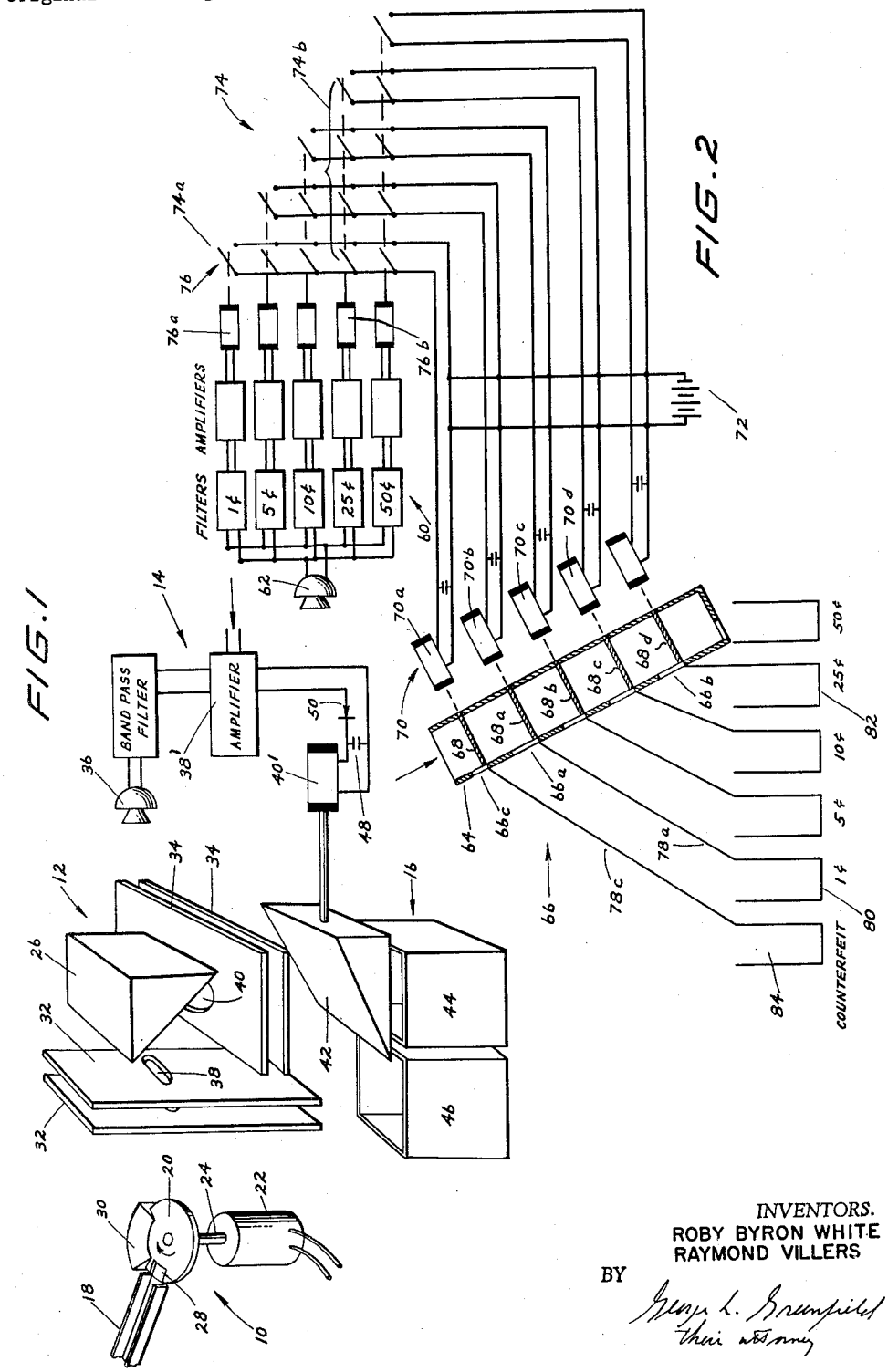
Dec. 12, 1961 R. B. WHITE ET AL 3,012,649

