Nov. 1, 1932. H. S. SATTERLEE 1,885,863

IDENTIFYING APPARATUS

Original Filed Jan. 20, 1922 2 Sheets-Sheet 1

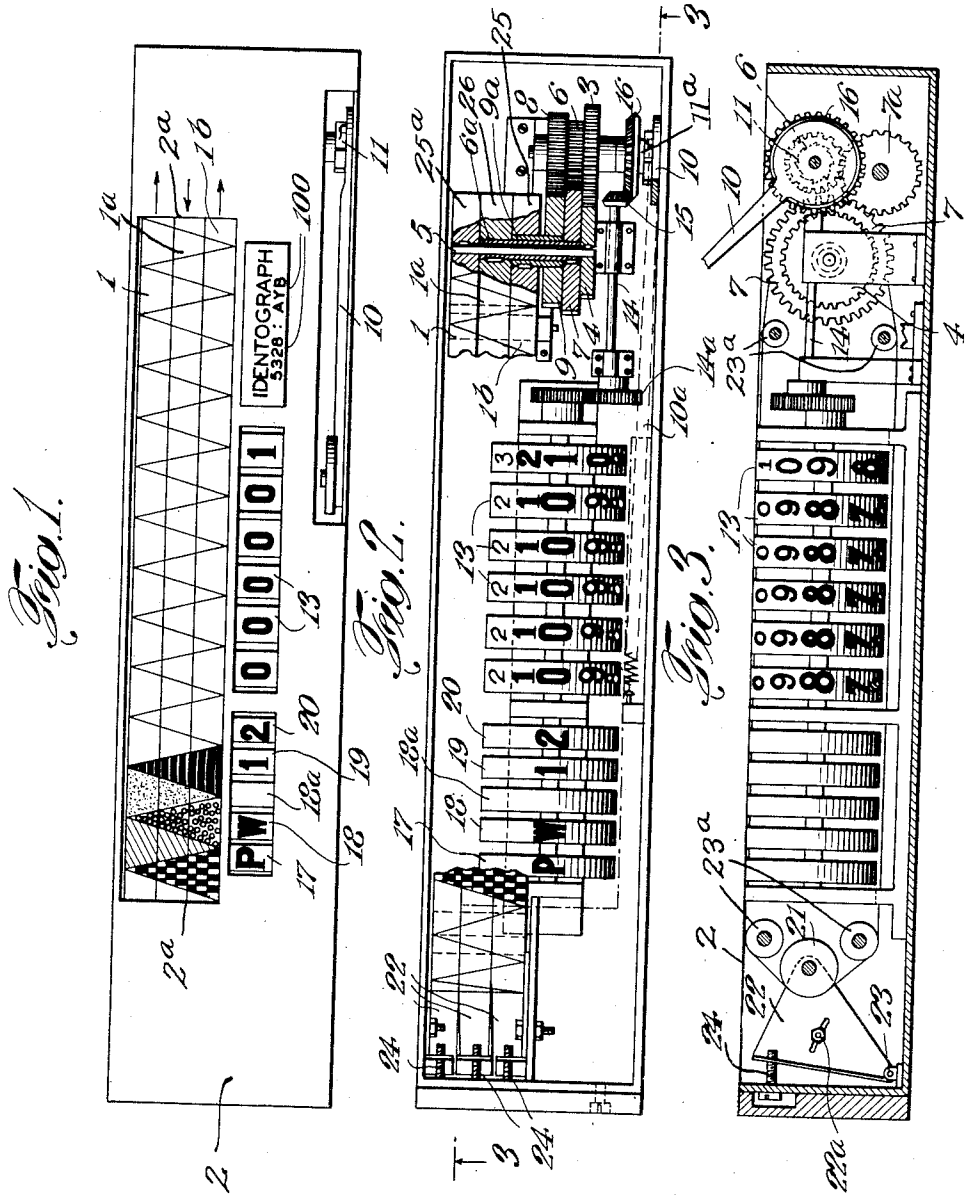


Fig. 1.

Fig. 2.

Fig. 3.

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Fig. 4.

