United States Patent

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[33] **Germany**
[31] **P 18 03 214.9**

[54] **ELECTRICAL READOUT FOR COUNTERS**
15 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** ..... **235/92 EA,** 235/92 R, 235/92 C, 340/379
[51] **Int. Cl.** **G06m 3/06**
[50] **Field of Search** ..... 235/92, 1, 65, 61 PF, 2.12; 340/378, 9, 147

[56] **References Cited**
UNITED STATES PATENTS

2,049,499	8/1936	Haselton		235/92 (65)
2,518,378	8/1950	Roggenstein		235/61 PF
2,617,870	11/1952	Kern		340/379 X

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ABSTRACT: An arrangement for reading out through electrically coded signals, counter registrations and indications. A common shaft within a supporting frame of a unit holds a plurality of electrical contact discs which are rotatably mounted on the shaft. The counter to be read out electrically is provided with individual rotatable drums connected to the electrical contact discs so that these are rotated in correspondence with the drums when the frame is detachably mounted on the supporting means of the counter. Through the application of contact blades supported on a contact carrier block within the frame member, the counter indications are read out through digitally coded electrical signals. The counter can be used in conjunction with a printout mechanism through which printout is realized in a uniquely defined numerical order.

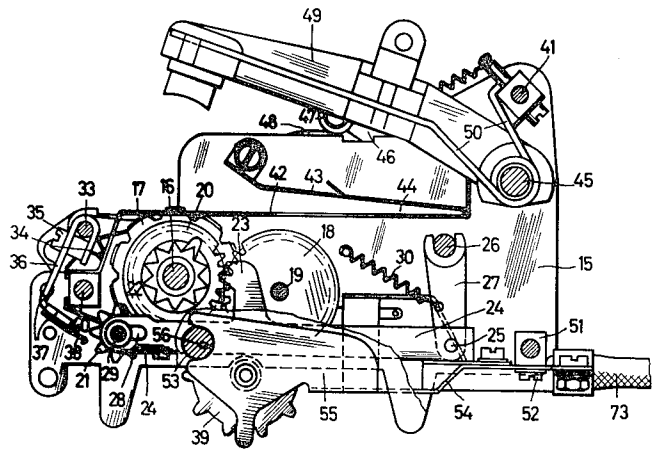
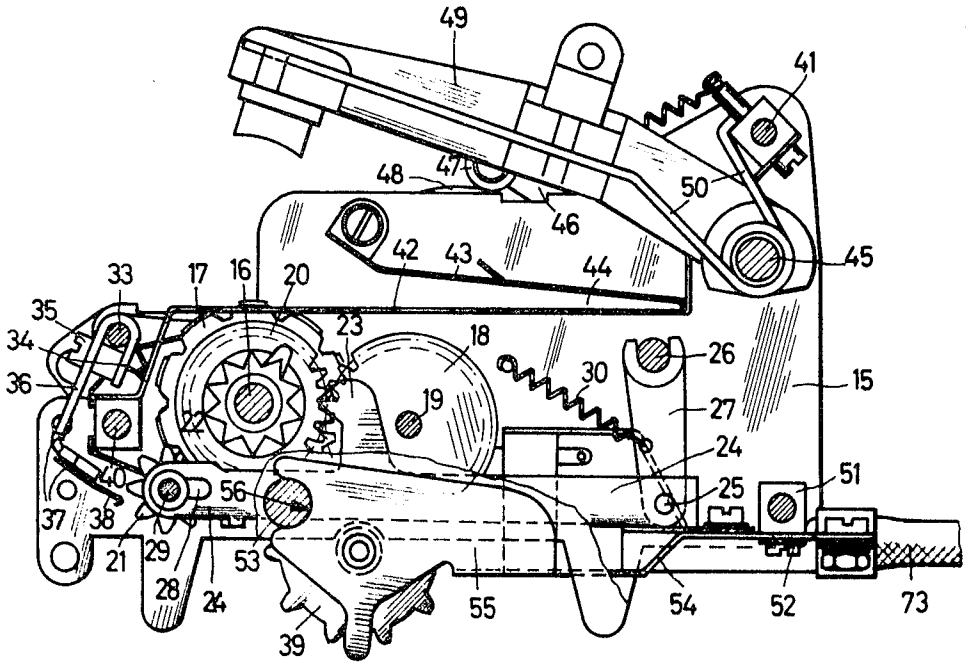


