July 4, 1967 R. E. WELLS 3,329,805

DECIMAL COUNTING DEVICE AND STEPPING UNIT THEREFOR

Filed Sept. 23, 1963 3 Sheets-Sheet 1

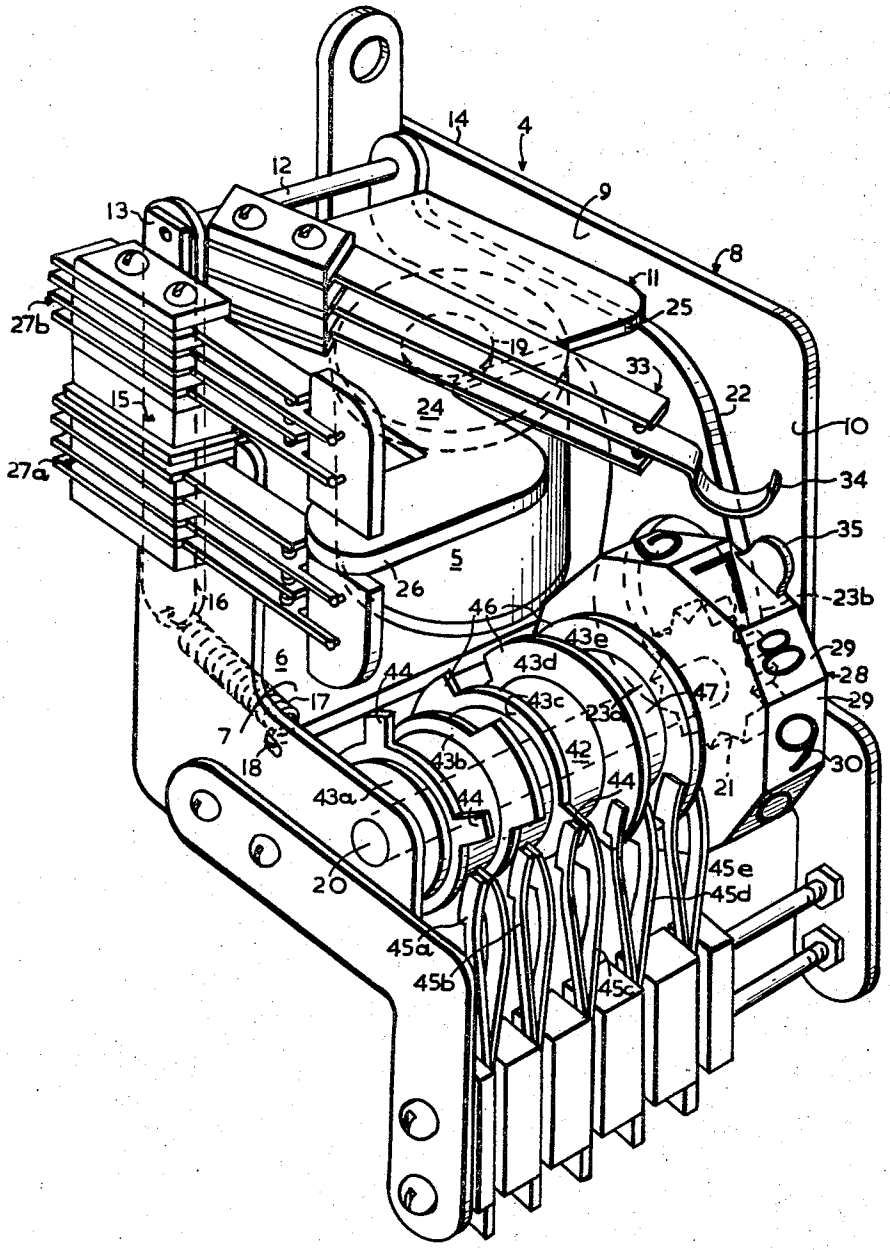


