July 22, 1969 J. E. BAYHA 3,457,421

RADIATION SENSITIVE PAPER SECURITY VALIDATION APPARATUS

Filed Feb. 24, 1966 3 Sheets-Sheet 1

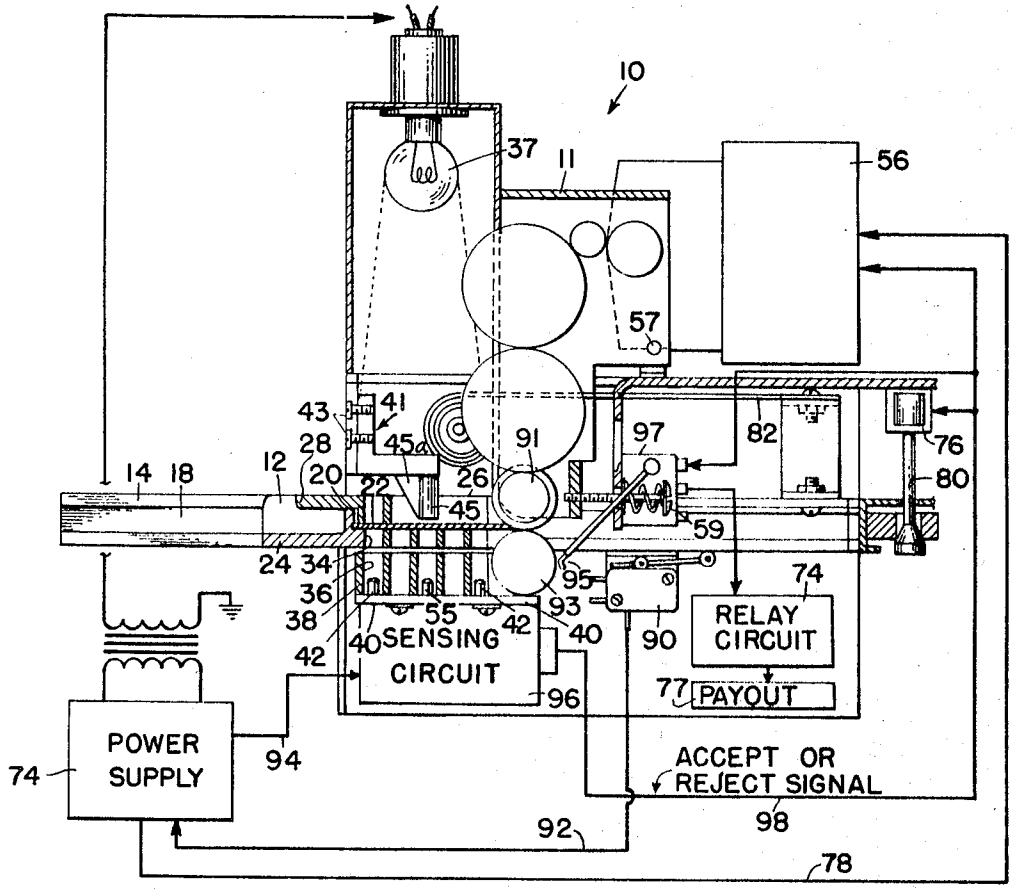


FIG. 1

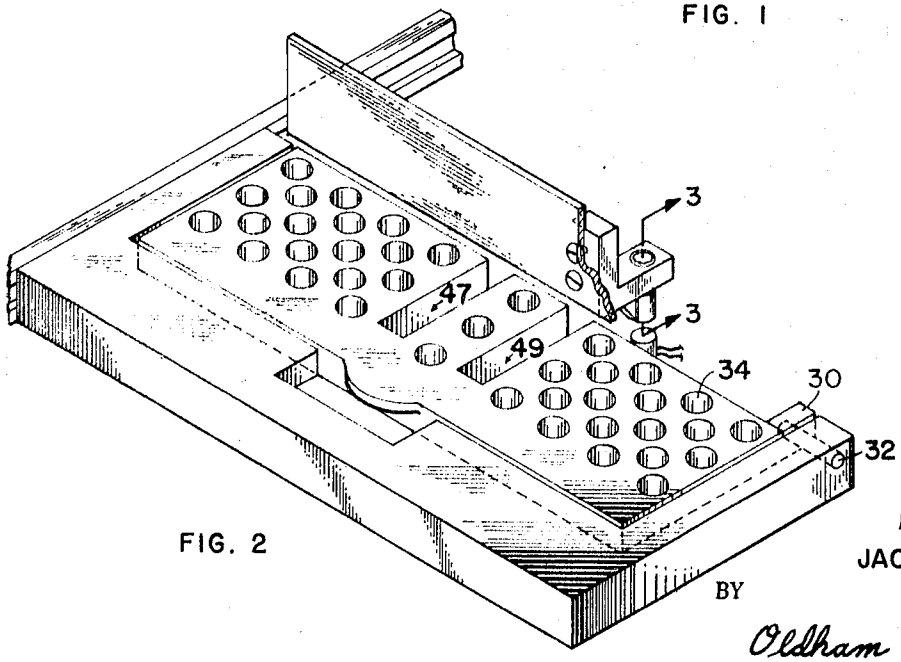


FIG. 2

INVENTOR.
JACK E. BAYHA

BY

Oldham & Oldham
ATTORNEYS

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RADIATION SENSITIVE PAPER SECURITY VALIDATION APPARATUS

