIG. 6** is a flow diagram showing a normal running mode of an embodiment of the invention; and

[0024] **FIG. 7** is a flow diagram showing part of a modified running mode of an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] Referring firstly to FIGS. **1** to **3**, an electronic counter unit is indicated generally at **10**, which forms part of a batch counter according to an embodiment of the invention for use with a paper or sheet feed device, such as a paper finishing machine or a paper folding machine.

[0026] As can be seen in **FIG. 1**, the front **11** of the counter unit **10** includes an LCD portion **12** for displaying operative

details of the batch counter. The front of the unit **10** also includes an operator interface **14** having function buttons **16**, which enables an operator to manually select or programme a mode of operation of the batch counter, as will be described in more detail below. A light **18** is provided in the front of the unit **10**, which illuminates during the counting operation of the unit **10** (described below). Further, a reset button **20** is included for resetting the mode of operation of the unit **10** and the display details on the LCD portion **12**, as will be described below.

[**0027**] Turning to **FIG. 2**, a plurality of sockets are provided in the rear of the counter unit **10**. The sockets include a power socket **22** for connection to a mains power source, and auxiliary ports **24**, **26** and **28**. Auxiliary port **24** is provided for connecting the counter unit **10** to a conventional electronic interrupt circuit for interrupting the operation of a paper feed device, such as a paper finishing machine or a paper folding machine. Auxiliary port **26** is provided for connecting the counter unit **10** to a sensor unit, such as that described below with reference to **FIG. 4** and auxiliary port **28** is provided for connecting the counter unit **10** to a mechanical kicker device, such as that described below with reference to **FIG. 5**.

[**0028**] The rear **21** of the counter unit **10** also includes a switch **29**, which is used to select the means of operation of the counter unit **10**, e.g. for indicating which auxiliary port the unit is configured to, operate in conjunction with for a given feed device or feeding processing job.

[**0029**] The counter unit **10** houses electronic controller and counter circuitry, indicated at **30** in **FIG. 3**. The circuitry **30** includes a signal detector portion **32** adapted to communicate with port **26** for detecting signals from a sensor unit. The circuitry **30** also includes a memory portion **34** for storing incremental count data from the signal detector. The memory portion **34** includes a batch count memory portion, a job count memory portion, a total count memory portion and a life memory portion, all of which will be described in more detail below.

[**0030**] A controller circuit **36** is provided in communication with memory portion **34**. The controller **36** is programmable via the operator interface **14**, for setting the mode of operation of the unit **10** and for activating the interrupt means selects via auxiliary ports **24**, **26** or **28**. Operation of the circuitry **30** is described in more detail below with reference to **FIG. 6** and **FIG. 7**.

[**0031**] Referring now to **FIG. 4**, a senor unit for use with the counter **10** is indicated at **40**. The sensor unit **40** includes a base plate **42** for securing the sensor unit **40** at a desired position on a paper feeding machine. Typically, the sensor unit **40** will be bolted or clamped at a desired position on a paper feed device, for example at the output end of the feed device. The sensor unit **40** also includes a side panel **44** for mounting a kicker device, such as the device described in more detail below with reference to **FIG. 5**.

[**0032**] The sensor unit **40** includes a pair of columns **46** extending from the base portion **42** at a predetermined spacing from one another. The columns **46** are arranged for enabling product to be counted between the columns **46**.

[**0033**] Each column **46** includes a sensor head **48** containing motion sensor means, one of which is indicated at **50** in **FIG. 4**. In this embodiment, the motion sensor means **50** are in the form of a light source mounted in a first sensor head **48** and a light sensor mounted in the other column **48**. The motion sensor means **50** generate a signal if the communication pathway between the sensor means **50** is interrupted, for example if a product to be counted physically blocks the communication pathway between the light source and light sensor. The signal is then detected by the counter unit **10**, as described in more detail below.

[**0034**] Turning now **FIG. 5**, a solenoid kicker device, is indicated at **52**, for use with the counter unit **10**. As can be seen, the kicker device **52** is mounted on the side plate **44** of the sensor unit **40**. The kicker device **52** includes a pivoting arm **54** movable between an operative position, as shown in **FIG. 5** and an inoperative position (not shown), under the control of a solenoid **56**.

[**0035**] The solenoid **56** is configured to move the arm **54** to the operative position in response to a signal transmitted from the controller circuit of the counter unit **10**, as will be described below. In the operative position, the arm **54** extends across the distance between the columns **46** of the sensor unit **40**, thereby preventing the product passing through the sensor unit **40**, in use. In the inoperative position, the arm **54** extends substantially parallel with the columns **46** on the sensor unit **40**, so that product may pass between the columns **46**.