FIG. 1

DECIMAL COUNTING DEVICE AND STEPPING UNIT THEREFOR

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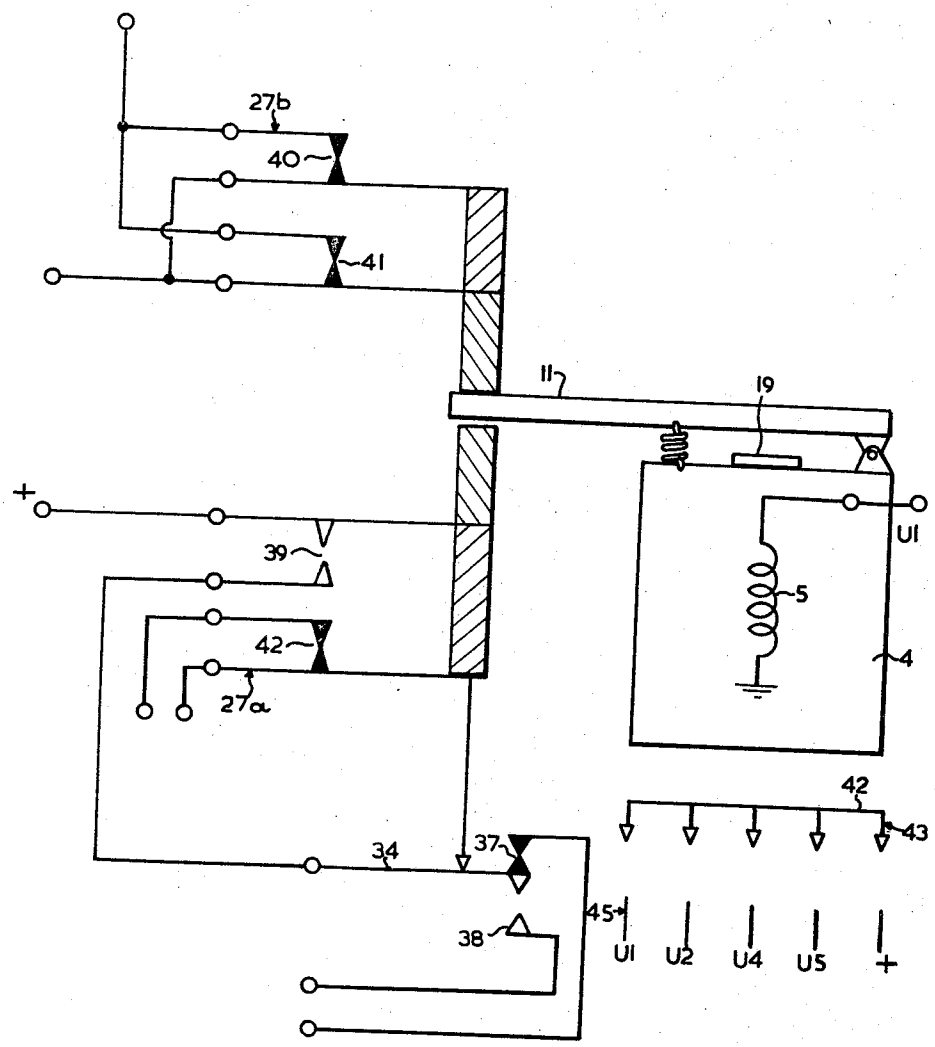