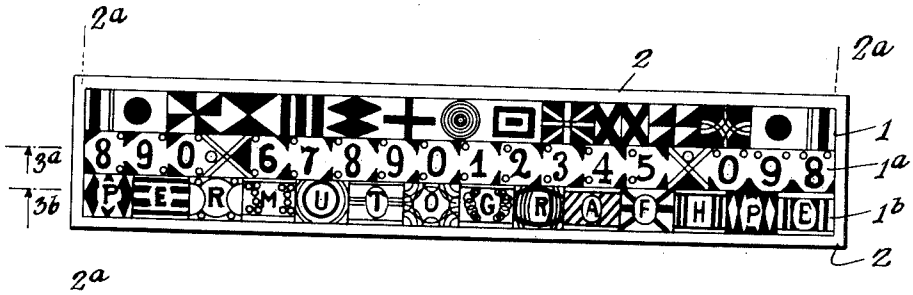



Fig. 5.

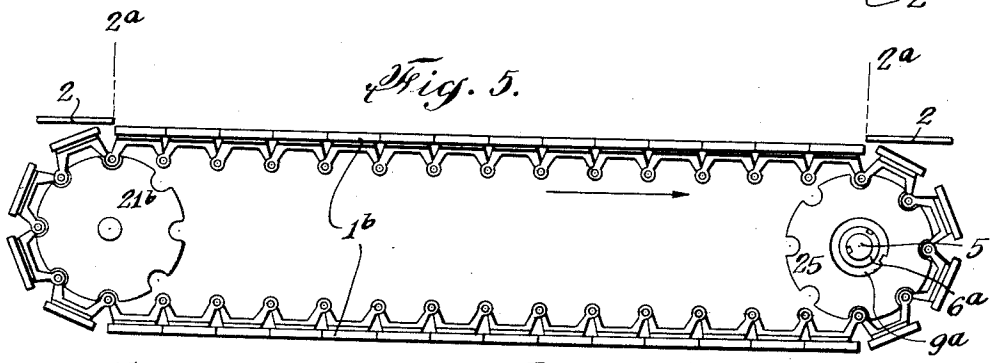
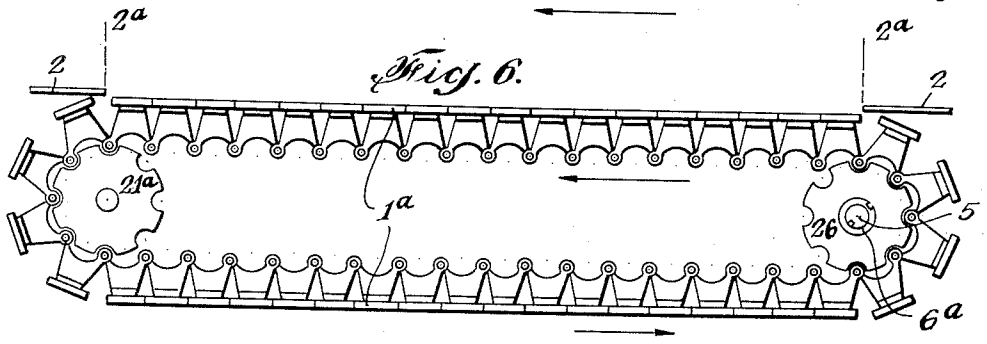



Fig. 6.

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Patented Nov. 1, 1932

1,885,863

# UNITED STATES PATENT OFFICE

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## IDENTIFYING APPARATUS

Original applications filed January 20, 1922, Serial No. 530,504, and April 7, 1925, Serial No. 21,430. Divided and this application filed June 19, 1930. Serial No. 462,390.

My invention relates to identifying apparatus. It will be described in connection with photographic reproductions. However, it is understood that it may be applied in many other ways and is in no way limited to this particular use.

While photographic reproductions for purposes of identification are not uncommon, it is evident that the methods commonly employed do not in themselves provide means for positive identification of the copy, but depend ultimately upon the testimony of the person making the copy. With such methods there is often the question of a spurious copy of a document or of copies of questionable data, as, for instance, of copies made before or after disputed changes or erasures. No method of which I am aware is capable of fixing the date, source and other precise circumstances connected with the making of a photographic copy by reliable means of mechanical certification.