COIN PROVER AND SORTER

Original Filed Aug. 5, 1957 2 Sheets-Sheet 1



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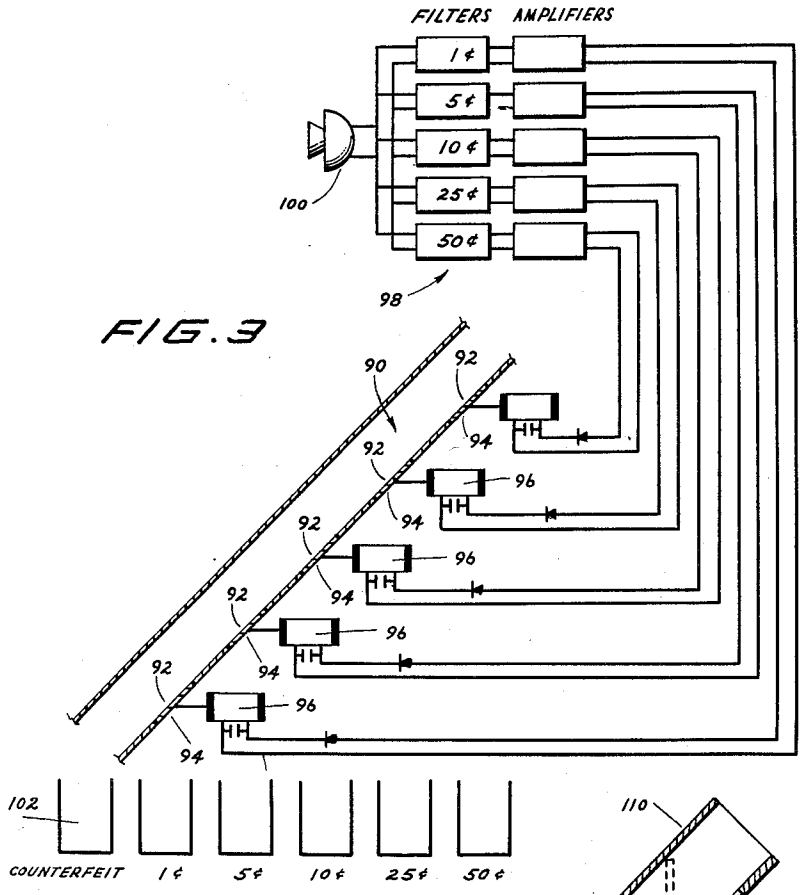