FIG. 2

DECIMAL COUNTING DEVICE AND STEPPING UNIT THEREFOR

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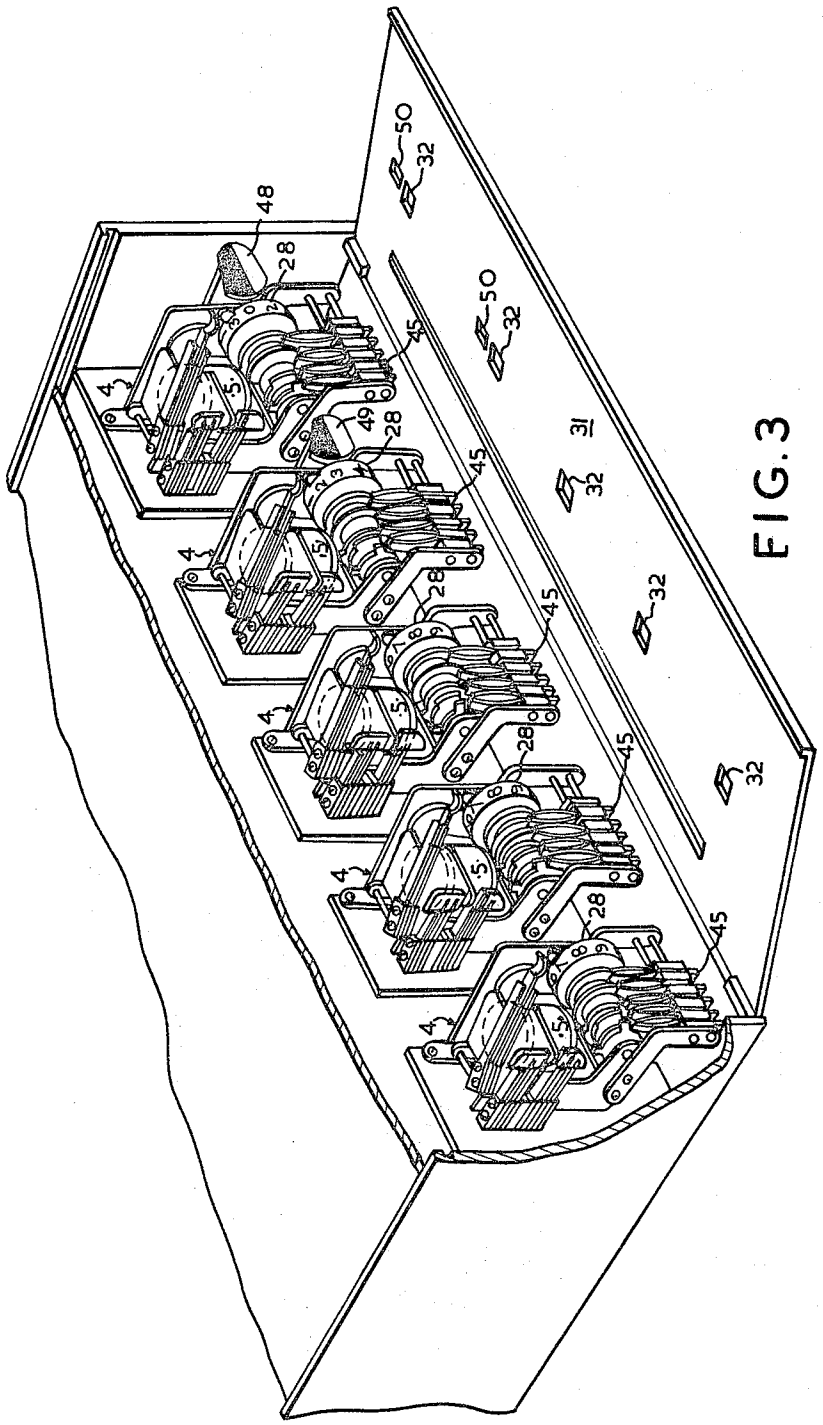


FIG. 3

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DECIMAL COUNTING DEVICE AND STEPPING UNIT THEREFOR

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ABSTRACT OF THE DISCLOSURE

An electrical counter stepping unit having a magnet, armature and driven calibrated drum, wherein electrical signalling of value indicated is effected by different groups of contacts, and the armature carries contacts and an actuator momentarily engaged by a projection on the drum when the armature is off-normal, and a decimal counter composed of a plurality of these stepping units each receiving individual driving signals representative of respective values and also transfer signals from lower order stepping units in the counter with a two-positional flag indicating half values and connected by transfer link to signal an associated stepping unit.

This invention relates to decimal counting devices, and stepping units therefor, for recording values indicated by electrical signals applied thereto, and more particularly to such devices providing a visual indication of the progressive total value.

Many devices are known which will perform this function if the applied signals are representative of a single value; or in a case where different values are to be recorded, a certain number of signals are applied for each value corresponding to the relationship of the value to be recorded to a basic value.

The application of a decimal counting device, particularly one with provision for visual indication of the recorded total, is most advantageous to racecourse totalisator systems so that a continuous indication is given of the total of the individual values recorded by the equipment during the course of betting transactions. However, the difficulty which arises in applying such a device to this equipment is that most totalisators accept wagers of different money values and to avoid excessive complexity it is usual to utilize similar electrical conditions, such as a single marking potential for each different value. To facilitate discrimination between signals representative of different values it is usual to provide separate signalling paths so that signals representative of one money value are kept separate from signals representative of any other money value.