By applying my invention to objects such as a letter or other document having a series of pages, it is possible not only to record the original pages photographically in a definite series, but to place with each original page of the series a photographic certification relating not only to the documents as a whole, but to the order of its sequence with respect to other pages. Moreover, provision is made for a simultaneous record of the date, the place, the operator, the copying machine, the identifying mechanism, and a variety of other circumstances, which would make the identification of this particular copy of the document so positive as to remove all doubt as to its individual significance.

The principle of my invention is subject to other wide use and is not confined solely to documents, but may be extended to any object capable of being photographed in the ordinary manner, or by projection for the identifying of transparencies, or by photo-mechanical processes or with color photography and has a wide range of usefulness beyond the obvious adaptation of the reproduction and identification of commercial or legal documents, such as exhibits, fingerprints, drawings and the like. For instance, my perpetually differential symbol system is in itself specifically applicable to the photo-mechanical identification of the individual members of a serial issue of bonds, banknotes, passports and the like, where the differential symbol complexes may be merged with the border or background, or with the consistent ornamental design of the series, which latter would serve as the frame of reference for the system as applying to the particular series of documents.

In the form in which I choose to illustrate my invention I employ a series of identifying symbols. These elements may be movable, one with respect to the other, or in sequence, or together and there may be a plurality of sets of symbol-carrying elements. One or more of these sets of symbol-carrying elements is designed to produce non-duplicating relations within themselves, by the mechanism to be presently described, consisting of a non-multiple combination of gear trains.

The identifying apparatus may be operated independently of the will of the operator, if desired, or it may be operated entirely by him, or it may be partly automatic and partly manual.

The special application of my invention is to associate with an object being reproduced or copied a positive identifying means mathematically designed to prevent reduplication, it will be seen that this invention is capable of wide application in the photo-mechanical arts; and is not limited to the precise embodiment here shown and described, which I choose purely for the purposes of illustration and description.

In the following specification and drawings, wherein like reference characters are appended to like parts in the various figures, I set forth the invention in one of its forms:

Figure 1 is a plan view of one embodiment of the identifying apparatus.

Figure 2 is a plan view, partly in section, of Figure 1 with the cover removed.

Figure 3 is a longitudinal section through 3—3 of Figure 2.

Figure 4 is a plan view of identifying belts showing a part of a set of symbols carried

thereby as the set would appear within the aperture of the reference frame of the apparatus.

Figure 5 is a longitudinal section through one of the symbol belts of Figure 4 at 3*b*, illustrating the means of carrying the identifying symbols upon a linked belt and of moving the belt by sprocket wheels past the aperture of the reference frame of the apparatus.

Figure 6 is a similar longitudinal section through another of the symbol belts of Figure 4 at 3*a*.

For the purpose of description I show my special non-duplicating identifying mechanism as having three endless belts 1, 1*a* and 1*b* in Figures 1, 4, 5 and 6 upon which may be any desired series of symbols comprising an abundance of different elements showing detailed contracts, preferably in black and white, and which I show in Figures 1 and 4 as being of geometric shape and of various designs. Obviously these designs may be varied greatly and may be combined with conventional letters and figures to suit requirements as in Figure 4 but part of them, or their arrangement in series, may be in some respect unique for each machine manufactured. These belts may be driven in different directions, as shown by the arrows past an aperture 2*a*, 2*a*, in the reference frame 2, which forms the surface of the mechanism lying in the photographic focal plane of the object to be copied and identified, or they may be geared to move all in the same direction if preferred. For this purpose I provide a train of differential non-multiple gearing for a series of concentric shafts 5, 6*a* and 9*a*; that is, belt 1 would be carried upon a wheel or sprocket 25*a* keyed to a shaft 5 and driven by gear 4 and gear 3. Similarly belt 1*a* would be carried upon a wheel or sprocket 25 keyed to a shaft 6*a* and driven by gears 7, 7*a* and gear 6. Belt 1*b* would be carried upon a wheel or sprocket 26 keyed to shaft 9*a* and driven by gear 9 and gear 8. The belts 1 and 1*b* moving in the same direction and belt 1*a* in the opposite direction, it is necessary to reverse the direction of gear 7 and this I do by placing an idler or intermediate gear 7*a* between the gears 7 and 6 as shown in Figure 3. All of these gears 3, 6 and 8 are affixed to a common drive shaft 11*a*, which in turn is rotated by any convenient method of producing intermittent motion. In the illustration this is accomplished by the oscillating movement of the arm 10 and this oscillating movement is transferred to the gears by a pawl and ratchet 11 and the arm 10 is normally held upward by the tension of the spring 10*a*, so that each time this arm 10 is depressed the gears are actuated and, when the arm 10 is released, it resumes its upward position without affecting the gear mechanism. In Figures 1 and 3 this arm 10 is shown in its upward position.