Fig.1



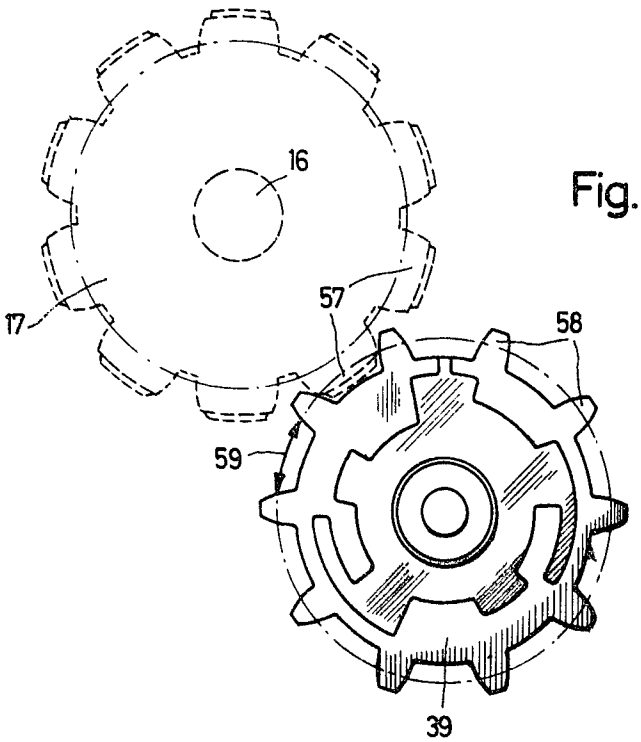


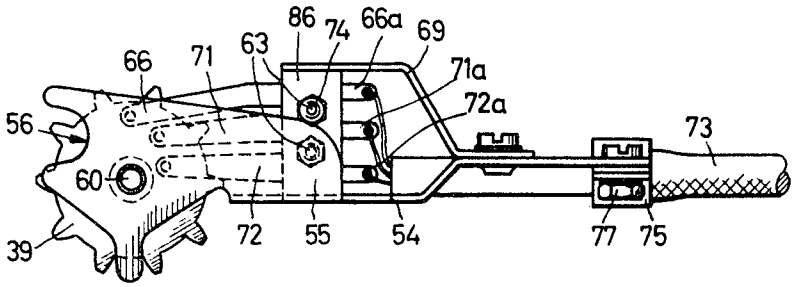
Fig.2

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Fig.3



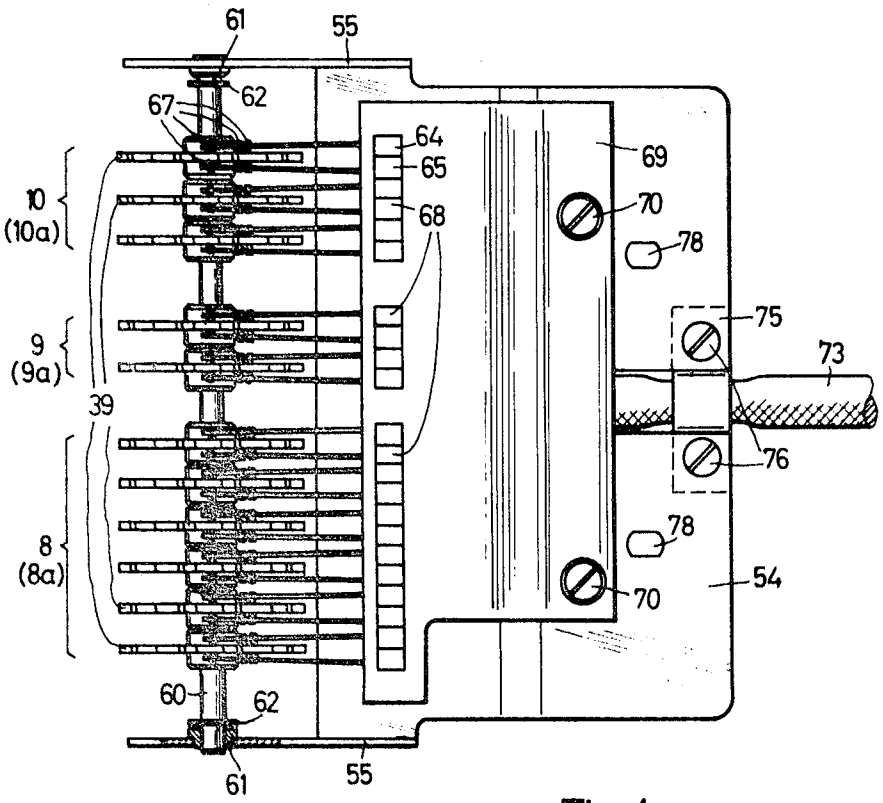


Fig.4

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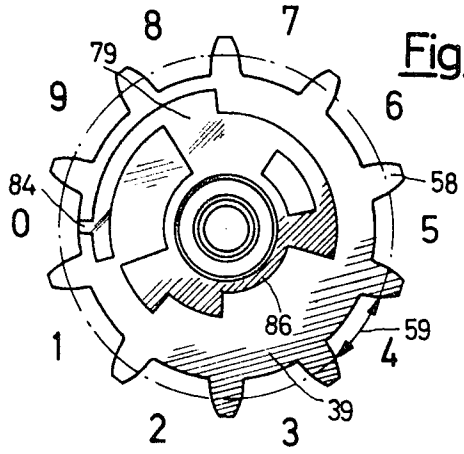


Fig.5a

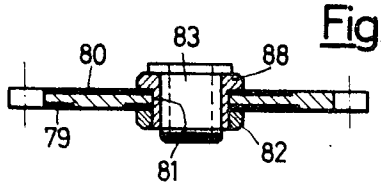


Fig.5b

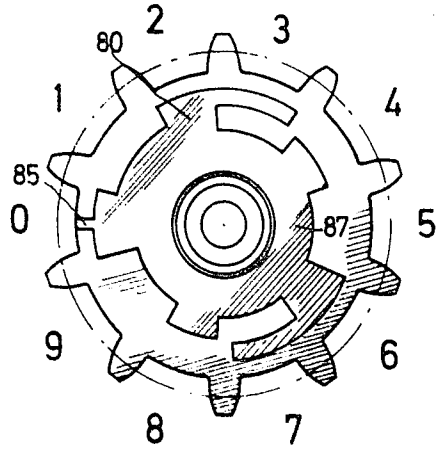


Fig.5c

Fig.5d

DIGIT	CODE				
	1	2	4	8	P
0	L	L	L	L	L
1	L	0	0	0	0
2	0	L	0	0	0
3	L	L	0	0	0
4	0	0	L	0	0
5	L	0	L	0	L
6	0	L	L	0	L
7	L	L	L	0	0
8	0	0	0	L	0
9	L	0	0	L	L