It is a main object of this invention to provide a decimal counting device incorporating visual indication of the progressive computed total which will accept input signals representative of different money values.

It is also a main object of the invention to provide a stepping unit for the decimal counting device of such a construction that it may be duplicated throughout the device so that each unit counts a respective digit of the recorded total.

It is a further object to provide a decimal counting device which besides providing visual indication of the progressive total also provides for the transmission of electrical signals indicative of the total computed.

The invention, therefore, provides a decimal counting device comprising a plurality of stepping units, each unit serving to record a respective digit of the computed total, each stepping unit having a rotatable indication drum,

an electromagnetic device associated with said drum, an armature for each electromagnetic device, stepping means connected with each armature for rotating step by step its respective drum, and calibrations upon each drum for visually indicating the value of the respective digit in the computed total, said counting device also comprising at least one two-positional reciprocating element, separate receiving circuits each individual to input signals representative of a different one of a plurality of input values, operative input connections between said receiving circuits and respective ones of said stepping units and said two-positional reciprocating elements, and operative transfer connections between any one of said stepping units, excepting the one recording the digit of highest order of the total, and the stepping unit recording the digit of next higher order of the total.

The invention also provides a stepping unit for a decimal counting device comprising a frame, an electromagnet on the frame, a shaft rotatable on the frame, an armature for the electromagnet, means connecting the armature with the shaft for rotating the shaft step-by-step with each energization and release function of the electromagnet, a calibrated drum on the shaft visually indicating a value representative of the stepped position of the shaft, fixed contacts for connection to remote equipment, contact wipers rotatable with said shaft to close at least one of said contacts upon stepping of said shaft to transmit electrical signals indicative of the said value.

The invention will be described with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a stepping unit constructed in accordance with this invention;

FIG. 2 is a schematic representation of the stepping unit shown in FIG. 1; and

FIG. 3 shows a row of stepping units arranged as a decimal counting device also according to this invention.

The application in which the decimal counting device is described hereafter is with accumulating equipment associated with a totalisator system designed to receive betting wagers in units of four different money values, viz. $2, $5, $10 and $50. Whereas the description will clearly explain the construction of the device and its function in respect of this application, it should be understood that it is equally applicable to totalisator systems capable of accepting wagers at other than these unit values. One such system within this latter category is the Automatic Bookmaker Machine described in copending application No. 146,389, now Patent 3,248,525. In that instance the value of any wager can be determined by the customer and the system so designed to express the money value wagered in terms of signals according to a code having elements in the relationship of 1, 2, 4, 5, 10, 20 and 40. Thus any value of money, in even amounts could be expressed by this code with provision for decimal multiplication to convert the value from units to tens, hundreds, thousands of pounds, dollars etc. A money value of $6 or £6 would be expressed by a 4 element and a 2 element, while a money value of $9 or £9 would be expressed by the code in terms of a 5 element and a 4 element. A somewhat different relationship between the elements exists in this code as compared with the present code having elements of 2, 5, 10 and 50, but by modification of the device suitable provision could be made to convert the device from one use to the other.

With reference to the drawings the counting device of the present invention consists of a battery of five stepping units **4** arranged in juxtaposition in a single column. Each stepping unit **4** comprises an electromagnet **5** screwed upon a metal base plate **6** which is formed as a bent limb **7** upon a box shaped metal casing **8**. The top **9** and one side **10** of the casing **8** are open so that the electromagnet **5** is

enclosed on three sides and from beneath. An armature plate **11** is pivoted upon a spindle **12** passing between opposite sides **13** and **14** of the casing **8** and has a bell crank section **15** one arm **16** of which is engaged by a helical spring **17** anchored at its other end to a tab **18** formed in the casing **8** near its open side **10**. The spring **17** provides bias upon the armature **11** so that it is normally displaced under the spring tension, from a metal pole piece **19** passing through the electromagnet **5**.