Filed Feb. 24, 1966 3 Sheets-Sheet 2

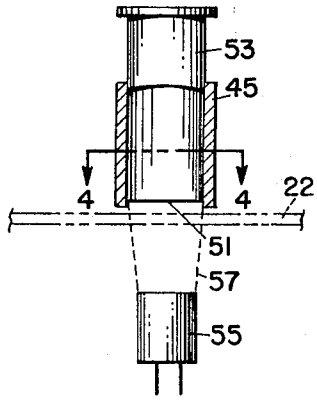


FIG. 3

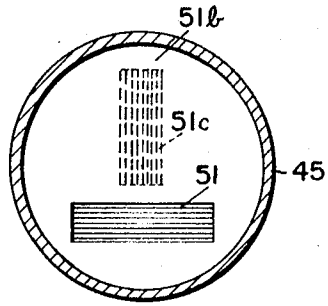


FIG. 4

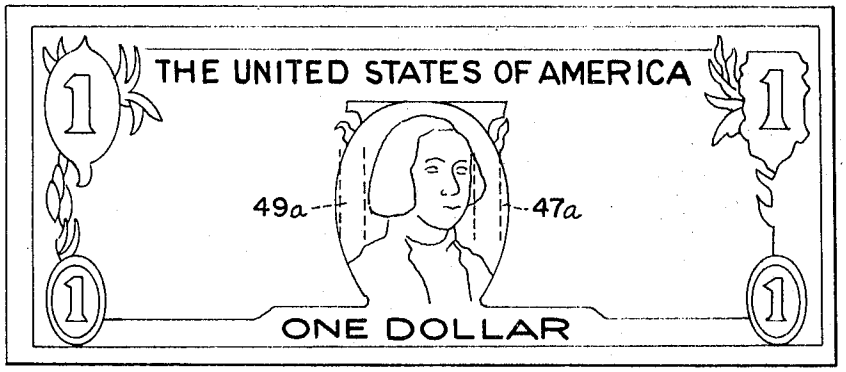


FIG. 5

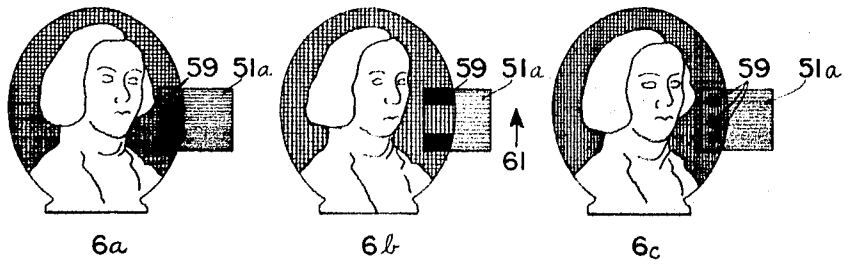


FIG. 6

INVENTOR.
JACK E. BAYHA

BY

Oldham & Oldham
ATTORNEYS

July 22, 1969 J. E. BAYHA 3,457,421
RADIATION SENSITIVE PAPER SECURITY VALIDATION APPARATUS
Filed Feb. 24, 1966 3 Sheets-Sheet 3