FIG. 3

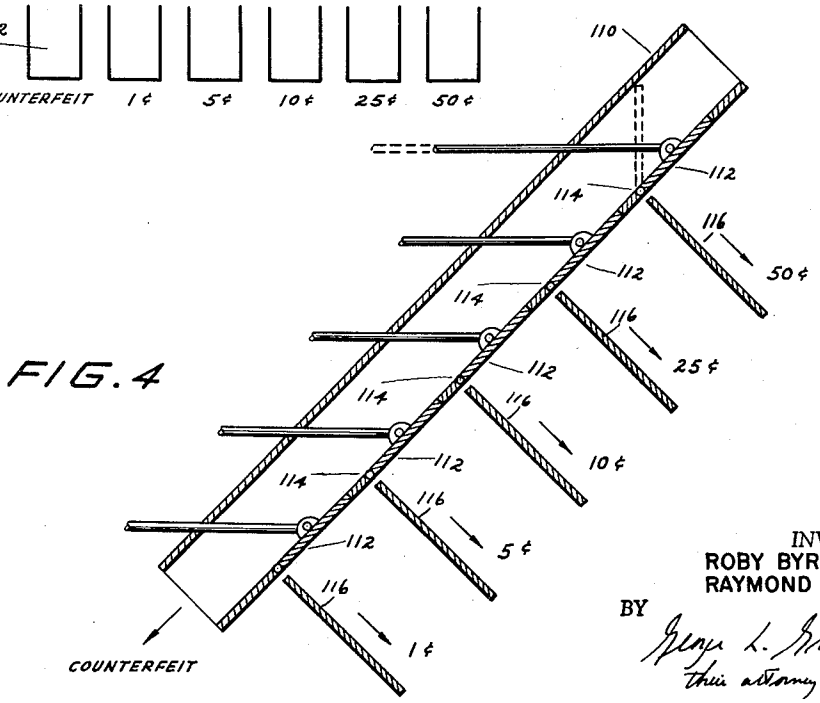


FIG. 4

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COIN PROVER AND SORTER

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Continuation of application Ser. No. 676,207, Aug. 5, 1957. This application Oct. 17, 1960, Ser. No. 63,221

6 Claims. (Cl. 194—100)

This invention relates to coin handling apparatus and more particularly comprises a new coin proving and sorting machine. This application is a continuation of our copending application Ser. No. 676,207 filed August 5, 1957.

The sorting and proving of change has always constituted a major problem in business operations in which gross receipts in large part are received in coins. Public transportation companies and companies which operate vending machines are but a few of the many forms of businesses which spend considerable sums in the handling of change. Very often coins received in such operations are sorted and counted as many as seven times between their receipt and their reintroduction into circulation.

The primary object of our invention is to provide a machine capable of automatically separating counterfeit and authentic coins.

Another important object of our invention is to provide a machine which is capable of automatically separating coins of different denominations.

Still another important object of our invention is to provide a machine which is rather small and compact and relatively inexpensive and which can be introduced into certain types of vending machines to prove the authenticity of a coin before it is allowed to pass through the trip mechanism which sets the vending machine in operation.

To accomplish these and other objects, our invention includes among its many features, a device for causing coins deposited in it to ring at their natural resonant frequency. This device includes a projecting mechanism which throws the coins against a block, causing the coins to vibrate. The block should be made of wood or plastic material or any other material which itself will not vibrate when coins are thrown against it, or, alternately, if the block is made of a metal such as steel, the resonant frequency of the metal should be totally different from that of any coin which is to be tested.

Disposed adjacent the block is a transducer in the form of a microphone which picks up the sound waves and converts them to an electrical signal having a frequency equal to the frequency of the audible ring. The microphone is electrically connected to a band-pass filter which has a preselected band width that includes the natural resonant frequency of the particular coin to be tested. This band width will be rather narrow so as to include only frequencies which are substantially identical to the particular resonant frequency of an authentic coin of the denomination to be tested. If the frequency of the ring is what it should be, that is, it is the natural resonant frequency of an authentic coin, the filter will pass the signal to a solenoid through an amplifier, which operates a mechanism for directing the coin into one of a number of bins or containers. If the machine is to prove and sort coins of all denominations, a bank of five filters can be used, each adapted to pass the natural resonant frequency of one of the five coins, i.e. pennies, nickels, dimes, quarters and half-dollars. In this arrangement each of the filters may form part of a control circuit for a device for directing the coins to the points of collection.

These and other objects and features of our invention along with incident advantages, will be better understood and appreciated from the following detailed description of a number of embodiments thereof, selected for purposes of illustration and shown in the accompanying drawings, in which:

FIGURE 1 is a view partially diagrammatic and partially schematic of a proving and sorting machine constructed in accordance with our invention;

FIGURES 2 and 3 are views partially diagrammatic and partially schematic of other embodiments of our invention; and

FIGURE 4 illustrates a modification of a part of the machine shown in FIGURE 3.

The embodiment of our invention illustrated in FIGURE 1 includes in its general organization a coin projecting mechanism 10, a sounding mechanism 12, a sensing circuit 14 and a coin director and collector 16. Each of these components will be described in detail in the following paragraphs.