A shaft **20** is rotatably mounted between the edge portion of the casing **8** at its open side **10** with a ratchet wheel **21** at one of its ends. A lateral extension **22** is formed on the outer end of the armature **11** which terminates in confronting jaws **23***a* and **23***b* coacting with the ratchet wheel **21** to provide for step-by-step rotation of the shaft **20** with repeated attraction and release functions of the armature **11** under the magnetic influence of the electromagnet **5**. An opposite lateral extension **24** is formed on the end **25** of the armature **11** which carries a finger **26** associated with one or more contact spring sets **27***a* and **27***b* mounted upon the side **13** of the casing **8** to effect, by movement of the armature **11**, making and breaking of the contacts of the spring sets **27***a* and **27***b*.

A calibrated drum **28** is mounted upon the shaft **20** adjacent the ratchet wheel **21** and has its periphery formed with multiple adjacent flats **29** upon which calibrations such as numerals **30** are depicted. These numerals **30** are arranged in such a progression order that with normal step-by-step rotation of the shaft **20** the numerals **30** indicated at any particular point of rotation of the drum **28** are increasing in value within any particular sequence, although in a complete revolution of the drum **28**, and therefore shaft **20**, there may be more than one sequence of numerals **30**. The individual stepping units **4** thus each provide for counting of respective digits of an indicated total and are arranged in line as shown in FIG. 3 so that by reading from left to right a total value, representing the computed total of recorded wagers may be read off from the calibrated drums **28**. To assist in the reading of the total an escutcheon plate **31** is hingeably mounted in front of the line of stepping units **4** and is provided with windows **32**, each of which corresponds in position to a respective viewing point for the calibrations of each drum **28**. As shown in FIG. 3 the escutcheon plate has been swung to its open, inspection, position. Interconnection between the stepping units **4** is by electrical signalling connections which will be described in greater detail hereafter.

Signalling from one stepping unit to an adjacent stepping unit indicating a digit of the total of a higher order is preferably facilitated by a spring set of change-over contacts **33** carried upon the armature **11** of each stepping unit **4** with the actuating change-over arm **34** of the spring set **33** extending above the calibrated drum **28**. A tab **35** extending from the periphery of the drum **28** is so located as to contact and lift the actuating change-over arm **34** when the armature **11** and drum **28** move to step from the highest value numeral **30** of a sequence displayed to the lowest value numeral **30** to commence a fresh sequence or to recommence the same sequence. Upon release of the electromagnet **5** completion of the stepping function is achieved and the armature **11** will restore and lift the arm **34** off the tab **35**. This action will cause momentary change-over of the contacts **33** by which means signalling to the succeeding stepping unit may be achieved. It should be appreciated that a momentary pulsing of contacts **33** is important in order to achieve attraction and release of the armature **11** of the succeeding stepping unit **4** for correct registration of a unit of higher order. If the contacts **33** are maintained closed in the final stepped position of the stepping unit **4** a pulse generator would be required to achieve a complete step in the higher order stepping unit and thus indicate in the decimal counter the correct summated total. The present arrangement is far simpler and reliable.

With reference to FIG. 2 it will be seen that the normally open pair of contacts **39** of spring set **27***a* are connected to one side to potential and on their other side to the change-over arm **34** of contacts **33**. The fixed contact **37** normally making with the arm **34** will thus be connected to perform some function for which a separate transmitted signal for each step of the shaft **20** is required while the opposite fixed contact **38** is connected to other circuitry, not shown, responding to completion of a calibrated sequence. This particular provision is one way in which conversion say from a 2 element, or a 4 element, to a 5 element of a code can be accomplished. However, other contacts or other interconnections may be employed.

Various forms of associated electrical apparatus may be used with this decimal counting device to provide for routing of incoming signals as well as internal transfer signals and an example of such apparatus is described and claimed in copending patent application No. 146,389 now Patent 3,248,525. The principal function of such apparatus is to provide appropriate signalling paths for input signals representative of money values wagered by punters. The paths will be automatically switching between several components of the counting device depending upon the state of their operation so that signals representative of the same value may be applied to different parts of the device at different times. Some of the important functions to be achieved by the associated apparatus are holding the registration of an input signal until all functions are completed and then restoring the circuitry to normal, clearing the input signal line after registration of the bet, switching input signalling paths depending upon a binary notation of 5, 50 etc., elements of the code registered, conversion of the total computed from signalling of one element of the code into terms of a higher element of the code, and cancellations of the total recorded and thus reversion of the apparatus to normal after use.