The principles of differential gearing ratios of step-motion, are not so well known to the art but that it is necessary to explain their application in this instance and to indicate the means employed to obtain non-multiple step movements of a series of belts moving in juxtaposition. It should, therefore, be noticed that in the illustration, Figure 2, the number of teeth on all driving gears is a prime number, viz, gear 3 has thirty-one teeth, gear 6 has seventeen teeth, and gear 8 has twenty-nine teeth. To produce a non-multiple step-by-step rotation of the belt-driving shafts 5, 6*a*, and 9*a*, with relation one another, it is convenient but not strictly necessary to have prime numbered teeth on these drive gears; it is, however, necessary to have numbers of teeth on these gears which are not multiples one of another, or else to introduce non-multiple ratios elsewhere in the gear trains of the drive mechanism, that is to say between the actuating device and the sprockets or drums which carry the symbol belts. To produce non-recurrence of the symbol-carrying belts 1, 1*a*, and 1*b* in like position with respect to the reference frame and its gauge marks it is provided that the distances which represent the complete circuits of the belts along their pitch lines are constructed so as to be not multiples of the distances of their respective step movements. By the arrangement here shown it will be seen that a single throw of the actuating arm 10 will rotate drive shaft 11*a*, and the driving gears which are keyed to it will move through a certain arc. This rotation produces a differential movement of the drums or sprockets 25, 25*a*, and 26 which carry the symbol-bearing belts, so as to propel these belts different distances, such distances having to each other the non-multiple ratios: 31/29 for belt 1, 17/33 for belt 1*a*, and 29/31 for belt 1*b*. These ratios expressed as decimals are respectively: 1.0689 ... (a 28-place repeating decimal), 0.5151 ... (a two-place repeating decimal), and 0.9354 ... (a 15-place decimal). The belts 1, 1*a*, and 1*b* have therefore steps of motion which carry the symbols which they bear on their faces over distances which have no common divisor. It is evident that such steps represent mathematical surds or irrational numbers with respect to one another which prevents recurrence of any one coincidence of position with respect to one another, of the belts which move in the same direction, and also of all belts with respect to any point on the reference frame, as upon the margin of the above 2*a*—2*a*. When such a mathematical progression is applied to a very large number of different elements connected with each of the moving factors, as is the case with the symbol aggregations on the belts, it is obvious

that we have to deal with an infinite variation of positions between, say 116 elements and any given point taken on the surrounding frame of reference. It will also be evident that the variability of the identifying symbol-patterns is still further elaborated by other fixed and movable reference marks presently to be described as part of my invention.

On the same shaft 11*a* actuated by the arm 10 I show a bevel gear 16 meshing with bevel pinion 15, adapted to drive the shaft 14 which turns the wheels 13 through the gearing 14*a*. These wheels 13 are indicating wheels which carry symbols, and in the present instance I show them as indicating and accumulating wheels having simple multiple gears common to numbering machines, i. e., of the ratio 10:1, for serial numbers to 999999. At 17, 18, 18*a*, 19 and 20 are other indicating wheels, but these differ from the first wheels inasmuch as they are not automatically operated, by arm 10, but any one of them may be set at any position at the will of the operator to register any symbol or series of symbols desired.

Surrounding the symbol carrying elements just described, is the upper surface of the frame 2 of the identifying mechanism, which I designate as the frame of reference. On this frame 2 on either side of the aperture 2*a*, 2*a* may be laid, pasted or otherwise affixed, a card or cards bearing any legend, seal or signatures which may thus be photographically registered in association with the other symbols. Although these spaces are provided for special or occasional use as just stated, they may be employed to display permanent engraving or ornamentation to suit requirements.