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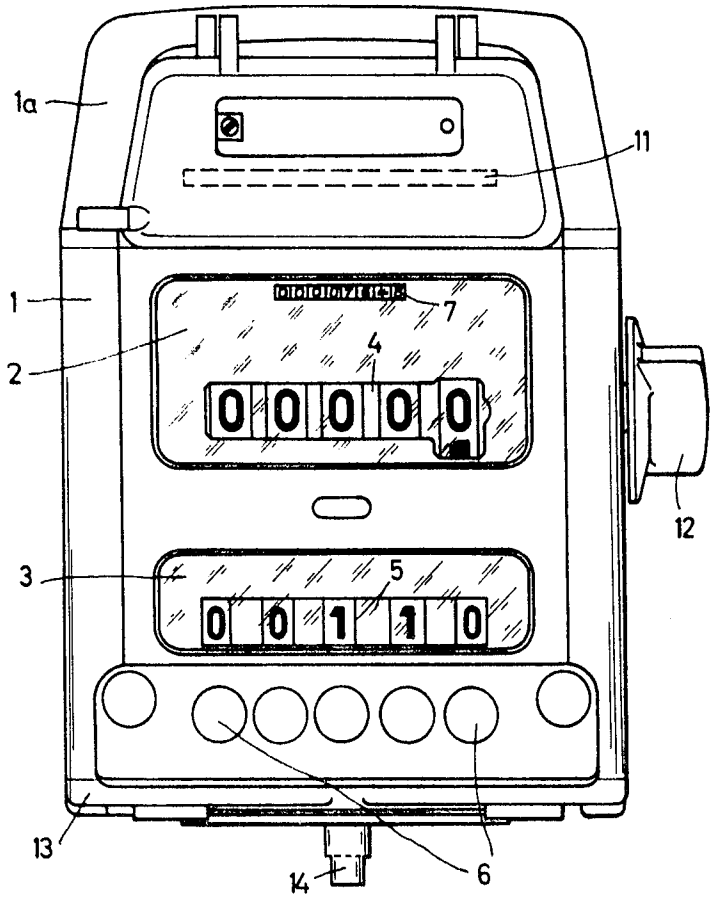


Fig.6

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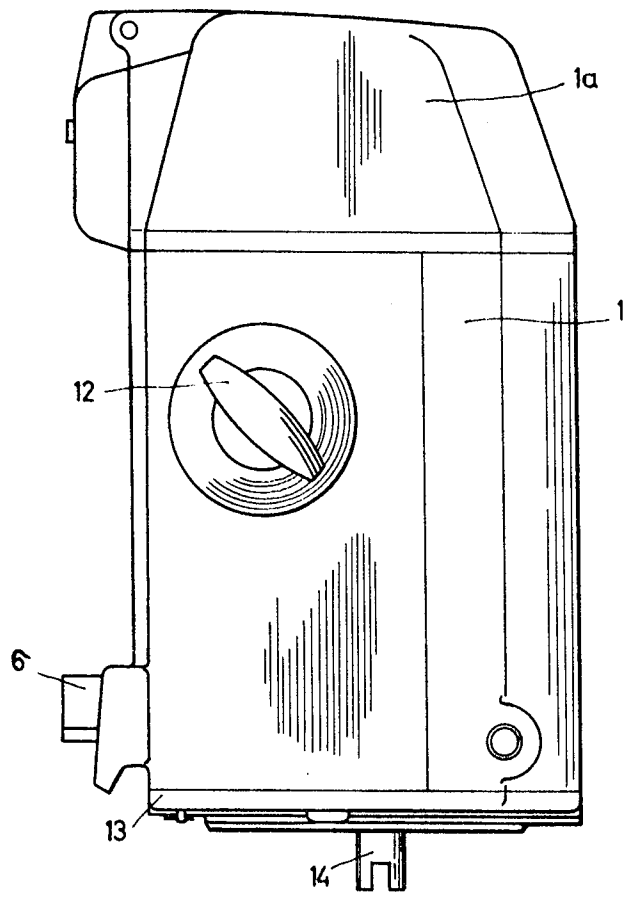


Fig.7

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ELECTRICAL READOUT FOR COUNTERS

BACKGROUND OF THE INVENTION

The present invention resides in an electrical sampling output device parallel situated readouts of counters, preselected counters, and/or printing mechanisms, which are connected with measuring devices or sensors, for example.