The spring set **27***b* is shown by FIG. 2 to have separate pairs of normally closed contacts **40** and **41** which are shunt connected mainly for security purposes to safeguard against false operation. These contacts **40** and **41** are operated by the armature **11** in the released condition of the electromagnet **5** and open each time the armature **11** is attracted to the electromagnet **5**, so that they may be utilized to transmit a potential back through the associated apparatus to restore the components to normal in readiness for receipt of another input signal. The normally closed contacts **42** of spring set **27***a* may be used for homing purposes of the stepping units **4**. With each attraction of the armature **11** they will open to release the electromagnet **5** and complete the stepping. They will thus be supplied with potential from an external source whenever homing is desired.

The counting device also has facility for transmitting to remote equipment certain electrical conditions indicative of a particular numerical value corresponding to the calibration indicated upon each stepping unit **4**. This is achieved by the provision of a contact wiper cylinder **42** preferably of an electrically conductive metal fixed upon but electrically insulated from the shaft **20** and hence rotatable with the calibrated drum **28**. In the present form of the invention five annular axially spaced metal flanges **43***a*, **43***b*, **43***c*, **43***d* and **43***e* are formed upon the contact cylinder **42**. Parts of most of these flanges are cut away to leave small lug-like radical projections **44** arranged in a predetermined sequence so that at any particular angular position of rotation of the cylinder **42** a different combination of projections is present, corresponding to the calibrated steps of the shaft **20**. A bank of five knife contacts **45***a*, **45***b*, **45***c*, **45***d* and **45***e* are secured to the casing **8** and lie adjacent the periphery of the contact wiper cylinder **42** so that each pair of knife contacts **45** is wiped by a respective projection **44** on the cylinder **42**. Passage of a projection **44** between the jaws of its respective contact **45** results in its electrical contact with the contact **45** and this condition is relayed to remote equipment by suit-

able electrical leads. A respective electrical condition is therefore created by the contact wiper cylinder **42** individual to each calibrated setting of the drum **28** and shaft **20** by making of a different group of the knife contacts **45**. These different electrical conditions may be used in any desired fashion to convey to suitable apparatus the progressive total computed by the decimal counting device. This arrangement of different grouping of marked contacts corresponding to respective values indicated visually by the drum, does not require any registering and counting apparatus as would be necessary if identical pulses were transmitted with stepping of the unit **4**.

Preferably the contact wiper cylinder **42** is constructed of a plurality, in the present instance five, keyed washers **46** upon whose periphery suitable projections **44** are formed which are mounted upon the shaft **20** and separated by cylindrical spaces **47** of lesser diameter and tightened together to form a robust assembly.

As a practical example of the construction of the shaft **20** and associated drum **28** and contact wiper cylinder **42** and knife contacts **45**, it will be assumed that input signals representative of a 1 value are applied to the stepping unit **4**. Receipt of each signal will then cause the electromagnet **5** to step the shaft **20** on one step at a time. The shaft **20** will thus have ten rotational positions which will be indicated by the calibrations on the drum **28** as ranging from 0 to 9. Each position of the shaft **20** will provide a visual indication corresponding to a computed total of the number of input signals received. Electrical signalling of this total will be effected through making of certain ones of the knife contacts **45**. One contact **45*e*** will be connected to local potential and the wiper **43*e*** associated with this contact will be a continuous annular flange so that potential is always supplied to the wiper cylinder **42**. The other four contacts **45*a*–45*d*** will be representative of 1, 2, 4 and 5 values, respectively, and their associated wiper projections **44** will be arranged with respect to the various positions of the shaft **20** so that the marking potential normally on the wiper cylinder **42** is applied through the wiped contacts **45** to the remote equipment according to a predetermined grouping of contacts, such as:

Calibrated position of shaft **20**:	Marked contacts
1	U1
2	U2
3	U2 and U1
4	U4
5	U5
6	U5 and U6
7	U5 and U2
8	U5 and U2 and U1
9	U5 and U4
0	Nil

The counting device of this invention as applied in the foregoing description to a totalisator system capable of receiving stakes of $2, $5, $10 and $50, is provided with five windows **32** so that a total involving tens of thousands of dollars may be indicated. The stepping unit **4** corresponding to the units digit of the total is on the right hand end of the line of stepping units as viewed from the escutcheon plate **31** and in the preferred form the drum **28** individual to the units digit values is calibrated in the sequence of 2, 4, 1, 3, 0, 2, 4, 1, 3, 0 for the complete rotation of the drum **28**.