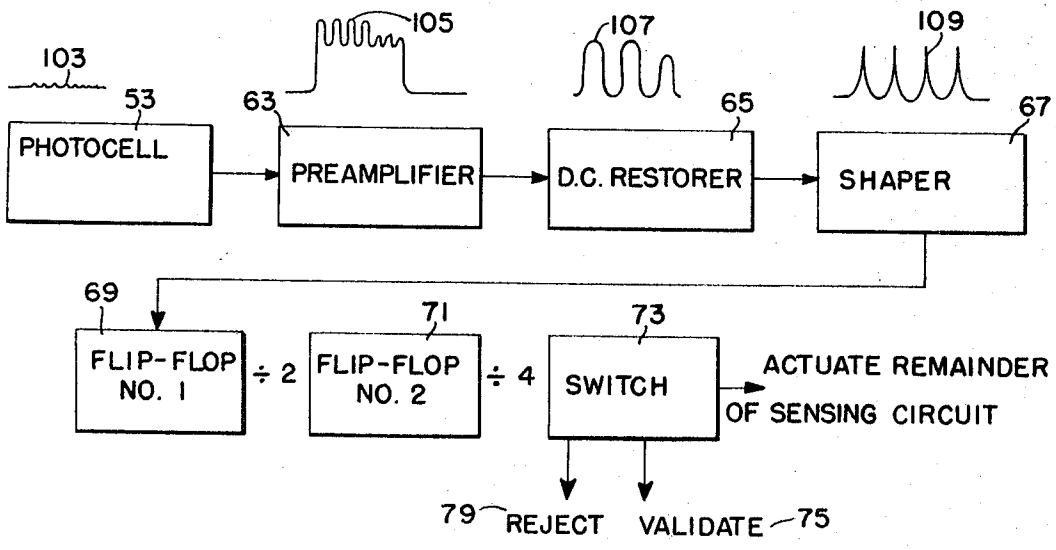


FIG. 7

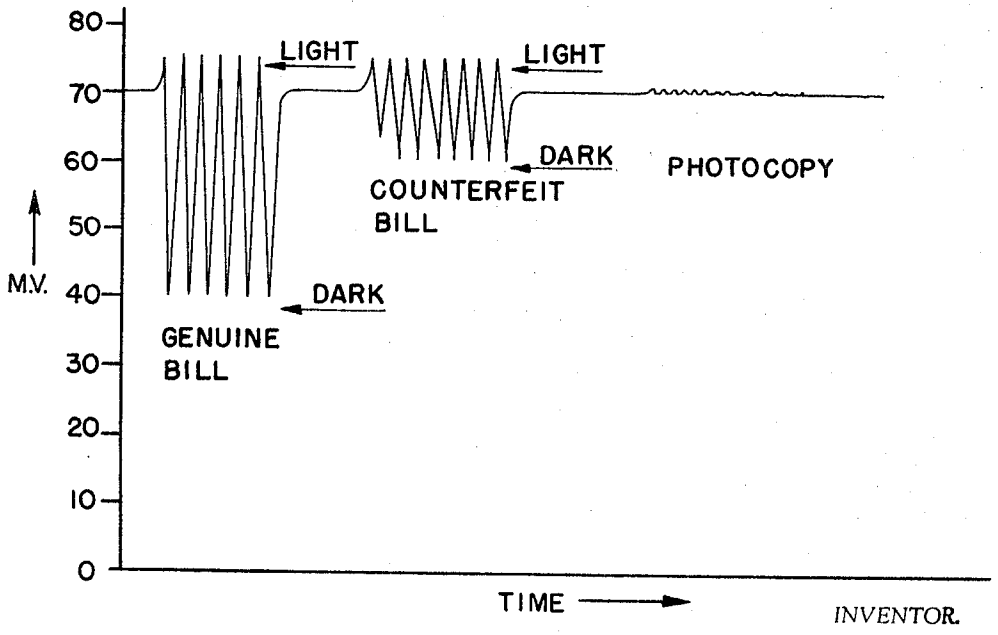


FIG. 8

INVENTOR.
JACK E. BAYHA
BY
Oldham & Oldham
ATTORNEYS

United States Patent Office 3,457,421
Patented July 22, 1969

3,457,421

RADIATION SENSITIVE PAPER SECURITY VALIDATION APPARATUS

Jack E. Bayha, Chesterland, Ohio, assignor to Transmarine Corporation, Chesterland, Ohio, a corporation of Ohio

Filed Feb. 24, 1966, Ser. No. 529,750
Int. Cl. G01n 21/32, 21/30; H01j 39/12
U.S. Cl. 250—219 10 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for authentication of paper securities, and more particularly, a device for receiving and identifying as genuine a piece of paper money by measuring the parallel printed lines behind the portrait in the paper money. This is accomplished by utilizing a reticle with a lined pattern similar to the pattern in the portrait background, moving the reticle and/or the paper money relative to each other while simultaneously passing radiated energy through the bill and the reticle for detection by a suitable photocell or other detector. The relative movement between the reticle and portrait background of the bill causes alignment and misalignment of the lines enabling an accurate measurement to be made of the density of the ink which makes up the lines in the portrait background of the paper money. This measurement must exceed a predetermined minimum, and must exceed this minimum for a predetermined minimum number of times during the relative movement between the reticle and/or the paper money before a validation signal is achieved. The validation signal may be followed by the performance of a vending function.