[**0036**] As described in more detail below, the counter unit **10** transmits the actuation signal when a pre-determined batch quantity is detected as having passed through the columns **46** of the sensor unit **40**. The kicker arm **54** is arranged to strike and thereby offset a product 'n' as it passes through the paper feed device, where product 'n' represents the last product in a desired batch quantity. This enables a specified batch quantity to be visually identified. The time interval between activating the arm to move to the operative position and returning the arm to the inoperative position is referred to as the interrupt or 'dwell' time, which is controlled by the controller circuit **36** and is set using the operator interface **14**.

[**0037**] An example of a typical use for the invention will now be described, in conjunction with the flow diagram for a normal running mode, shown in **FIG. 6**. In this example, the batch counter according to the invention is arranged for counting batches of leaflets passing through a paper finishing (folding) machine.

[**0038**] In this embodiment, the unit **10** is arranged to operate with the kicker device and **52** and the senor unit **40**. The kicker device **52** is mounted on the sensor unit **30** to form a single unit, which is mounted at the output end of the final stage of processing of the machine, for counting the finished leaflets as they are discharged.

[**0039**] The sensor unit is arranged to that the columns **46** are aligned in the process pathway of the leaflets such that the processed leaflets pass, in turn, between the sensor heads **48** on the columns **46**. The sensor/kicker unit is also arranged with the kicker device **52** on the output side of the sensor unit **40**, with the kicker arm **54** stowed in its inoperative position.

[**0040**] Sensor unit **40** and kicker device **52** are connected to ports **26** and **28** respectively, via cables (not shown), and the switch **29** is set to indicate that the unit **10** is operating via both ports **26** and **28**. The desired program or mode of operation is set using the function buttons **17** on the operator interface **14**, which is indicated on the LCD portion **12**. In this example, the unit **10** is programmed to count a total job count of 1000 leaflets consisting of 10 batches of 100 leaflets. For each batch, a dwell or interrupt time of 0.5 seconds is used.

[0041] To start the program, the reset button **20** is pressed which zeros a batch count value shown on the LCD portion **12**. The counter unit **10** then communicates with the paper finishing machine to initiate the leaflet finishing process, causing a series of folded leaflets to be produced.

[0042] As each folded leaflet passes between the sensor heads **48**, it physically interrupts the communication pathway between the motion sensor means **50**. A signal is produced for each sequential interruption, which is instantaneously communicated to the base counter unit **10** via port **26**. For each signal, an increment of one is registered in both the total count memory and the batch count memory, representative of a finished leaflet being counted. The sequential increments are accumulated by the memories, and the count is transmitted to the control circuit **36** to be displayed on the LCD **12**. In addition, the light **18** on the front of the unit **10** is illuminated upon each detected interruption, and the throughput rate of the product being counted (e.g. sheets per hour) is indicated on the LCD **12**.

[0043] After each increment, the control circuit **36** checks whether the value in the batch count memory equals the set batch total, i.e. 100. If the incremental total is less than the set batch total, the process continues. If the incremental total is equal the set batch total, the controller circuit generates an instantaneous signal which is transmitted via port **28** to the kicker device **52**.

[0044] Accordingly, the solenoid **56** instantaneously actuates the kicker arm **54** to move to the operative position shown in **FIG. 5**, whereby the last leaflet in the first batch is struck by the arm **54** and is offset relative to the adjacent leaflets in the process pathway.

[0045] In the operative position, the kicker arm **54** extends across the process pathway and momentarily prevents further product passing beyond the kicker device **52**. In this position, the reset button **20** is illuminated to indicate that the kicker/pause function has been activated. Once the dwell period of 0.5 seconds has elapsed, the control circuit **36** acts to operate the solenoid **56** and deactivate the kicker arm **54** to return to its inoperative position.

[0046] At the time that the kicker device **52** is activated, the control circuit **36** resets the batch count memory and the accumulated batch count on the LCD **12**.

[0047] This cycle continue until the job count memory value reaches the set value of 100 leaflets, whereupon the unit **10** communicates with the feeding machine to halt processing.

[0048] This cycle is repeated until the job count memory value reaches the set value of 1000 leaflets, whereupon the unit **10** communicates with the finishing machine to halt processing. The counted product is easily identifiable as constituting ten distinct batches by the offset leaflets.

[0049] The life count memory runs alongside the batch count memory and job count memory, for keeping a lifetime total of increments recorded by the unit **10**. This enables periodic maintenance to be carried out after a given number of 'counts', for example 50 000 increments. In this embodiment, the control circuit **36** is programmed to display a message of the LCD portion **12** to call a maintenance engineer.