Counting arrangements of the preceding species are, for example to be installed where many takeoffs or readouts are required from a large storage or memory unit, and in which devices are controlled and registered throughout the entire process. In this regard, mechanical counting units are regulated, of the type of roller, barrel, or drum type of countering. These counters consist, in general, of shafts upon which drums or rollers or barrels are mounted and subdivided on their circumferences in decade manner. These rollers or drums are coupled to each through advancing drives or mechanisms. These advancing mechanisms transmit or propagate information between the rollers. The wide applicability and the high precision of such mechanical integrated counters are of immeasurable value in today's times.

In order to maintain pace with the rapidly advancing automation field, counters and registering devices were finally built which provide other features than mechanical summations. Accordingly, counters have been made available with built-in contact output systems in conjunction with the counting rollers, for the purpose of providing optical or acoustical indications, for example, when a predetermined or present quantity has been attained. Furthermore, these counters will automatically stop an output device. At the same time, it is often desired in the use of counters, to provide a printout when a predetermined count or quantity has been attained, or to actuate apparatus which lies outside of the counter, for example. It is also desired to remotely transmit to a distant station the counter readout for purposes of indication.

In a counter known in the art, electrical preselection is provided, and a circuit closure is established when a predetermined and preset quantity is attained on the counter. Furthermore, each counting roller of a counter with a plurality of stages has arranged with it a contact carrier which is provided with two spring contact points or terminals. These contact carriers are associated in coded form with the corresponding counting rollers and extend over the contact elements on a fixed contact carrier plate, when the counting rollers are driven and rotation of the contact elements take place. Aside from the spring contact carriers, the carrier plate is coaxial between the individual counting rollers. This design is very disadvantageous from the viewpoint of the limited space available in such counters. Furthermore, such an arrangement requires a considerable number of different parts. When an exchange of parts is required, and a defective carrier plate is, for example, to be replaced, complete disassembly of the counting unit is required with the accompanying large amount of time consumption. The contact carrier plate is in the form of a commutator disc. In a ring-shaped arrangement, the designated values of the digit rollers become electrically sampled through 10 conductive segments arranged concentrically with each other and through a contact ring which is isolated from these. For all segments, electrical line connections must be established for most counters which have different positions. Thus, at least 11 lines are required per decade. This additional and costly equipment in the wiring and labor therefor, is undesirable when taking into account furthermore the limited space conditions.

Electromechanical transmitting apparatus for converting counter indications of mechanical counters through electrical signals, are also known in the art. In such arrangements, sliding contacts are also mounted on a rotatable disc.

Through a gear rack mechanism, different digital values are taken from a counter or calculating mechanism, and transmitted to a sliding contact carrying wheel which is geared at half of its circumference. The pair of contacts transmit the readout of the calculating mechanism over a region within

180° of oscillatory motion. This action takes place through a half rotation of a uniformly subdivided and conductive contact segment ring. Even in this arrangement, a wiring combination of at least 11 lines is required for the purpose of readout or sampling of 10 digital positions per decade. Aside from having to include a large number of connecting lines which are not without accompanying problems, the arrangement of the driving gear with the pair of contacts thereon in the axial direction, as well as the associated fixed segment discs, are very disadvantageous from the viewpoint of space. Such counter constructions are usually undesirably wide, due to the inherent design of their parts, and are not very readable when a counter mechanism with many places or readout is used.

From the viewpoint of electrical readout or sampling symbols, the contact arrangements on the decimal basis are not very well adapted for the readout or output of values or quantities. Only with costly and complex decoders, can such counting arrangement be connected with the electrical and electronic processing apparatuses. In order not to cut off progress in automation on the one hand, and to avoid the universal utility of mechanical counters with their high precision, the counter results become converted in so-called digital-analog converters for data processes, in different manners.

For this purpose, a magnetic coder is available, for example, and has a magnetized rotatable coding disc perpendicular to the upper surface of the magnetic coder. The coding disc is provided with a plurality of tracks of different places. These tracks have a plurality of segments which have alternatingly high and low magnetic flux or magnetic reluctance. The coders are furthermore provided with tracks and read heads for processing the different magnetic flux intensities. Such coding discs with the magnetic code tracks arranged on one of their sides, have a very large diameter, since a predetermined amount of spacing must prevail between the individual code tracks. For the exact sensing of a symbol which is realized through variations in the inductance of the generated signals, sensitive read heads are required. This results in substantially high fabrication costs in their installation in the data carrier, and adds to an already expensive installation. Further, such installations are either difficult to build in or are not possible to be included with the usually crowded counters that have no space available for these.

An analog to digital converter is also known in the art which rotates through an angle corresponding to the quantity designated. Upon a second and separate shaft, the code discs with the contact tracks on one side, are mounted. The sampling elements contact in radial manner, the instantaneous values or quantities of both shafts, and through means of a comparator, both shafts become adjusted in position until the actual and desired values are in agreement. Aside from the usually required bit for designating information, it is necessary to avoid the indication of two values during the transfer from one counter quantity to another. This embodiment also shows how complex and costly a coding disc arrangement can be for processing uniquely in the defined manner the counter readouts. Furthermore, the coding discs therein may also be used for corresponding digital to analog converters.