This invention relates to an apparatus for authentication of paper securities, and more particularly, to an apparatus for receiving and identifying as genuine a piece of paper money by measuring the parallel printed lines behind the portrait in the paper money, which may be followed by the performance of a vending function.

This application represents a validation technique which might be used alone or in combination with the validation circuit design of patent application Ser. No. 405,666, filed Oct. 22, 1964 by James K. Phares, now Patent No. 3,360,653 and also assigned to the Transmarine Corporation.

It is well known that there have been many and varied types of paper security validating circuits and apparatus, and that it is becoming increasingly necessary to perform more than one validation of the paper security by more than one test means to obtain valid test results. Heretofore, it has not been possible to perform more than one validation test without incurring considerable extra expense in the equipment, and further there has not been a technique to insure two positive, yet very simple and foolproof validations tests in the same apparatus.

Therefore, it is the general object of the present invention to disclose a new validating technique and apparatus for performing same which might be used alone or in combination with the light passage validation technique defined in the above-identified patent application.

A further object of the invention is to provide a validation technique for paper securities which effectively measures the spacing and clarity of the printed lines behind the portrait in a paper security to determine whether they meet predetermined standards.

Of specific value to this method of authentication is the inability of known available methods of photocopying to achieve sufficient resolution in attempted copying of genuine bills to generate this signal. Further, analysis of

bogus or counterfeit bills indicates the relative relationships of light to dark signals compared with those of genuine currency give wide variations which can be measured to determine genuineness.

The aforesaid objects of the invention and other objects, which will become apparent as the description proceeds, are achieved by providing in an apparatus for authentication of paper securities having parallel equally spaced straight lines on some portion thereof, the combination of frame means defining a testing area, means slidably received by the frame means to receive and hold a security to be validated in a substantially flat position, the means being manually slidable into the testing area, reticle means positioned in the testing area so as to be in substantially parallel close spaced relation to the portion of the security having the parallel lines when the security is moved into the testing area, the reticle further having straight equally spaced parallel lines of a number per inch substantially equal to the parallel lines on the security to thereby create a light dark effect when the security is moved into the testing area, means to pass light through the portion of the security with the parallel lines from the side thereof opposite the reticle, photocell means to view only a small selected portion of the reticle to determine the amount of light passed through the security and the reticle, and circuit means to count the number of light-dark signals created by the reticle in combination with the security, upon the movement of the security a predetermined distance relative to the reticle, and to provide a validation signal if the proper minimum number of light dark signals are counted.

For a better understanding of the invention reference should be had to the accompanying drawings wherein:

FIGURE 1 is a digrammatic view partially in section showing the apparatus and control circuits of the invention;

FIGURE 2 is an enlarged perspective view, partially broken away, showing the tray and arrangement of the reticle of FIGURE 1;

FIGURE 3 is a vertical cross sectional view of the reticle position taken on line 3—3 of FIGURE 2;

FIGURE 4 is a horizontal cross sectional view, as taken on line 4—4 of FIGURE 3, through the tube mounting the reticle showing the masking thereof;

FIGURE 5 is a plan schematic view of a one dollar bill of United States currency illustrating those areas in the background of the portrait which are viewed by the apparatus of the invention for validation;

FIGURES 6*a* and 6*b* illustrate how a reticle with lines per inch substantially equal to the lines per inch in the background of the portrait will produce a detectable light-dark effect as the reticle is moved very small distances over the surface of the bill;

FIGURE 6*c* illustrates an improper light-dark effect on the bill because its portrait background is not genuine;

FIGURE 7 is a block diagram showing how the signal received by the photocell pickup associated with the reticle is passed through logic or counting circuitry to provide a validation signal; and

FIGURE 8 is a graphic illustration of the difference in light-dark signal achieved by the apparatus of the invention for genuine, counterfeit, and photocopy bills.

