July 3, 1934. D. W. TROY 1,964,966

COIN TESTING

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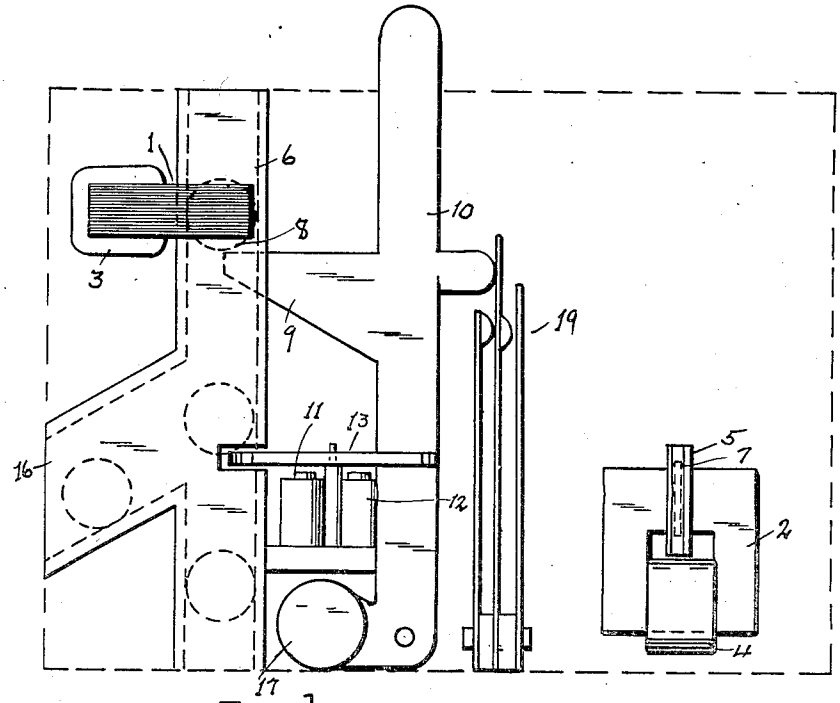

FIG. 1.

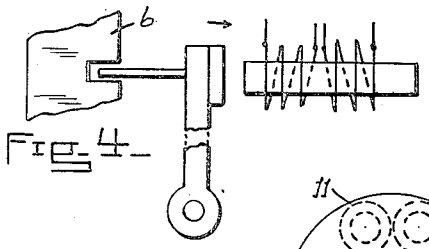

FIG. 4.

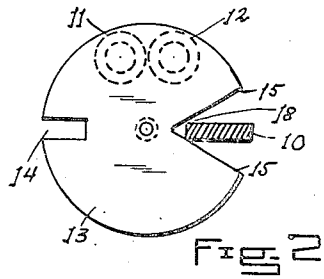

FIG. 2.

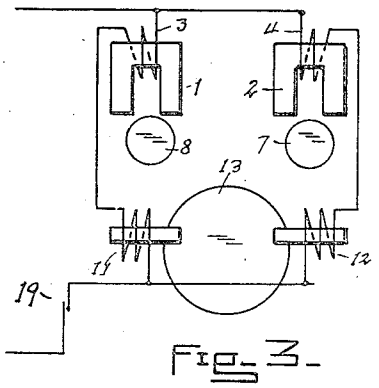

FIG. 3.

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COIN TESTING

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15 Claims. (Cl. 194—101)

The invention relates to the testing, for material, of coins, tokens, checks, slugs or similar devices used to operate or release what are generally known as coin-controlled apparatus, the term "coin" as herein used being taken as equivalent to any such device of similar function. The object of the invention is to provide a new, useful, efficient, reliable, inexpensive, quick and easily operated method for making material tests of coins, in accordance with their functioning as closed circuit windings upon the magnetic field of inductive windings carrying varying or alternating current, and to provide similarly characterized apparatus for carrying the method into effect. These objects are attained excellently by the ways and means hereinafter described.

In the drawing Fig. 1 is an elementary assembly of apparatus arranged to test coins for material content, Fig. 2 a detail of the split-phase coin-routing device, Fig. 3 a circuit diagram for Fig. 1, and Fig. 4 a detail showing a variation of the system when it is desired to utilize directly variations in amperage of the usual pair of currents employed.