For purposes of describing the state of the art, a counter with electrical output in the form of digital to analog conversion is also known. The solution through that device resides in providing an electrical signal for each digit in integral form and to define the digit uniquely. Thus, an electrical parameter is made proportional to the digital magnitude. On broadened digit drums or rollers, contact elements and slippering are embedded. Between the contact elements of one decade, resistors are located corresponding to the digital places of zero to nine, in sequence. In a similar manner, resistors are provided from decade to decade, corresponding to the digit values. The resistors advanced with the counter rollers become added through slit contacts, on a collector basis. The result is in analog form and is proportional to the equivalent of the digital integral value of the mechanical counter. The con-

siderable disadvantage in this arrangement is that the resistor elements must be precise and retain constant their values. In this regard, the precision of transmitting the lowest decade values, leaves much to be desired. Aside from this, additional equipment is required for converting such analog output into digital values for further use in data processing arrangements.

Accordingly, it is an object of the present invention to provide counting units with a readout which are simply constructed and require little equipment. It is a specific object of the present invention to convert the digital indications of the counter unit into uniquely defined electrical information symbols and to make them available for sampling or interrogation. It is also an object of the present invention to construct the readout arrangements so that it may be readily extended. It is a further object of the present invention to design the sampling contacts and the readout arrangements so that it may be interchanged with any desired selectable code system.

The preceding objects of the present invention are achieved through a frame which is separately designed to make possible simple assembly and disassembly. A common axis within the frame has rotatably arranged on it, electrical contact discs. These contact discs are brought into direct coupling with the individual rollers of the counter and/or printing mechanism.

In order not to widen the readout region unnecessarily and thereby worsen the readout properties of a counter with a plurality of places, the contact discs are radially in mesh with the counter and/or counting rollers.

A further feature of the present invention resides in the conductivity of both sides of the contact discs. Advantages from this design are realized in that the contact tracks may be arranged and coded so that the conductive contact layers may be interconnected to provide the entire picture. The contact tracks connecting junctions or fields which are usually required, are here superfluous, and consequently maximum use of the defined region is made possible.

In a further embodiment of the present invention, the contact discs permit with the same diameter and without reducing the contact track width, double the number of codified conducted tracks. This is in comparison to the arrangement using layers on one side only. In the opposite case, the advantage of the present invention resides in the possibility of subdividing the predetermined contact track code on both sides of a contact disc.

A further feature of the present invention resides in the formation on both sides of the contact layers, different code systems through corresponding conductive track combinations. Thus, the readout and sampling of a digital value may be realized in different codes. In a practical application, such a readout unit is directly connectable to a data processing unit or other peripheral equipment with different information input requirements.

In further features of the present invention, contact discs are arranged on parallel shaft. An extension reduction of the place capacity or an exchange of defective blades or sampling springs may be carried out without extensive effort or time consumption. The sampling pressing blades or springs are also arranged in parallel on both sides of the contact discs axis. In this manner, the spring forces of the blades are lifted and there is no interference with the neighboring decade disc through axial displacement or rubbing action.

SUMMARY OF THE INVENTION

An arrangement for reading out electrically parallel-counter indications, in which the counter is of the drum or barrel type with one drum for each decade stage. A supporting frame member permits simple disassembly and assembly of the arrangement. A common shaft member within the frame holds electrical contact discs which are mounted rotatably thereon. The counter has the individual rotatable drums connected to the electrical contact discs so that these are rotated in correspondence with the drums. The electrical contact discs supply through means of contact blades, the readout of the counter in uniquely defined coded form.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an assembled side view of the readout arrangement in the form of a printing roller mechanism;

FIG. 2 is a side view of the contact in mesh with the printing roller mechanism for the arrangement of FIG. 1, in accordance with the present invention;

FIG. 3 is a side view of a complete 11-position readout arrangement of the present invention;

FIG. 4 is a plan view of the arrangement of FIG. 3;

FIG. 5*a* is a plan view of one side of the contact discs of the present invention;

FIG. 5*b* is a sectional view taken through a diameter of the contact disc of FIG. 5*a*;

FIG. 5*c* is a plan view of the other side of the contact disc shown in FIG. 5*a*;

FIG. 5*d* is a logical truth table for defining the digital codes associated with the contact sides of FIGS. 5*a* and 5*c*;

FIG. 6 is a front view of a combined preselectable counter, registration and indicating counter and recording and printing unit used in conjunction with the present invention; and

FIG. 7 is a side view of the combination of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, and in particular to FIG. 6, a combination of a plurality of counting mechanisms are shown therein. This combination is installed in conjunction with multiple measuring devices, when, for example, in addition to multiple counting, the preselection of a desired output quantity and a record of the actual output is sought. This combination is of conventional and commercial construction, and serves to clarify an application of the present invention. Within a housing 1, the numerical digits of two counters 4 and 5 are visible from the front side and through glass or window coverings 2 and 3. A pushbutton row 6 is located beneath the lower counter 5. This row of pushbuttons 6 serves to insert a desired quantity. The counter 5 is coupled to the pushbutton 6, and for this reason indicates the numerical quantity which has been inserted through settings of these pushbuttons. In the functional operation of the counter 5, the latter runs in a subtracting manner towards zero. A further barrel or disc counter 4 is arranged over the counter 5. The counter 4 is setable to zero, and counts the individual output quantities as well as indicates these. A control counter 7 mounted above the preceding counters is continuously driven in operation, and registers the total quantities. At the upper portion or end of the housing, an output printing arrangement, not visible from the exterior, is mounted. The printing rollers of this printing arrangement, are designed in the form of notched drums and are coupled to the other counters. The printing rollers print the output quantity 8, the takeoff position number 9, and the sampled number 10. An opening 11 is provided on the front side for the purpose of exposing or making visible the feed of the record paper. A rotatable knob 12 is mounted upon a shaft projecting from the side of the housing 1. This knob 12 serves the purpose of initiating the printing, beginning the interrogation, and finally the setting of the counter to zero. A drive shaft 14 projecting from the bottom plate 13, is provided for connecting to any desired multiple measuring device or quantitative measuring device. The shaft 14 is operatively coupled with the corresponding counters.