The term "paper money" has been largely used heretofore in reference to the article or articles to be identified by the testing apparatus of this invention, but this term is intended to include paper currency of all sizes, denominations, and countries of origin, in addition to bonds, documents, other paper, textile, or colored articles which might be subject to tests for genuineness, weave, composition, color, pattern, or the like by equipment of the character hereinafter described and claimed. How-

ever, the apparatus of the invention is primarily designed for the determination of genuineness of United States paper money in lower denominations. For example, one dollar, five dollar and ten dollar bills. It is designed particularly for authentication of any document which has very closely equally spaced parallel lines on some portion thereof, which generally fall in the background of a portrait on the paper security. In order to shorten the designation of the article being tested, as called for hereinafter, it will be designated in the drawings as a bill and will be so described in the specification.

With reference to the form of the invention illustrated in FIGURE 1 of the drawings, the numeral **10** indicates a bill changing apparatus supported by a packaging frame **11** only a portion of which is indicated in the drawing. A substantially horizontal guide rail **14**, secured to the frame **11**, guides a bill slide **12** to an in and out position. To provide clearance for the movable bill slide **12**, the dimension of the slide in the direction normal to its slightly less than the height of the guide rail **14**. The guide rail **14** is formed with a longitudinally extending groove **18** to slidably receive the slide **12**. The slide **12** contains a bill chamber **20** adapted to receive a bill **22**. The bill chamber is formed by a bill support plate **24** and a bill cover **26** which has an outwardly extending lip **28** that serves as a handle for the operator. The cover plate **26** has a forwardly extending ear **30** which receives a pivot pin **32** to mount the cover plate **26** on the slide **12**. When the cover plate **26** is opened, the lower surface of the ear **30** functions to position the bill accurately in the bill chamber **20**.

The support and cover plates have a plurality of spaced concentric bores **34** which extend through the plates in a direction normal to the movement of the slide. The large number of the bores **34** provides the apparatus with inherent versatility since a large number of different portions of the bill can be comparatively tested to determine the authenticity thereof.

As shown in FIGURE 1, the slide **12** is in the in position. In this position, the bores **34** are in alignment with matching bores **36** in a plate **38**. Plate **38** is secured to and spans the lower portion of the guide rail **14**. A circuit board **40** positions a selected number of light sensitive photocells **42**, such as photo diodes or photo resistors, in the bores **36**. The number of cells, the electrical characteristics of the separate cells, and the relative locations can be varied in accordance with the unique requirements of the document being tested. Light from a suitable bulb **37** is directed through the bores and through the bill to be detected by photocells **42**.

The validation test comprising the object of the invention is achieved by mounting a testing device indicated generally by numeral **41** to the frame **11** by suitable fastenings **43**. The device **41** has a viewing tube **45** extending downwardly so as to be in closely spaced adjacent relationship to the top surface of the bill **22**. The cover plate **26** has a pair of slots **47** and **49** cut therein, as seen in FIGURE 2, of sufficient width to allow the tube **45** to easily pass therein so the end of the tube will be over a selected portion of the bill to be tested. One or two slots are provided, two when it is desired that two testing devices **41** might be utilized, or that the user of the apparatus will not know which side the bill will be tested. A wedge **45***a* is connected to the tube **45** to prevent the end of the tube from catching on the edge of a bill as the tray **12** is moved into position. The tube **45** is designed to pass over the background of the portrait section of a United States bill. For example, it will pass in the areas indicated by dotted lines **47***a* and **49***a* in FIGURE 5 of the drawings.

The tube **45** consists of a reticle **51** mounted at the bottom end so as to be in close spaced parallel adjacent relationship to the bill **22**. It is anticipated that the reticle **51** must be within about .025 inch spaced relation from the bill **22**. The other end of the tube **45** is mounted to a photocell **53**, as clearly shown in FIGURE 3 of the drawings. The exact spaced relationship of the reticle **51** from the photocell **53** is not important as long as the tube **45** acts to transmit light passed through the reticle to the photocell **53**. In order to pass light through the bill, and through the reticle **51**, a high intensity light source **55** is mounted to direct its beam, indicated by dotted lines **57**, through the bill **22** for passage through the reticle **51** and detection by photocell **53**.