The coin projecting mechanism 10 includes a chute 18 which feeds the coins to be proved and sorted to a disc 20. The disc 20 is driven by a motor 22 through the shaft 24 and serves to throw each coin against a block 26 in the sounding mechanism 12. The disc 20 has a recess 28 which is adapted to pick up coins one at a time from the bottom of the chute 18. A guide 30 extends about a part of the periphery of the disc 20 and is disposed above it; the guide prevents the disc from taking more than one coin at a time from the chute and guides the coins as each is discharged by the disc in the direction of the block 26.

The sounding mechanism 12 is acoustically isolated from the rest of the mechanism by a number of partitions diagrammatically shown at 32 and 34, so that only the ring of the coin is detected by the microphone 36 of the sensing circuit 14. Openings 38 cut in the partitions 32 to permit the coins to reach the inclined surface of the block when they are thrown by the disc, do not impair the sound proofing function performed by the partitions. Openings 40 are cut in the partitions 34 to allow the coins to drop in the direction of the director and collector 16 after the coins have come in contact with the block 26.

A coin thrown against the block rings at its natural resonant frequency which is a function of the diameter of the coin and its elasticity. Because these physical properties are different for coins of the different denominations, it is clear that the frequency of the rings of coins of different denominations are also different. This particular phenomena is utilized in the testing circuit 14.

The device shown in FIGURE 1 is adapted to test the authenticity of coins of a particular denomination and separate the authentic coins of that denomination from counterfeits and coins of other denominations. The microphone 36 is disposed immediately adjacent the block 26 and senses the ring of each coin thrown against the block. The microphone which is of standard design converts that audible signal into an electrical signal having the frequency of the ring. This signal is directed to a band pass filter also of standard design. Because the details of the filter form no part of this invention, the filter is represented in box form. Any one of the many filters disclosed in Reference Data for Radio Engineers, 4th edition copyright in 1956, by International Telephone & Telegraph Corporation and printed by the Stratford Press, Incorporated, New York, N.Y., pages 170–179, may be used in this device. However, it is important that the filter used be permitted to pass only a particular narrow band width of signals. For example, if an authentic coin of the particular denomination to be tested has a natural resonant frequency of 1000 cycles, the band width of the filter may be adjusted to pass signals of ap-

proximately 900–1100 cycles. This will allow for slight differences in the natural resonant frequencies of authentic coins due to wear, but is not so wide as to pass signals of counterfeits or of coins of other denominations. If the particular signal relayed to the filter is within the preselected band width, the signal will be sent to the amplifier 38' which in turn will send the amplified signal to a solenoid 40'.

The solenoid 40' controls the deflector 42 which either permits the coil to drop into the bin 44 or directs the coin into the bin 46. Energization of the solenoid 40' causes the deflector to move to the right as viewed in FIGURE 1, so that the coins which are thrown against the block 26 and drop through the openings 40 in the partitions 34, fall directly into the bin 44. The capacitor 48 serves as a holding device to allow the solenoid to retract the deflector 42 for a period of time sufficient to allow a coin to reach the bin 44 from the block 26. The rectifier 50 provides the capacitor with the necessary direct current.

In operation, the coins are fed from the chute 18 to the disc 20 which in turn projects them one at a time against the inclined surface of the block 26. If the electrical signal produced by the microphone from the ringing of the coin passes through the filter, the solenoid 40' energizes and withdraws the deflector 42 away from the top of the bin 44. Thus the authentic coins provided by the filter are collected in the bin 44. On the other hand, if the band pass filter fails to pass the signal, it indicates that the coin is not of the denomination to be collected, but rather it is either a counterfeit or a coin of different value. Thus, the deflector 42 will remain above the bin 44 and such coins dropping through the openings, 40 from the block will be deflected into the bin 46.