At 100 in Figure 1 is a series of fixed symbols, such as the name of the machine, the manufacturer's serial number and type of that machine and a code, giving the particular symbol belts used with the corresponding gear ratios as, for instance, the letters A Y B may here have reference to the first three geometric symbols shown on belt 1, Figure 4 and these letters and the associated symbols just mentioned may refer in the manufacturer's code to the numbers 31, 17 and 29 respectively, which are the numbers of the teeth on the drive gears 3, 6 and 8 in Figure 2.

The belts 1, 1*a* and 1*b*, being endless, it is desirable to provide some means for maintaining upon them the proper tension and this I do by having the idler wheels 21 affixed to the supports 22, pivoted at 23 and adjustable for tension by these screws 24. When the desired tension has been secured the plate 22 may be secured in position by the binding screw 22*a*. The guide pulleys 23*a* are used only when employing friction belts as indicated in Figure 3, and are not used when linked belts are employed as shown in Figures 5 and 6.

If the identifying apparatus is to be used in connection with photographic reproduction it is merely necessary to expose the same within the photographic field in connection with the article to be photographed. Each time that a new article is to be photographed the arm 10 is forced down. This may be accomplished automatically or by hand, or by means partly automatic and partly manual. The depression of the arm 10 automatically actuates the symbol-changing device as follows:

The pawl and ratchet 11 being in engagement, the gears 3, 6 and 8 will rotate a short distance to move the belts 1, 1*a* and 1*b* in their respective directions and the symbols on these belts will then assume a combination for a particular reproduction to be made. Also the wheels 13 will be rotated through the bevel gear and pinion 16 and 15 to show the proper serial number. The wheels to the left of wheel 13 will not move but will present the symbols determined upon in advance by the operator. In the present instance the PW. might stand for Perkins against Walker and the 12 represent that this reproduction was the twelfth paper in the case. A card placed upon the reference frame 2, in the space provided for this purpose on either side of the symbol opening 2*a*, 2*a*, may show the operator's name and date on which he was operating the machine. Therefore with the apparatus set, as shown, there would be a definite symbol combination on the belts 1, 1*a* and 1*b*, an identifying code at 100 for the particular machine and belts used, the serial number of the copy at 13, the matter to which the reproduction relates shown at 17 and 18, and the place of the document at 19 and 20 and the operator's name and the date on a card lying on the reference frame.

So it will be seen that there is a positive and unalterable identification which is obtained, not only by a perpetually differential system of specific marking, but also by the relation of so many associated facts and circumstances, connecting the copy with its specific marking as to make identification certain.

When the device is to be used in connection with photographic reproductions, as soon as one operation is completed, the object photographed is usually withdrawn. The mechanism here shown is adapted to be operated by the positioning of a glass plate over the object to be copied while said object is lying in juxtaposition to the reference frame of the identifying mechanism and while both the object and the reference frame of the identifying device are within the field and focal plane of the copying camera. Arm 10 assumes the raised position

through action of spring 10*a*, as already explained, whenever the glass plate is raised for positioning of a new object; the depression of arm 10 by the glass plate prior to photographic exposure therefore produces rotation of the gears on shaft 11*a* through a predetermined arc, effecting the formation of a new combination.

As previously set forth, the rotation of drive shaft 11*a* may well be accomplished by any piece of mechanism which conveniently connects it with other apparatus, such as the copy holder or camera itself. Arm 10 is merely illustrative of a connecting mechanism for the identifying mechanism to provide a means of automatic functioning in continuity with other apparatus if desired.

While I illustrate the method of driving the belts by means of frictional contact for the sake of simplicity of drawing in Figure 3, I do not limit myself to such a method as a drive by sprocket wheels at 25 and 26 in Figures 5 and 6 or other means in place of a friction drum on shafts 5, 6*a* and 9*a* and suitable conveyor belts with linked sections, as in Figures 5 and 6 bearing the symbols on their faces, as in Figure 4, are equally capable of accomplishing the same purpose.

The first of these classes of identifying elements is the specially devised, non-multiple, differential system of movable elements, constituting an unlimited progressive series of distinguishable symbol-combinations. Obviously this collection of symbol-bearing elements may be a unique assortment or show an individual arrangement peculiar to itself in each individual machine; and this is one of its important functions.

The second class of identifying elements consists of a set or sets, of automatically numbering or lettering systems of the conventional multiple repeating design and limited range, but geared so as to be moved step-by-step simultaneously with the step changes of the first system above mentioned.