The operating principle of the invention is based on the fact that the background of the portrait on United States currency is made up of parallel equally spaced lines. For example, the background behind George Washington on a U.S. one dollar bill has 120 lines per inch both in a horizontal and vertical direction. The portrait background on a five dollar bill has approximately 117 lines per inch in a horizontal direction and 75 lines per inch in a vertical direction, while the background on a ten dollar bill has approximately 75 lines per inch in a vertical direction and 75 lines per inch in a horizontal direction. Therefore, if the reticle contains parallel equally spaced lines in a number per inch substantially equal to one or the other of the parallel lines in the background of the portrait of the U.S. one dollar, five dollar, or ten dollar bills, it will create a wide light-dark effect when the reticle is positioned in substantial alignment with one or the other of the sets of lines and in substantially parallel close spaced relation thereover. This is rather clearly shown in FIGURE 6*a* where an enlarged reticle **51***a* is shown to produce a dark area **59**. As shown in FIGURE 6*b* when the reticle **51***a* is moved upwardly in a direction indicated by arrow **61** a light area is achieved in previously dark area **59**. If the reticle is masked, as indicated by numeral **51***b* in FIGURE 4, the view through the opening **51** will be alternating dark and light areas.

The purpose of the invention is to be able to count the number of light to dark signals, or in other words the number of light and dark passes as the reticle **51** is moved relative to the background portion of the bill, or vice versa. It has been found that on a U.S. one dollar bill or other lower denomination bills a movement of only about 1/16 inch between bill and reticle will give as many as nine light and dark indications. If there is any appreciable difference in the lines of the background of the portrait to the number of lines in the reticle, light-dark areas will not be of sufficient width to give the desired fully light or dark areas over the opening of the mask **51***b*. FIGURE 6*c* illustrates a spotty or narrow light-dark configuration which will occur when the lines in the portrait background are blurred or of a different count per inch than the reticle portion **5**. In this instance no validation will occur. It has been found that about a 5 to 7 percent variation in the number of lines per inch between the reticle and the lines on the bill will not produce the desired width of light-dark areas necessary to indicate validation. For this reason in this form of authenticity checking a one dollar or five dollar bill could be evaluated with the same reticle.

In order to indicate validation with the light-dark effect as described above, the reticle is masked a specific viewing area, this most clearly indicated in FIGURE 4. Here the mask is indicated by numeral **51***b* while the exposed reticle portion **51** is all that will pass light. The physical dimensions of the exposed portion of the reticle **51** might be about 3/16 inch in a horizontal direction and about 1/16 inch in a vertical direction. It has been found that this masked area of the reticle **51** will provide proper validation where the lines in the bill and the reticle are within about 5 to 7 percent of each other in number per inch, and will also allow for some slight angular variation in the positioning of the bill in the tray so that the lines in the background of the portrait are not in exact alignment with the reticle **51**. The angular misalignment of the reticle with the lines in the bill results in the light-dark effect being angularly misaligned, and this misalignment

cannot be too great or a substantially complete darkening or blackout of the masked portion of the reticle will not occur. The results of the invention, as more fully described below are dependent on achieving a full coverage of the unmasked area of the reticle, as seen in FIGURE 4, when the light-dark areas pass across.

If it were desired to measure the vertical lines in the portrait background the bill would have to move endwise relative to a reticle opening indicated by dotted lines **51***c* in FIGURE 4 and the lines in the opening **51***c* would be perpendicular to those in reticle **51**. A cam action at the end of tray insertion could deflect the tray for this endwise movement to effect validation on the vertical lines. In some instances it might be desirable to measure both horizontal and vertical lines for a dual validation.

In order to achieve a recognized signal with the light-dark effect illustrated in FIGURES 6*a* and 6*b*, it is contemplated that the light **55** and photocell detection **53** will not be activated until the tray **12** is almost fully to its inward position. In fact, it is anticipated that the contacting of a microswich **90** will energize a sensing circuit **96** which in turn actuates light **55** and photocell **53** to view the bill as it is moved the last approximate ⅛ of an inch of its inward movement until a plunger **80** operated by a solenoid **76** is actuated to hold the tray **12** in its inwardly position. It has been determined that during this final movement of the tray into position of about 1/16 inch the light-dark areas **59** as seen in FIGURE 6*a* and 6*b* alternately appear as light-dark to the masked area of the reticle many more times than necessary to assure validation. A sequence of light, dark, light, dark easily achieved in the short space permitted for examination is sufficient to determine genuineness. In any event, the alternation of the light-dark area **59** is independent of the speed of the movement of the tray into the inwardly position. Thus, no costly constant speed drives, nor other synchronizing mechanism is necessary to achieve the desired creation within the reticle of the light-dark, as the mere manual positioning of the tray by the operator will achieve the necessary relative movement to obtain a desired readout.