The primary step of the method consists in linking the coin to be tested upon the magnetic field of an inductive winding carrying a varying current and utilizing certain values of the characteristics of such current as modified by the action of currents induced within the coin to determine the destination of the coin. Preferably this inductive winding is a primary upon the core of a transformer, the coin itself being employed as the whole secondary winding, complete in itself and not a directly connected element of any other conducting path.

The determination of the destination of the coin is best effected by employing along with the coin to be tested, linked as described upon the field of an inductive winding, a second and standard coin, similarly linked, and balancing the currents of the two inductive windings, the one against another; the condition of balance of characteristics of these two currents being the condition under which the tested coin is accepted and the condition of unbalance similarly being the condition under which the tested coin is rejected. This is very readily done by employing two transformers, having appropriate air gaps in their cores, in one of which is permanently positioned the standard coin and in the other of which the tested coin may be temporarily introduced during the testing process. The currents employed will, of course, generally be alternating and of any desired frequency. However, as the system will operate with a varying current it should be understood that the term alternating current is equivalent here to pulsatory or varying current, in fact to any current with which inductive phenomena will arise.

The preferred system under the method is to utilize as comparison characteristics of the two modified currents the phase displacements due to the action of the coins as closed circuit secondaries linked upon the magnetic fields. This permits of the balance of amounts of energy wholly unknown heretofore in the art of coin testing and through the use of apparatus responsive to phase differences makes the automatic routing of coins easy and certain. I may, of course, employ directly the difference in amperage of the currents in the two inductive windings, transformer primaries ordinarily, balancing them when test coin and standard coin function identically, and utilizing their difference when these coins fail to match in function, and in such case would operate coin routing means by such agencies as differential windings upon an electromagnet, or its equivalent. The phase displacements, however, are so conveniently handled, and the indications so positive, and the degree of refinement of comparison so high in practice that I prefer to determine where a coin shall go by the condition of balance or unbalance of the two phase displaced currents in the inductive windings.

It should be noted that under the present method the currents affected by the two coins, the tested and standard coin, may be as large as desired; as much as a hundred watts or more of energy may flow in each of the two inductive windings. In fact the amount of energy which may be employed in the test is practically limited only by the capacity of the coins to carry induced currents without undue heating. This immediately lifts the matter of coin testing from the comparison of relatively minute current differences to the matching of substantial amounts of energy, so that small percentages of difference, practically inobservable with weak currents, become now considerable absolute quantities, not only observable with ease but amply strong to actuate automatic coin routing mechanism of any kind. Actually only a few watts of energy will be needed in any such automatic mechanism. I may, if desired, use a hundred times as much.

Referring to Fig. 1, 1 and 2 are two transformer cores, each having primary windings as at 3 and 4. The cores of these transformers are provided with air gaps wide enough to admit a coin chute,

such as at 5 and 6, the first, that for the standard transformer, being only a dummy and long enough, as shown, to contain the standard coin, say a silver quarter dollar, as at 7. On core 1 the transformer windings are complete with the primary 3 and the secondary which is the coin to be tested. The standard coin is, of course, connected to nothing and forms in itself the entire secondary winding of its transformer. The coin chute 6, leading down from above, say from the top of a coin-controlled mechanism, serves to guide the coin to be tested to a position as at 8, where it can serve as secondary of the transformer of which 1 is the core. Means are provided for stopping the coin at this point, and these may be either automatic as where governed by electromagnetic means energized by the coin as it enters or descends chute 6, or manually operated as here shown. Here a detent or stop 9 is normally beneath the coin when at 8 (the dotted circle representing the coin so at rest) and is arranged to be withdrawn by a lever 10 the end of which may be moved by a would-be purchaser. The movement of this lever, however, before withdrawing the detent 9 first turns on the current through the primaries, by switch 19 and then, before completely withdrawing detent 9, turns off the current, so that during a short period of movement of lever 10 the transformers are both energized and opportunity given for the comparison of effects upon their primary currents to be made. The time required is very short but obviously the apparatus can be arranged to make this interval ample.