The third class of identifying elements consists of a set or plurality of sets of marks or symbols, each such set being movable and selectively changeable, within its own limited range of mutations, at the will of the operator.

The fourth class of identifying elements consists of marks and legends which are more or less permanently fixed upon the surface of the reference frame which encloses and displays through its openings the movable classes of elements. The function of this class is to identify the machine as a whole and with it the particular group-complexes of symbols which are associated with its mechanism.

The fifth class of elements consists of such accessory markers, legends or pasters as may serve to record dates, times of day or night, witnesses, authorities or other associated circumstances according to requirements. These elements may be simply laid upon the reference frame in the places provided, or at any other convenient place within the photographic field, it being understood that the reference frame is not limited in position to any one part of the photographic field, but may occupy any marginal area or the entire border. The intrinsic part of the machine which represents this last class of identifying elements is the reference frame itself which supports these accessory marks of record and holds them in relation to the other groups of symbols.

It will be seen, that the function of the first two classes of elements is to identify the object in relation to a single phase in the changing aspect of an individual mechanism; that the function of the third class of identifying marks is to provide for the segregation or allocation of the copy to any set, group or office system of records; that the fourth class is to furnish identification for the identifying mechanism itself in connection with the copy; and that the fifth class is to provide the ordinary attestation of witnesses to a copy, or the official authority of a copy for certain legal or commercial purposes.

From the foregoing it will be clear that I provide a positive identification for the photographic reproduction of flat objects through the agency of five classes of identifying elements, all of which are marks of such nature as to be plainly reproduced by any photographic process suited to copying and that my invention is adaptable to a very wide field of use beyond what I have specifically described and I desire to bring within the scope of my claims all such adaptations and changes.

Having described my invention it is obvious that many modifications may be made in the same within the scope of the claims without departing from the spirit thereof.

This application is a division of my copending applications for identifying apparatus, Serial No. 21,430, filed April 7, 1925, on which application Patent Number 1,835,340 was granted on December 8, 1931, and for photographic apparatus, Serial No. 530,504, filed January 20, 1922, on which application Patent Number 1,801,458 was granted on April 21, 1931.

I claim:

1. An identifying device having a plurality of symbol-bearing elements movable longitudinally with respect to one another, a plurality of rotatable symbol-bearing elements movable with respect to one another and with respect to said longitudinal movable elements and a common actuating means independent of the will of the operator to vary the relative position of all of said elements.

2. In a device of the class described, in

combination, a plurality of belts having symbols thereon, means for mounting said belts, and means for simultaneously moving each belt at a specifically non-multiple rate oppositely with respect to the adjacent belt to form different combinations of symbols.

3. In a device of the class described, in combination, a plurality of movable elements having symbols thereon, means for mounting said movable elements, and means for adjusting each element in a definite progression oppositely with respect to the adjacent element to form different combinations of symbols.

4. In a device of the class described, a plurality of movable elements having symbols thereon, means for mounting said movable elements, and means for determining the rate of movement of certain of said movable elements in a definite non-multiple progression with respect to the adjacent elements to form non-duplicating combinations of symbols.

5. In a device of the class described, in combination, a plurality of movable elements having surfaces bearing symbols, means for mounting said movable elements to be relatively movable, a common actuating means for moving said elements, and connections, having specifically non-multiple ratios between the mounting means for said elements and said actuating means for producing step movements of said elements in differential progression.

6. In a device of the class described, in combination, a plurality of movable elements having symbols thereon, means for mounting said movable elements, and means for actuating each movable element at a rate intermittent progression which is neither a multiple nor a divisor of the rate of the adjacent element to form various combinations of symbols.

7. In a device of the class described, in combination, a plurality of means having surfaces bearing symbols, means for mounting said symbol-bearing means so as to be relatively movable, a common actuating means for moving said symbol-bearing means, and connections between said plurality of symbol-bearing means and said actuating means for moving said means simultaneously at rates different from one another.

8. In a device of the class described, in combination, a plurality of belts having symbols thereon, means for mounting said belts, and means for simultaneously moving each belt oppositely with respect to the adjacent belt to form different combinations of symbols.