The embodiment of our invention shown in FIGURE 2 is adapted to sort and prove coins of all denominations. This embodiment includes, not one, but a bank of five band pass filters 60, each permitted to pass signals of a frequency which include the natural resonant frequency of one denomination of coin. Each of the filters is connected to an amplifier which in turn is connected to a relay. Although a sounding mechanism is not illustrated in FIGURE 2, it is to be understood that the arrangement shown in FIGURE 1 or some similar arrangement would be used to cause the coin to ring. When the coins are directed against the block or caused to ring in any particular manner, the microphone 62 sends the signal detected and converted to electrical form to each of the filters. The coins leave the surrounding mechanism and are directed into the chute 64 and are either allowed to pass all the way through the chute or, alternatively, are directed by one of the deflectors or baffles 68 out of one of the openings 66 formed in the side of the chute. Each deflector 68 is controlled by one solenoid 70, and each solenoid is energized by the battery 72. It will be noted that the circuits for each of the solenoids 70 are adapted to be closed by one or several of the switches 74 forming part of the relays 76.

In operation the device works as follows: If the coin projected against the block produces a signal which is within the band of one of the filters, that filter will in turn pass the signal through its amplifier to the particular relay in circuit with it. For example, if the uppermost filter in the bank 60, noted as sensitive to the natural resonant frequency of a penny, passes the signal to the amplifier and the uppermost relay 76*a* in the bank 76, the switch 74*a* will close and complete the circuit of the uppermost solenoid 70*a*. Energization of the solenoid 70*a* will withdraw the baffle 68 from the chute 64 and the coin will be permitted to pass downwardly in the chute to the baffle 68*a*. This baffle which will remain in the chute causes the coin to pass out of the opening 66*a* formed in the side of the chute and the inclined plane 78*a* will direct it to the bin 80 that collects pennies. If the coin is a quarter, the band pass filter which has a band width that includes the natural resonant frequency of a quarter will cause the relay 76*b* to energize, which in turn will cause the switches 74*b* to close. These switches will energize solenoids 70*a*, 70*b*, 70*c*, and 70*d*, which in turn will move the baffles 68, 68*a*, 68*b*, and 68*c* out of the chute 64. As a result, the quarter will pass downwardly through the chute until it reaches the deflector or baffle 68*d*. That baffle will direct the coin through the slot 66*b* into the quarter bin 82. If the coin tested is a counterfeit, none of the band pass filters will pass a signal to the relays 76 and as a result, all of the baffles will remain in position as illustrated and the uppermost baffle 68 will direct the counterfeit out of the opening 66*c* and down the plane 78*c* into the bin 84 which collects counterfeit. Nickels, dimes, and fiifty-cent pieces are directed to the proper bins in the same manner as described.

The embodiment of our invention shown in FIGURE 3 is substantially the same as that of FIGURE 2, but employs a somewhat different arrangement for directing the coins into the appropriate bin. Rather than using a bank of relays 76 as in the embodiment of FIGURE 2, simple circuits are used between the amplifiers and the solenoids. In detail, a chute 90 which receives the coins after they have been directed against the block (not shown) has a number of openings 92 formed in its side. Each of these openings is controlled by a deflector 94 which in turn is operated by a solenoid 96. If none of the band pass filters 98 pass the signal received from the microphone 100, all of the solenoids 96 remain denergized and the coin tested passes through the chute 90 and collects in the bin 102 for counterfeits. Alternatively, if a good coin is introduced into the machine and rings at its natural resonant frequency, the particular filter adapted to pass that frequency causes its solenoid to energize and remove the deflector from proper opening, and the coin drops through the uncovered opening into the bin disposed beneath it. Thus, it is seen that the embodiment of FIGURE 3 merely includes five independent testing circuits of the kind shown in the embodiment of FIGURE 1.

In FIGURE 4 we have illustrated a chute 110 which can be substituted for the chute 90 in the embodiment of FIGURE 3. Each deflector 112 disposed along the side of the chute opens in response to energization of its controlling solenoid (not shown). The deflectors 112 pivot on their hinges 114 into the chute 110 and direct the coins down the adjacent slide 116. Each of these slides will carry the coin to a point of collection. If none of the deflectors 112 are pivoted to the position shown in broken lines, the coin tested passes downwardly through the chute and collects in a separate bin for counterfeits.