[0050] The unit **10** also includes a variable count mode, for example for use as a calibration tool for checking that circuitry **30** and/or the means of interrupt used with the unit **10** is functioning correctly. **FIG. 7** shows a flow diagram for a portion of this variable count mode and will be described by way of example with reference to a pre-programmed calibration test.

[0051] The calibration test is set to count a total number of 1000 leaflets, wherein the first 200 leaflets have a kick or batch indication per 50 leaflets with a dwell time of 0.5 seconds, the next 500 leaflets have a kick or batch indication per 100 leaflets with a dwell time of 0.5 seconds, and the last 300 leaflets having a kick or batch indication per 30 leaflets, with a dwell time of 0.5 seconds. That is to say, the calibration test consists of a set total count which is broken down into three individually set jobs, wherein each job includes its own batch value. The test is set with each job value having a set dwell period of 4 seconds.

[0052] In the variable count mode, the unit **10** utilises the batch count memory for activating the kicker device **52** when the programmed batch value is reached, a job count memory for activating the kicker device **52** and re-setting the batch value after completion of each 'job', and a total count memory for stopping the processing of the product being counted after the set total number of product has been counted, i.e. after all the jobs have been completed.

[0053] Once the variable count mode has been selected, the finishing machine begins processing leaflets. With each subsequent signal transmitted to the unit **10** from the sensor unit **40**, the three memories are each incremented by 1.

[0054] When the batch count total reaches 50, the kicker device is activated and then returned to the inoperative position after the 0.5 second dwell time period has elapsed. At the same time, the batch count memory is re-set to zero. This cycle is then repeated until the job count total reaches 200 at which point the kicker device **52** is activated for the 4 second dwell period. At the same time, the job count and batch count memories are re-set to zero

[0055] The control circuit **36** then changes the batch count set value to 100 and the job count set value to 500. The above cycle is then repeated, wherein a kick is activated for every 100 leaflets up to a total of 500 leaflets.

[0056] When the second job count total reaches 500, the control circuitry **36** then changes the batch count set value to 30 and the job count set value to 300, before repeating the above cycle.

[0057] The variable count mode can be programmed to alter batch sizes and job counts for any given number of cycles. It is also advantageous in that, where it has been found that a particular arrangement of different total of product batches can be optimally packaged, e.g. in a particular box, a particular string of batches or jobs can br programmed for efficient packaging of the product being processed and counted.

[0058] It will be appreciated that the unit **10** can operate in substantially the same manner as described above, with reference to both the normal running mode and the calibration or variable count mode, with a combination of suitable kicker/sensor/electronic interruption devices. If an electronic interruption device is used (via port **24**), the programmed dwell time will act to momentarily stop the processing of the product being counted, to provide a gap in the product out-feed, indicative of the end of a required batch quantity.

1. A counter for a paper feed device, for counting product being processed by the paper feed device, the counter comprising:

electronic counter means for accumulating count data indicative of the number of items of processed product, in which the counter means operates to record an incremental count value in response to signals transmitted to counter means via sensor means, each signal being indicative of product detected by the sensor means, and in which the counter includes control means adapted to indicate when a desired batch quantity of product has been counted.

2. A counter as claimed in claim 1, in which the control means is adapted to produce an interrupt signal when a desired batch quantity has been counted.

3. A counter as claimed in claim 1 in which the counter includes interrupt means for interrupting the passage of product to be counted after a predetermined batch quantity has been counted.

4. A counter as claimed in claim 3, in which the interrupt means is in the form of a solenoid activated device comprising a member movable to prevent the passage of product to be counted.

5. A counter as claimed in claim 3 in which the interrupt means comprises a swing arm adapted to be moved between an operative position in which the passage of product to be counted is prevented, and an inoperative position in which product is free to pass beyond the interrupt means.

6. A counter as claimed in claim 3, in which the interrupt means is in the form of an electrical interrupt circuit, adapted to selectively interrupt the processing of product to be counted.

7. A counter as claimed in claim 1, in which the counter includes sensor means for detecting the passage of product to be counted.

8. A counter as claimed in claim 7, in which the sensor means includes two sensor heads arranged for passage of product to be counted therebetween, wherein a signal is generated every time a product to be counted passes between the sensor heads.

9. A counter as claimed in claim 7 when dependent on claim 3 or 4, in which the interrupt means and the sensor means comprise a single unit.

10. A counter as claimed claim 1, in which the control means include a variable count mode, adapted to enable a first predetermined number of selected batch values to be counted, followed by at least a second predetermined number of selected batch values to be counted.

* * * * *