9. In a device of the class described, in combination, a plurality of belts having surfaces bearing symbols, means for mounting said belts so as to be relatively movable, a common actuating means for moving said belts, and connections of different ratios between said belt-mounting means and said actuating means for moving said belts at rates differing from one another.

10. In a device of the class described, in combination, a plurality of means having surfaces bearing symbols, means for mounting said symbol-bearing means so as to be relatively movable, means for moving said symbol-bearing means relatively to one another in a definite progression to form different combinations of symbols, a numbering mechanism associated with said symbol mechanism for further identification, and a common member for operating said symbol-bearing means and said numbering mechanism.

11. In a device of the kind described, in combination, a plurality of longitudinally movable elements having symbols thereon, a plurality of revolving elements having symbols thereon and actuating means common to both sets of elements.

12. In a device of the class described, in combination, a plurality of movable elements having surfaces bearing distinctive symbols, means for mounting said movable elements to be relatively movable, a common source of power for moving said elements, and connections of different ratios between the mounting means for said elements and said source of power for moving said elements at different rates relative to one another, so as to produce step-by-step symbol complexes in unlimited differential sequence.

13. In a device of the class described, in combination, a plurality of movable elements having symbols thereon, means for mounting said movable elements, and means for automatically actuating each movable element at a rate differing from the rate of the adjacent element to form various combinations of symbols, adapted to produce a perpetually differential non-duplicating series of said symbols.

14. In a device of the class described, in combination, a plurality of means having surfaces bearing symbols, means for mounting said symbol-bearing means within a reference frame to be relatively movable past an aperture within said reference frame, a common actuating means for simultaneously moving said symbol-bearing means, and connections between said plurality of symbol-bearing means and said actuating means for moving said plurality of symbol-bearing means to step distance bearing definitely non-multiple ratios with respect to one another.

15. In a device of the class described, in combination, a plurality of belts having surfaces bearing symbols, means for mounting said belts so as to be relatively movable, a common actuating means for moving said belts, and connections of different non-multiple ratios between said belt mounting means and said actuating means for moving said

belts at specifically calculated non-multiple rates relative to one another.

16. In a device of the class described, in combination, a plurality of means having surfaces bearing symbols, means for mounting said symbol-bearing means so as to be relatively movable, means for moving said symbol-bearing means relatively to one another in a definite non-multiple progression to form differing combinations of symbols, a numbering mechanism associated with said symbol mechanism for further identification, and a common member for simultaneously operating said symbol-bearing means and said numbering mechanism.

17. In a device of the kind described in combination, a reference frame, a plurality of movable elements bearing symbols thereon adapted to be displayed within said reference frame, and a common actuating and differentiating means for producing specifically non-multiple step movements of said elements relative to one another to form a perpetually differential system of distinctive changes in the displayed combinations of said symbols and in the positions of said displayed combinations relative to said reference frame.

18. In a device of the kind described, in combination, a plurality of longitudinally movable elements having surfaces bearing distinctive symbols thereon, an apertured reference frame common to both sets of elements and adapted to display a part of said symbols through its apertures, and actuating means common to both sets of elements adapted to produce simultaneous step movements of said symbols past said apertures.

19. In a device of the class described, in combination, a plurality of systems of movable elements having surfaces bearing distinctive symbols, means for mounting said systems of movable elements to be relatively movable within an apertured reference frame, a common source of power for imparting simultaneous step-by-step movements to said systems of elements, and connections of non-multiple gearing between said source of power and said mounting means for moving a part of said symbol-bearing elements or said systems of symbol-bearing elements through step-movements having non-multiple ratios to one another, so as to display within the aperture of said reference frame an unlimited succession of symbol-complexes in distinctive differential sequence as to detail combination and as to position within said aperture.

20. In a device of the class described, in combination a plurality of movable elements having surfaces bearing distinctive symbols, means for mounting said elements to display their symbol-bearing surfaces adjacently and collectively and to be relatively movable within a frame of reference, differential actuating means adapted to produce a succession of step movements of each of said movable elements through step distances of such magnitude as not to be a multiple nor a divisor of the step distance of any adjacent element and so as to effect a perpetually differential sequence of transformation of symbol grouping.