FIG. 1 which pertains to an application of the sampling and output arrangement of the present invention, shows the entire output or readout in a single unit construction, and in conjunction with printing means 17 located in the upper portion 1*a* of the housing of the counter combination. A shaft 16

mounted between two sidewalls **15**, of which only one is shown for simplicity, 11 counting rollers or drums **17** being mounted and arranged denominational order. These drums or rollers **17** are designed as printing wheels. In accordance with FIG. **4**, furthermore, three different data units are embodied by these counting drums or rollers **17**. Thus, for example, the sixth position **8***a* corresponds to the output quantity, the second position **9***a* corresponds to the takeoff position number, whereas the third position **10***a* corresponds to the desired output data which may be possibly insertable. The drums or rollers **17** are coupled, through transfer means, with the corresponding counting mechanisms, in the conventional manner.

As shown in FIG. **1**, a gear **18** mounted upon the shaft **19**, is in mesh with a rim gear **20** which is secured firmly to the counting drum **17**, and drives the lowest order of the measuring printing roller **8***a*. Through the 10's transfer mechanism **21**, 10's transfer through the decade arrangement is accomplished in the conventional manner. A star-shaped arresting wheel **22** is firmly joined to the printing roller **17**. During the printing process, a pawl-shaped arm **23** grips or reaches into the star wheel **22**. The pawl-shaped arm **23** is on a feed rod **24** which is pivoted at one end on a bolt of pivot **25**. A crank **27** hangs on this pivot **25** and is swingable about the bearing axle **26**. The other end of the rod **24** has an elongated slot **28** which moves on the shaft **29** of the advancing mechanism. Under the influence of the tension spring **30**, the pawl-shaped arm **23** moves into the star wheel **22** upon release of the feed rod **24**. The arm **23** reaches thereby into the last printing and counting roller **17** of the star wheel **22**, and sets the latter to a position corresponding to an integral digit.

A shaft **33** is further provided between the sidewalls **15**, and upon this shaft are seated and fixedly mounted overlays or covering members **34** which serve as clamping members. A bracket **36** is held in place by being drawn together through two cylindrically shaped screws **35**. A row of leaf springs **37** are soldered upon this bracket **36**. During the time interval of the printing process, the shaft **33** is rotated counterclockwise through the printing mechanism, not further shown. In this manner, the arms **38** of the leaf springs are each at the height corresponding to the advancing function, and lock or hold in place the advancing mechanism **21**. At the same time, the printing rollers or drums **17** and therewith the contact discs **39**, to be described, are also held at a precisely defined position corresponding to an integral digit, during the printing and sampling or interrogating time duration. Although not part of the invention, it is to be noted that a blade member **42** is secured to two four-edged members **40** and **41**, and a guide blade **43** is, furthermore screwed to the sidewalls **15**. This arrangement serves as the record carrier guide compartment behind the guide opening **11** for a record carrier sheet. A printing hammer shaft **45** is mounted between the sidewalls **15**, and pinned to this shaft **45**, is a rotatable lever **46** in which a follower roller **47** is seated. The latter functions in conjunction with a cam **48** for the purpose of controlling the printing hammer **49** secured to the shaft **45**. The printing hammer **49** is subjected on both sides thereof, to the action of torsion springs **50** which rotate the printing hammer **49** in counterclockwise direction for printing purposes. A four-edged member **51** serves as a spacer between the sidewalls **15**, and simultaneously as a support bars **53** are mounted in both sidewalls. The frame **54** is held in place by cylindrically shaped screws **52**. The frame **54** is provided with a fork-shaped guide slot **56** at one end. After detachably mounting in place the frame **54** with the guide slot **56** on the supporting bar **53**, which is carried by walls **15**, it is possible thereafter to fasten the frame **54** to the spacer **51** by means of the cylindrical screws **52**, so as to realize the correct position of the contact discs **39** to the printing drum **17** of the detachable unit **54**, **39**, **60**.