From the foregoing description of the functioning of each stepping unit **4**, it will be appreciated that a full reciprocating movement of the armature **11** is necessary to provide complete stepping of the drum **28** and shaft **20** from one calibrated position to another. Thus registration of a stake by the stepping units **4** requires a momentary electric pulse.

It is necessary, therefore, that signals representative of a $2 bet be applied to the electromagnet **5** associated with the units digit stepping unit **4** and then be disconnected to complete the stepping function. This is achieved by passing the input signal corresponding to a $2 bet through associated electrical apparatus preferably employing two-positional devices and thence into the counting device, and in turn sending a return signalling pulse to restore the apparatus and thus release the electromagnet **5** of the respective stepping unit **4**. This will result in the stepping of the drum **28** and its associated contact wiper cylinder **42** into the next position of its operating sequence, thereby providing visual indication of the recording of a $2 amount. In a similar manner recording of a $10 bet may be recorded and indicated upon the adjacent tens digit stepping unit **4**.

Provision is also made for registering and indicating in the counting device stakes of $5 and $50 which, as previously stated, are represented by a single electrical signal and hence cannot be applied directly to the electromagnets **5** as described in connection with the $2 and $10 value bets. By the invention, however, this is achieved through the provision of individual shutters or flags **48** and **49** displaceably mounted behind further windows **50** in the escutcheon plate **30**. It is intended that these flags **48** and **49** be normally concealed from sight and be displaced into viewing position upon receipt of a respective signal representative of a $5 or $50 value.

An input signal representative of say $5 is applied to a solenoid, not shown, which upon operation moves an individual flag **48** into viewing position, or if already in viewing position, withdraws the flag **48** and applies the signal to the electromagnet **5** of the tens digit stepping unit **4**. In a similar manner operation of the flag **48** can be effected as well by the stepping of the units digit drum **28** from the end of one sequence to the start of another, such as from calibration 4 to calibration 1, or from calibration 3 to calibration 0. Transmission of these latter signals is effected by suitable positioning of the peripheral tabs **35** on the drum **28** to change over the contacts **33** carried by the armature **11**.

It will be appreciated that computation of both $5 values and $50 values is performed according to a binary notation and for this purpose bi-stable solenoids are preferred. Initial energization of the solenoid will cause display of the respective flag **48** or **49** to indicate that a $5 value or $50 value should be added to the otherwise indicated total, and the next signal received will cause stepping of the drum **28** indicating the digit of higher order in the total and withdrawal of the flag **48** or **49**. In effect, therefore, the counting device functions both as a binary counter and a decimal counter with conversion of the values computed by the former into terms of the latter, so that a grand total is obtained expressed principally according to the decimal system.

What I claim is:

1. A stepping unit for a decimal counting device comprising a frame, an electromagnet on the frame, a shaft rotatable on the frame, an armature for the electromagnet, means connecting the armature with the shaft for rotating the shaft step-by-step, each individual complete step of said shaft requiring a reciprocating movement of said armature from a normal position to an off-normal position and return, a calibrated drum on the shaft visually indicating a value representative of the stepped position of the shaft, a projection rotatable with said shaft, a contact spring set carried upon the armature, an actuator for said contact spring set also carried by said armature and located in the off-normal position of said armature in the path of movement of said projection for momentary engagement therewith, said engagement producing momentary closure of said contacts to signal a predetermined rotation of said shaft and calibrated drum.

2. A stepping unit according to claim **1**, having a plurality of fixed contacts for connection to remote equipment, a plurality of electrically connected contact wipers rotatable with said shaft to engage and mark respective fixed contacts, the rotational angular relationship of the

wipers being such that a different group of said contacts is marked at each different step of said shaft during a single rotation thereof to indicate electrically said value visually indicated by said drum.