21. In a device of the class described, in combination, a reference frame enclosing an aperture or apertures, a plurality of sets of movable elements having surfaces bearing symbols thereon, mounting means for said sets of elements adapted to display a part of said symbol-bearing surfaces in juxtaposition as symbol-complexes within the visual aperture or apertures of said reference frame, and a means for actuating each set of elements step-by-step with respect to its adjacent set of elements by a non-multiple differential drive, to produce a succession of perpetually different transformations of said symbol-complexes and of the positions of said symbol-bearing surfaces relative to one another and relative to said reference frame.

22. In a device of the class described, in combination, a plurality of movable belts bearing a plurality of distinctive symbols upon their surfaces, means for mounting said belts so as to display a part of said symbol-bearing surfaces within an aperture or apertures in a surrounding reference frame, a plurality of gauge marks, fixed symbols, or other stationary indicia displayed upon said reference frame, means for producing simultaneous step movements of constant magnitude for each belt, and means of gearing said step motion for each belt to determine a non-multiple ratio between the constant magnitude of motion of any one belt and that of any adjacent belt, to effect a distinctive succession of combinations and of differing permutations of said symbols within said apertures and with reference to said gauge marks and stationary indicia of said reference frame.

23. In a device of the class described, in combination, a plurality of movable elements having surfaces bearing distinctive symbols, means for mounting said movable elements, means for actuating all of said movable elements intermittently and simultaneously, and connecting means between said actuating means and said mounting means for determining the extent of the intermittent step motion of any one of said movable elements with respect to that of any one other of said movable elements to determine a definitely non-multiple ratio between the magnitudes of said steps of motion of said two movable elements.

24. In a device of the kind described, in combination, a stationary reference frame, a plurality of sets of linked movable elements bearing symbols thereon adapted to be displayed within said reference frame, a common actuating means for intermittently driving said sets of linked elements to perform a

definite circuit within said reference frame, and differentiating means in connection with said actuating means for producing specifically non-multiple step movements of each of said sets of linked elements relative to one another and relative to the distance traversed by it in making a complete circuit of said reference frame.

25. In a device of the class described, in combination, a stationary reference frame bearing fixed indicia, a plurality of movable elements having surfaces bearing symbols thereon, means for mounting said movable elements to display their symbol bearing surfaces adjacently and collectively to be driven circuitously past an aperture in said reference frame, differential actuating means adapted to drive said elements so as to produce simultaneously a succession of step movements of each of said elements of constant magnitude for each element and of such magnitude for each element as to have no rational common multiple with respect to the magnitude of the constant step distance proper to any adjacent element, nor with respect to the total circuit distance of the course of said element within said reference frame, and so as to effect a perpetually differential sequence of symbol groupings with respect to said reference frame and its indicia.

26. In a device of the class described, in combination, a plurality of movable elements having surfaces distinguishable from one another, means for mounting said elements to be relatively movable in a precisely determined circuitous course with respect to said reference frame, means for actuating all of said elements intermittently to move simultaneously by steps, and connecting means between said actuating means and said mounting means for precisely determining the extent of the step motion of each and every one of said movable elements with respect to said reference frame, to effect a pre-determined non-multiple ratio between the magnitudes of said steps of motion proper to any two movable elements and a non-multiple ratio between the magnitude of step motion of any one element and the magnitude of the total distance traversed by said element in one circuitous course with respect to said reference frame.

27. In a device of the class described, in combination, a plurality of endless belts bearing a plurality of distinctive symbols upon their surfaces, means for mounting said belts to be relatively movable within a stationary reference frame so as to display a part of said symbol-bearing surfaces within an aperture or apertures of said reference frame, a plurality of gauge marks or other stationary indicia upon said reference frame for gauging the visible positions of said symbols with reference to said aperture or apertures, means for driving said endless belts circuitously by intermitted step movements of constant magnitude for each belt and means of gearing said step motion for each of said belts to determine a definite non-multiple ratio between the constant magnitude of motion of any one belt and that of any other belt and also in relation to the total circuit length of said belt or distance traversed in one complete circuit of its pitch line, to effect a distinctive succession of perpetually differing combinations of said symbols in their grouping and in their visible positions within said aperture and with reference to the stationary indicia of said reference frame.

In testimony whereof, I have signed my name to this specification this 14th day of June, 1930.

HENRY S. SATTERLEE.