Each of the primaries is connected in series with a winding on a relative small electromagnet, see 11 and 12, so positioned that their fields traverse a metallic disc, say of aluminum, at 13. In Fig. 2 this disc is shown in plan with magnets 11 and 12 below it. If, now, as and when the transformers are functioning, the phase displacements of the two primary currents are alike the fields of magnets 11 and 12 will be in phase and there will be no tendency for disc 13 to rotate. On the other hand, should the primary currents have unlike phase displacement that phase displacement will be manifest in the fields of magnets 11 and 12 and the disc will tend to and actually rotate, to an extent, and so govern the coin destination, as will be explained. Disc 13 is provided with two notches, the one at 14 normally permitting a coin in chute 6 to drop freely through, for the disc works in a suitable gating cut in the walls of this chute. The other notch serves to restore the disc to normal position after a test has been made. Stops, 15, 15, limit the movement of disc 13. If, therefore, the coins fail to match in effecting modification of phase displacements in the primary currents, the transformer action results in a rotary shifting of disc 13 so that the coin, released by withdrawal of detent, strikes the disc 13 and is rejected sidewise out of the chute 6 through the side outlet or rejection opening 16. This having been effected the lever, see sectional view Fig. 2, returning to normal position under influence of a spring or other control as at 17, entering the narrow part of notch 18, returns disc 13 to normal position with the chute 6 unobstructed other than by detent 9 and ready for insertion of another coin. The split-phase means shown as including the two magnets 11 and 12 and the rotatably mounted disc 13 are merely typical of any electromagnetic motor mechanism employing the principle of out-of-phase energization, whether the out of phase components produce a rotary or progressive magnetic field. This type of apparatus, as well understood, operates through the condition that the field of one component, being out of step with that of the other, acts upon currents induced by the other and produces an electromagnetic drag in this way. The means shown may be considered, as they are, equivalent to any split-phase motor mechanism adapted to move such a detent or coin deflecting means as necessary to rout a coin which by failing in the test has permitted the two currents to have different degrees of phase displacement.

If, however, I prefer to employ the actual differences in amperages of the two primary currents I may lead these currents through relatively small windings, differentially disposed upon a core, and in manner precisely similar to that with a differential relay move an armature with the difference between these two currents. Such an armature, of course, will move a coin routing detent. However, as indicated, phase split apparatus is preferred and may be operated with a great degree of sensitiveness, in the sense of close differentiation between coins, with an amount of energy enormously out of proportion to the work to be done.

While the simplest conception of the idea of the invention is to make the currents within the coins react upon the primary currents it is evident that, should need exist therefor, that the reaction utilized might be that in still other windings linked on the fields of the inductive windings actually carrying the energizing currents.

It should be noted that while if phase differences are to be utilized the primaries are in shunt relation, if differences in effects on tertiary windings are to be used the primaries may be in series.

It is obvious that if the detent is withdrawn before and not after a coin is inserted the immediate effect, the transformers being wholly unbalanced in that one has secondary and the other none, is to move disc 13 to reject position, so that any coin inserted after movement of lever is rejected. Similarly discs of paper, bakelite, or nonconducting material, dropped down chute 6 immediately produce unbalance of the transformers and rejection. Iron discs, or washers, unbalancing the transformers in another way, by increasing the flux, are similarly rejected, and it is immaterial that such iron members stick, for immediately current is turned off they will fall down chute and be rejected by disc 13.

Naturally the testing will be the same, whether or not the detent 9 and the switch mechanism and the return of the rejection disc be effected manually or by automatic coin-controlled means such as mentioned above. For this reason the means employed are claimed broadly in their essential aspects.

While described as operative to selectively receive silver quarter dollars the method, and apparatus when suitably dimensioned, may be used to selectively receive coins of any kind; the particular coin used as the standard secondary determining that only a coin of that kind will be received.

It may be noted here that in the particular use of the coins, in both the standard coin and the tested coin the coin becomes to an extent part of the magnetic circuit, the flux traversing the coin from side to side, as also the entire secondary circuit. The permeability of coins will thus affect their performance as such sec-

ondaries. Both conductivity and permeability of coins operate in the testing under my method.