3. A stepping unit according to claim 2, wherein said wipers are formed on an electrically conductive cylinder rotated by said shaft, and one of said contact wipers is an annular member on said cylinder and continuously in contact with the respective one of said fixed contacts, and the other ones of said contact wipers are projections on said cylinder.

4. A decimal counting device comprising a plurality of stepping units each unit serving to record a respective digit of the computed total, each stepping unit having a rotatable indication drum, an electromagnetic device associated with said drum, an armature for each electromagnetic device, stepping means connected with each armature for rotating step by step its respective drum, and calibrations upon each drum for visually indicating the value of the respective digit in the computed total, said counting device also comprising a two-positional flag member, a transfer connection between said flag member and one of said stepping units, separate receiving circuits each individual to input signals representative of a different one of a plurality of input values, input connections between said receiving circuits and respective ones of said stepping units and said two-positional flag member, the input value assigned to said two-positional flag member by its respective input connection being half the input value assigned to said one of said stepping units, said two-positional flag member being movable by a first input signal applied thereto to a position visually indicating a single unit of its assigned input and being movable from said indicating position upon receipt of a second input signal applied thereto to transmit over said transfer connection a stepping signal to advance one step said one of said stepping units, and further transfer connections between each of said stepping units and the stepping unit recording the digit of next higher order of the total.

5. A decimal counting device comprising a plurality of stepping units each unit serving to record a respective digit of the computed total, each stepping unit having a rotatable indication drum, an electromagnetic device associated with said drum, an armature for each electromagnetic device, stepping means connected with each armature for rotating step by step its respective drum, and calibrations upon each drum for visually indicating the value of the respective digit in the computed total, said counting device also comprising a two-positional flag member, a transfer connection between said flag member and one of said stepping units, separate receiving circuits each individual to input signals representative of a different one of a plurality of input values, input connections between said receiving circuits and respective ones of said stepping units and said two-positional flag member, the input values assigned by respective input connections to said two-positional flag member, said one of said stepping units and a second stepping unit serving to record the units digit of the computed total being 5, 10 and a whole number less than 5, respectively, said two-positional flag member being movable by a first signal applied thereto to a position visually indicating a 5 value and being movable from said indicating position upon receipt of a second signal applied thereto to transmit over said transfer connection a stepping signal to advance one step said tens digit stepping unit, and further transfer connections between each of said stepping units and the stepping unit recording the digit of the next higher order of the total, said transfer connection from said units digit stepping unit to the tens digit stepping unit being made through said 5 value two-positional flag member.

6. A decimal counting device comprising a plurality of stepping units each unit serving to record a respective digit of the computed total, each stepping unit having a rotatable indication drum, an electromagnetic device associated with said drum, an armature for each electromagnetic device, stepping means connected with each armature for rotating step by step its respective drum, and calibrations upon each drum for visually indicating the value of the respective digit in the computed total, said counting device also comprising a two-positional flag member, a transfer connection between said flag member and one of said stepping units, separate receiving circuits each individual to input signals representative of a different one of a plurality of input values, input connections between said receiving circuits and respective ones of said stepping units and said two-positional flag member, the input values assigned by respective input connections to said two-positional flag member, said one of said stepping units and a second stepping unit serving to record the units digit of the computed total being 5, 10 and a whole number less than 5, respectively, said two-positional flag member being movable by a first signal applied thereto to a position visually indicating a 5 value and being movable from said indicating position upon receipt of a second signal applied thereto to transmit over said transfer connection a stepping signal to advance one step said tens digit stepping unit, further transfer connections between each of said stepping units and the stepping unit recording the digit of the next higher order of the total, said transfer connection from said units digit stepping unit to said tens digit stepping unit being made through said 5 value two-positional flag member, means for transmitting a signal from said units digit stepping unit to said 5 value two-positional flag member whenever the computed total at least equals a further multiple of 5, and means for moving said 5 value two-positional flag member to said visual indicating position upon receipt of the first of any applied signal representative of a 5 value and every second such signal received thereafter and to relay every alternately received signal as said stepping signal to the tens digit stepping unit while returning said two-positional flag member to normal.

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