Readout is accomplished for validation by rather simplified logic circuitry more fully illustrated in block diagram form in FIGURE 7. Particularly, the photocell pickup **53** gives a somewhat sinusoidal signal **103** indicating the on-off viewing seen by the light passage through the masked reticle **51**. Naturally, the on-off viewing need not be a uniform sine curve, but will show peaks and valleys independent of the rate of movement of the tray relative to the reticle. The signal **103** is then sent to a preamplifier **63** where the signal is amplified and looks in waveform somewhat like the signal **105** indicated thereabove. The signal **105** illustrates that four complete light viewings have been detected, as four peaks are present. The preamplified signal is sent to a DC restorer **65** where the sinusoidal portion of the signal **105** is separated and indicated in waveform by numeral **107**. Conventional well known DC restoration techniques may be utilized for this purpose. Such techniques are well known to one skilled in the art. The signal **107** is sent to a shaper **67** where each of the peaks is represented as a large magnitude small duration pulse, as indicated in waveform by numeral **109**. It should be understood that the shaper **67** again is conventional circuitry well known in the art for changing the characteristics of voltage signals, as selectively desired.

The signal **109** represents four voltage pulses, or the viewing of four light-dark cycles completely by the reticle opening in the mask. The prior signals **103** and **105** represent the passage of more than four areas, but for the purposes of the invention, it is believed that seeing only two pulses or two areas will properly constitute a validation signal. Thus, although the shaper **67** may generate more than four pulses, the first four are the ones counted for validation although two would suffice. It should be understood however, that although four pulses have been selected for validation on U.S. lower denomination bills, the number of pulses counted for validation could vary as desired.

To logically count the number of pulses in signal **109**, the invention contemplates suitable logic circuitry, which includes solid state switching devices, more commonly known as "flip-flops." To this end, a flip-flop number **1** indicated by numeral **69** will count two pulses, one to switch it one way and one back to its original position to then send the signals on into a second flip-flop **71**, which will count two more pulses. Thus when four pulses have been counted, a switch **73** will be actuated to indicate a validation signal **75** or to actuate the remainder of the sensing circuit for a light passage authentication as indicated in patent application Ser. No. 405,666 identified above. If no validation signal is received nothing occurs. After a predetermined period without a validation signal the plunger **80** is released causing the withdrawal of the tray, which in turn causes cancellation of any counts already made. Suitable solid state devices for the flip-flops **69** and **71** might be Fairchild Fuh–92329, a medium power flip-flop adaptable for use in counters, which are made by the Fairchild Semi-conductor Company, 313 Fairchild Drive, Mountainview, Calif.

It should be understood that the light-dark effect achieved by the reticle **51** will not achieve a complete elimination of light passage into the photocell **53**, but the features of the invention indicate that the amount of light reduction is highly significant, and in effect provides a second validation parameter. Specifically, with reference to FIGURE 8, typical light-dark signals for genuine, counterfeit and photocopy bills are indicated. It can be seen that each of the signals has a top millivolt light level of about 75 mv. However, the big difference comes in the dark signal where the genuine bill has about 40 mv., while the counterfeit has about 60 mv., and the photocopy about 70 mv. Thus, it becomes quite clear that one can simply set thresholds on the dark signal that must be reached before genuineness can be indicated. In the illustration of FIGURE 8, this bottom threshold might be, for example, 50 mv. In other words, the preamplifier **63** of the circuitry of FIGURE 7 would not pick up and amplify any signals except those which came down to the predetermined minimum threshold level.

After a detailed and complete study of the printing technique used on genuine currency and compared with that used on counterfeit and photocopy bills, it was determined that the results of FIGURE 8 occur because of the properties of these printings and some special features of the apparatus of the invention. The printing of practically all the world's paper currency is by the intaglio method which provides a wide range of tonal effects. However, because of the cost and complexity of intaglio printing almost all attempts at counterfeiting have been by the letterpress or planographic processes. In the planographic process the printing area is on the same level or plane as the non-printing area, while in the letterpress process, the ink printing area is in relief. Neither the letterpress nor planographic processes deposit as much ink and so cannot provide the deep tonal effects achieved by the release of ink from recessed wells below the surface of the plate in the intaglio process.

In order to take advantage of this printing distinction to achieve signals such as indicated in FIGURE 8, the invention contemplates operating the light source **55** at a low voltage level so that there will be a high percentage of infra-red mixed with the white light. The photocell **53** is then selected to be more sensitive to infra-red and low light levels. For example, a Solar Energy Converter made by Solar Systems, Inc. of 8241 N. Kimball St., Skoki, Ill. meets the desired objects of the invention. Therefore, since the intaglio printing puts more ink on the bill, this tends to absorb more infra-red radiation and consequently the dark signal becomes much darker than is possible even with a very high resolution counterfeit bill made by planographic or letterpress processes.