As shown in FIG. **2**, the contact discs **39** are provided with connecting gear teeth **58** at their circumference or peripheries. The gap **59** between adjacent gear teeth is selected so that it grips directly a counter tooth **57** carried on the printing roller **17** and has a gear shape of conventional design. As best shown in FIGS. **3** and **4**, the contact discs **39** are rotatably mounted upon a shaft **60** on frame **54**, and are arranged corresponding to their designated digit position. The shaft **60** is held in bearings **61** pressed-in in both of the side portions **55** of frame **54**. The shaft **60** is secured against being shifted sidewise by two securing discs **62**. Two rods **63** threaded at their ends, have mounted upon them pairs of contact carriers **64**, **65** made of insulating material. The arrangement of these contact carriers corresponds to the positions of contact disc **39**. The threaded rods **63** are secured in place by nuts **74**. Each contact disc **39** is, in this arrangement, provided with a right contact carrier **64** and a left contact carrier **65**. The contact blades, contact springs, or fingers **66** are embedded within the insulating carriers **64** and **65**, and are provided with soldered contact points **67** for the purpose of sensing both sides of the contact disc. The carriers **64**, **65** are fixed in rectangular elongated slots in the frame **54** and holding bracket **69**. The contact blades or springs **66**, **71**, and **72** are of different length, and for this reason the contact points **67** are distributed over a quadrant of the contact disc **39**. With their other ends, the contact blades **66**, **71** and **72** project from the insulating carriers **64** and **65**, and are connected with a multiple lead cable **73** by being soldered thereto. These ends of the contact blade **66**, **71** and **72** are designed in the form of terminals **66***a*, **71***a* and **72***a*. A cable clamp **75** is mounted in place with two screws **76** and hexagonal nuts **77**, to the frame **54**. In this manner, tensile forces cannot be applied to the soldered connections. The entire arrangement of FIGS. **3** and **4** forms the construction of a plug-in unit. The frame **54** has, in addition, two elongated slots **78** in which the frame is fixed in place by screws **52** after mounting on the bar **53**.

FIGS. **5***a* to **5***c* show both side views of the contact disc **39** for applications in accordance with the present invention. The associated code table is shown in FIG. **5***d* in which the 10 digits for the decimal counting system are represented through conventional binary codes. In addition, a parity bit is associated with each of the digits, and provides the basis for testing with respect to even or odd number of bits which may prevail, for the purpose of detecting errors. The same code system is in the form of conductive contact tracks **79** and **80** distributed over both sides of the contact disc **39**. This may be seen in FIG. **5***a* to tc. From one side of the contact disc **39**, projects a contact ring **86** which is concentric with the periphery or perimeter of the contact disc, and is located at the central zone thereof. The conducting track segments or contact tracks for the parity bit P, and the contact tracks for the "four" and "eight" channels or code elements further surround the closed contact ring **86**. In a similar manner, the contact disc layer **80**, shown in FIG. **5***c*, is also provided with a closed contact ring **87**, and the remaining contact tracks for the "one" and "two" channels or code elements. The broadened contact ring **87** serves, at the same time, for the application of potentials to the one side. The contact tracks are arranged so that they form a conductive layer **79** and **80** without the formation of islands. Thus, without requiring conductive track junctions, these layers **79** and **80** may be utilized for the entire segment length which is made proportional to the value of the digit. The bearing bushing **81** is made of conductive material for the purpose of forming a conductive connection between the two contact layers **79** and **80**. This bearing bushing **81** is provided with a rim-shaped portion **88**, and is riveted to the disc **39** with a contact ring **82** made of the same material. If the voltage potential is applied through contact springs or blades, then the contact disc is inserted onto the shaft **60** with an insulating operating or running bushing **83**. It is possible to apply the entire potential to the contact layers, through a conductive shaft **60** and through the bushing **88**.

In the operation of the arrangement of the present invention, it is essential to note that when assemblying or in the state of operation, the contact discs **39** are always in mesh or contact with the counting and printing wheels or drums **17**.

Due to the coupling in the form of gear teeth **58** to these indicating and printing drums, the contact discs **39** also assume angular positions correlated to the values represented by the counting and printing rollers or drums. In the embodiment pertaining to the particularly selected application for the present invention, the printing and counting rollers or drums **17** always rotate in an adding direction. A quantitative measuring device drives these drums **17** through simultaneous and identically coupled motion with continuous contact or coupling with the contact discs. During the counting process, no voltage prevails at the contact **39**. Through means of the rotational knob **12**, a printing record for the printing process may be manually set and adjusted. The process is composed of individual phases which are essentially comprised of adjusting, printing and sampling, as well as setting to zero the counting and printing type of rollers or drums.

The recording of integral and readable printed digits is desired under many different light conditions. In this regard, the arresting rod **24** which is mechanically controlled, reaches with its pawl-shaped arm **23** into the star wheel **22**, through the action of the spring **30**, during the first phase of the printing process. As a result, the star wheel **22** becomes properly set and arrested. The star wheel **22** is rotatably secured to the printing roller or drum **17**, and adjusts the latter at this instant of time to a printing position which represents an integral number or a rounded-off number. At the same time, the associated contact disc **39** is set to the corresponding coded position. The counting rollers or drums associated with the higher decimal orders, however, are also retained in integral printing positions through the advancing mechanism, and experience a further fine adjustment in position and fixing in position for the purpose of realizing a satisfactory printed result. For this purpose, the shaft **33** moves, by means of the bracket **36** clamped thereto, into the gearing of the mechanism or drive **21**, and sets the latter into fixed position until printing and sampling are subsequently carried out. The leaf spring arms **38** are soldered onto the bracket **36**, at the height of the advancing mechanism or drive **21**. Through this arrangement, the entire printing roller assembly **17** and particularly also the coded contact disc assembly **39** which is coupled thereto, are set so that they are in a solute agreement and are precisely and finely set for the printing and interrogation, preparatory for the time interval during which the data is provided.