Having described my invention, what I claim is:—

1. The method set forth, which consists in linking the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying alternating current and utilizing the difference, if any, between certain characteristics of such current and like characteristics of another current in a like winding and with a standard coin similarly linked to determine the destination of the coin being tested, substantially as set forth.

2. The method set forth, which consists in linking the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying alternating current and utilizing the difference, if any, between the phase displacement of such current and the phase displacement of another current in a like winding and with a standard coin similarly linked to determine the destination of the coin being tested, substantially as set forth.

3. The method described, which consists in linking the coin to be tested as a closed circuit winding upon the field of a transformer, linking a standard coin in like manner upon the field of another transformer, and utilizing the differences, if any, in the characteristics of respective currents in other windings, one of them linked upon the field of each transformer, to automatically determine the destination of the coin being tested, substantially as set forth.

4. The method set forth, which consists in matching the action of the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying an alternating current, against the action of a standard coin similarly functioning upon the magnetic field of another inductive winding carrying an alternating current, and determining the destination of the coin being tested automatically by the difference, if any, between said actions, substantially as set forth.

5. The method set forth, which consists in matching the action of the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying an alternating current, against the action of a standard coin similarly functioning upon the magnetic field of another inductive winding carrying an alternating current, and determining the destination of the coin by the difference, if any, in phase of said alternating currents, substantially as set forth.

6. The method set forth, which consists in displacing the phase of an alternating current by the coin to be tested, displacing the phase of another alternating current by a standard coin, and utilizing the difference in phase, if any, between said currents to determine the destination of the coin being tested, substantially as set forth.

7. In apparatus of the class described, the combination with an inductive winding, of a standard coin linked upon the magnetic field of such winding, a second inductive winding, means arranged to link a coin to be tested upon the magnetic field of such second inductive winding, and means arranged to rout coins governed by difference in phase of currents in said inductive windings, substantially as set forth.

8. In apparatus of the class described, the combination with two transformers both arranged to receive coins as secondary windings of such transformers, of coin routing means operated by phase displaced currents and governed by the difference, if any, between the phases of currents within windings of said transformers, substantially as set forth.

9. In apparatus of the class described, a transformer having a primary and arranged to receive a coin to be tested as its secondary, a second transformer having a primary and having a standard coin as its secondary, and means governed by difference in phase, if any, between currents in said primaries, arranged to rout coins, substantially as set forth.

10. In apparatus of the class described, a transformer having a primary and arranged to receive a coin to be tested as its secondary, a second transformer having a primary and having a standard coin as its secondary, and means governed by differences, if any, in characteristics of currents in said primaries, arranged to determine the destination of coins, substantially as set forth.

11. In apparatus of the class described, a transformer having a wire wound primary and a secondary composed of a standard coin, a second transformer having a wire wound primary and arranged to receive a coin to be tested as its secondary, and automatic means governed by differences, if any, in the currents in said primaries arranged to determine the destination of a coin, substantially as set forth.

12. The method set forth, which consists in producing respective displacements of phase in two alternating currents by a standard coin and a coin to be tested, respectively, and by means of such alternating currents, so modified as to phase, governing the disposition of the coin to be tested in accordance with the difference of phase displacements of said currents, substantially as set forth.

13. The method described, which consists in linking the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying alternating current and utilizing the difference, if any, between certain characteristics of such current and like characteristics of another alternating current in another winding of predetermined inductance to determine the destination of the coin, sustantially as set forth.

14. The method set forth, which consists in linking the coin to be tested as a closed circuit winding upon the magnetic field of an inductive winding carrying alternating current and utilizing the difference, if any, between the phase displacement of such current and the phase displacement of another current flowing through a winding of predetermined inductance to determine the destination of the coin, substantially as set forth.

15. In apparatus of the class described, a transformer having a primary and arranged to receive a coin to be tested as its secondary, and a standard inductance of predetermined value, and means governed by the difference, if any, in the phase displacement of alternating currents flowing through said primary and said standard inductance, respectively, arranged to determine the destination of the coin, substantially as set forth.

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