From the foregoing description, those skilled in the art will appreciate that numerous modifications may be made of our invention without departing from its spirit. For example, many other arrangements may be used to direct the tested coins to a desired location. The details of the amplifiers and filters form no part of our invention, for numerous varieties of each may be used with satisfactory results. A well known amplifier such as model 232–B made by Herman Hosmer Scott, Inc., of Cambridge, Massachusetts, would give very satisfactory results. Therefore it is not our intention to be limited to the specific embodiments of the invention illustrated and described, but rather the scope of our invention should be determined by the appended claims and their equivalents.

We claim:

1. A device of the character described, comprising a block, means for directing coins to be proved and sorted against the block, a number of containers for receiving the coins after they have been directed against the block, each container to receive an authentic coin of a particular denomination, a microphone disposed adjacent the block for producing an electrical signal in response to the ringing of the coin when directed against the block, directing means between the block and the containers adapted to direct the coins into the appropriate containers, band pass

filters electrically connected to the microphone, said filters having a narrow band width capable of passing a signal having a frequency equal to the resonant frequency of an authentic coin, and means operable in response to the passing of the signal by one of the filters for controlling the directing means.

2. A device of the character described comprising a block, means for projecting coins against the block, a number of bins each for collecting coins of different denominations directed against the block, a transducer disposed adjacent the block for producing an electrical signal having the frequency of the ring of the coin when projected against the block, a number of band pass filters electrically connected to the transducer and each adapted to pass a signal whose frequency is substantially the same as the natural resonant frequency of one authentic coin of the different denominations, separate directors for controlling the flow of coins to each of the bins, and means including the band pass filters for actuating each of the directors in response to the passage of the signal by one of the filters.

3. A device for proving and sorting coins of all denominations comprising means for causing the coins to ring at their natural resonant frequency, a bank of band pass filters, each adapted to pass a signal having a frequency substantially equal to the resonant frequency of one of the different coins, means for sending the rings of the coins in the form of electrical signals to each of the filters, a chute into which the coins are directed after they have been caused to ring, separate openings in the chute for authentic coins of each denomination, directors controlling each of the openings, and solenoids operating the directors and each electrically connected to and energized by a circuit including one of the different filters.

4. A device comprising a member for projecting coins to be tested along a prescribed path, a block disposed in the path for causing coins projected against it to ring at their natural resonant frequency, a band pass filter, means electrically connected to the filter for sending to the filter the ring of the coin in the form of an electrical signal, said filter having a narrow bandwidth capable of passing signals having a frequency substantially equal to the resonant frequency of an authentic coin of a selected denomination, and means responsive to the passing of a signal by the filter for determining the direction in which the coins travel after hitting the block.

5. A device comprising a member for projecting coins to be tested one at a time along a prescribed path, a block disposed in the path causing each coin projected against it to ring at its natural resonant frequency, a band pass filter, means electrically connected to the filter for sending to the filter the ring of each coin in the form of an electrical signal, said filter having a narrow bandwidth capable of passing signals of a frequency substantially equal to the resonant frequency of an authentic coin of a selected denomination, and means responsive to the passing of a signal by the filter for directing coins from the block to a predetermined location.

6. A device comprising a rotatable member for tangentially projecting coins to be tested along a prescribed path, a block disposed in the path for causing coins projected against it to ring at their natural resonant frequency, a band pass filter, means electrically connected to the filter for sending to the filter the ring of the coin in the form of an electrical signal, said filter having a narrow bandwidth capable of passing signals having a frequency substantially equal to the resonant frequency of an authentic coin of a selected denomination, and means responsive to the passing of a signal by the filter for directing coins from the block to a predetermined location.

No references cited.