The subsequent operational phase is carried out through the lowering of the printing hammer **49** for the purpose of transferring the digits to the record paper, and for the purpose of briefly energizing the output arrangement to transmit the measured value. Through a direct current connection between the data processing system and the sampling counter, the individual codified digital positions are sampled and read out from the sampling counter. In this operating phase, the counter and printing rollers, and thereby the entire contact assembly of the output arrangement remain in locked position until the sampling of the different parameters has been fully completed. After this operational phase, which may take place during fractions of a second, the counters and printing rollers as well as the contact disc become first set or reset to their zero or initial positions. This third and last phase of the operating program, becomes controlled through a mechanism which is functionally reliable, and which requires here no further clarification in relation to the present invention.

The present invention provides for the illustrated application, apparatus which is packaged within a small amount of space and has a plurality of advantages for counters used in conjunction with the rapidly advancing data processing field. In compact constructional form, digital values are taken from mechanical counting units and are directly converted into one or more coded systems which are retained for subsequent sampling purposes. This compact construction, furthermore, may be combined with most of the conventional counter constructions. In the past, sensitive contact adjustment and/or a plurality of pulse signal lines with their accompanying problems were necessary for preparing the digital data for data processes, in conjunction with costly digital to analog converters. Furthermore, the arrangements in the past, have been very costly to produce. With the apparatus of the present invention, however, a solution to the problem is demonstrated with simplicity in construction and absolute reliability in operation. The present invention, furthermore, is significantly less costly to manufacture. The present invention is, furthermore, of particular significance in this age of rapidly advancing automation, through the assembly and disassembly features involving interchangeable parts and variable designs for a mechanical counting unit with one or more code systems. A coding arrangement directly coupled with the counting roller allows the equipment for remote transmission of the information to be considerably reduced with the accompanying savings. If one takes, moreover, into account the simple functional operation of the data output, in which an applied DC voltage prevails only during the sampling instant, the advantages of a unit with long operating life and free from disturbances becomes evident. The binary outputs are, furthermore, not influenced through disturbances from electrical sources, which are generally feared. A further feature of the present invention resides in the manner in which the individual parts are constructed so that they are readily accessible for servicing or interchanging when required. The contact springs or blades afford the contact discs which run loose upon their shaft, a precise operation free of disturbances. At the same time, torques or moments which may injure the contact springs through excessive spreading, are prevented. Thus, the spring pressures become compensated in line with this feature.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in counter readout arrangements, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. Electrical readout for counters, comprising supporting means; counter means mounted on said supporting means and including a series of individually rotatable counter drums having counter gear teeth; means for rotating said counter drums to a position representing a value; and a readout unit including a frame, and means detachably mounting said frame on said supporting means, a series of individually rotatable contact discs mounted on said frame and having connecting gear teeth meshing with said counter gear teeth of said counter drums, respectively, each contact disc including at least one contact layer having circumferentially extending contact portions representing different values, and a series of sensing contact means mounted on said frame for sensing said contact layers of said contact discs, respectively, each sensing contact means including sensing contacts engaging correlated contact portions of the respective contact layer for electrically transmitting information represented by the angular positions of said counter drums and contact discs.

2. Electrical readout as claimed in claim **1** wherein said counter gear teeth radially project from the peripheries of said counter drums; and wherein said connecting gear teeth radially project from the peripheries of said contact discs.

3. Electrical readout as claimed in claim **1** wherein each counter gear tooth and each connecting gear tooth corresponds to a digit, and wherein adjacent connecting gear teeth define recesses shaped corresponding to said counter gear teeth.

4. Electrical readout as claimed in claim **1** wherein said contact portions include codified contact tracks so that information is transmitted in coded form.

5. Electrical readout as claimed in claim 1 wherein each contact disc is made of insulating material; and wherein contact layers are located on both sides of each contact disc and engaged by the sensing contact means correlated with the respective contact disc.

6. Electrical readout as claimed in claim 5 wherein each contact disc includes a bearing bushing passing through said insulating material and conductively connecting said contact layers on opposite sides of the respective contact disc.

7. Electrical readout as claimed in claim 5 wherein said two contact layers of each contact disc have contact portions including contact tracks codified in accordance with different codes so that the same information represented by said counter drums can be transmitted in two different codes.

8. Electrical readout as claimed in claim 5 wherein at least one of said contact layers has a zero position indication.

9. Electrical readout as claimed in claim 5 wherein said sensing contact means include insulated carriers on said frame, and pairs of contact blades mounted on said carriers, respectively, and wherein the blades of each carrier resiliently abut opposite sides of the same contact disc for sensing said contact portions of said two contact layers.

10. Electrical readout as claimed in claim 9 wherein said contact blades of each pair have contact points abutting axially aligned points on opposite sides of the respective contact disc.

11. Electrical readout as claimed in claim 9 wherein said carriers are mounted adjacent each other on said frame and form a block.

12. Electrical readout as claimed in claim 1 comprising another unit exchangeable for said unit and having a correspondingly shaped frame fitting on said support, and a different number of correlated counter drums, contact discs, and sensing contact means.

13. Electrical readout as claimed in claim 1 wherein said unit comprises arresting means for arresting said counter drums and contact discs in uniquely defined angular positions representing digits.

14. Electrical readout as claimed in claim 1 wherein said means for rotating include measuring means connected to said counter means so that said counter means and said contact discs represent the quantity measured by said measuring means.

15. Electrical readout as claimed in claim 1 wherein said counter drums have digital printing portions separated by recesses engaged by said connecting gear teeth.

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