Therefore, with the apparatus of the invention designed to simply measure the range or spread from voltage peak representing the light signal to voltage valley representing the dark signal set at predetermined thresholds, the apparatus of the invention can thereby readily distinguish between genuine currency and very high resolution counterfeit currency. The apparatus still looks for a predetermined number of light-dark areas, but the spread between light and dark must meet the threshold requirements.

As stated above, the width or height of the aperture in the direction of bill movement defined by mask **51***b* will control the mask band to allow for variation in the lines of the bill for shrinkage, age or other possible variations while the length of the aperture transverse to the direction of bill movement will allow for angular variation between the lines in the bill and the reticle to a predetermined extent.

As pointed out above, the solenoid **76**, controllable by a signal from a power supply **74** over a line **78**, is adapted to position a plunger **80** slidably supported in the frame **11** to lock the slide **12** in the in position. An extensible flat coil spring **82**, having one end thereof secured to the slide **12** and the coil portion thereof secured to the frame **11** functions to return the slide to the out position when secondary validation or non-validation has been determined.

The control circuit power supply is conductively connected to a switch **90** by means of a conductor **92**. The switch **90**, as pointed out above, is operated by movement of the bill slide to the in position, and actually actuates the reticle validation circuitry about 1/16 of an inch before the bill slide **12** is moved to the complete in position. Conductor means **94** connects the power supply **74** with the secondary sensing circuit **96**. Sensing circuit **96** is connected to a plurality of light sensitive cells **42** and determines by a second test the validity of the bill **22**. An accept signal is sent over a conductor **98** to actuate a motor **56** to drive a pair of rollers **91** and **93** thereby removing the bill from the chamber **20**. The full movement of the bill **22** from the chamber **20** causes the leading edge of the bill to actuate an arm **95** of a microswitch **97**, which in turn actuates a relay circuit **74** to effect a desired payout **77**. A reject signal from the payout circuit deactuates solenoid **76** to release plunger **80** allowing withdrawal of the tray. The motor **56** is pivotally mounted by pin **57** so that a spring loaded screw **59** through the frame **11** tends to bias the rollers **91** and **93** into resilient contact with each other.

The accept or reject signal from the sensing circuit **96** may be dependent only on the reticle line test or the voltage peak to voltage valley test, as described above, or also on the light passage test described in the above-identified patent application. The payout signal **77** may energize any suitable payout mechanism.

It is thus seen, that the essence of the invention is achieved by accurately determining the number of lines in the portrait to background section of a bill by utilizing a reticle having substantially the same number of lines in parallel relation thereto so a moire effect created thereby will set flip-flops, or other simple counting circuitry, with on and off signals. It should be understood, that suitable mechanical mechanism could be included to move the tray **12** across the bill at the end of its movement after the reticle circuit has been energized to thus measure the vertical lines in the portrait background, rather than the horizontal lines. In this instance, the reticle itself would have its lines in a vertical direction, and the mask would probably be turned 90° from its illustrated position in FIGURE 4. Or a combination of two reticles could be used to validate both horizontal and vertical lines.

What is claimed is:

1. An apparatus for authentication of paper securities having respectively uniform spaced lines on some portion thereof which comprises

frame means defining a testing area,

first means movably mounted by the frame means to receive and hold a security to be validated, said first means being manually movable relative to the testing area,

reticle means positioned in the testing area so as to be in substantially parallel close spaced relation to the portion of the security having the repetitively uniform lines when the first means carrying the paper security is moved manually relative to the testing area, said reticle further having repetitively uniform spaced lines of a number per inch substantially equal to the lines on the security and being in substantially parallel relation to the lines on the security to thereby create a high energy-low energy effect with respect to predetermined radiant energy passing therethrough when the security is manually moved in the testing area,

means to pass radiant energy through the portion of the security with the repetitively uniform lines from the side thereof opposite the reticle,

radiant energy detection means to scan only a small selected portion of the reticle to determine the amount of radiant energy passed through the security and the reticle as the security is moved by manual actuation relative to the reticle, and

circuit means to count the number of low energy-high energy areas passing the reticle upon the movement of the first means carrying the paper security a predetermined distance relative to the reticle, and to provide a validation signal if a predetermined minimum number of signals are counted.

2. An apparatus according to claim **1** where the reticle is positioned within at least .025 inch spaced parallel relation to the security.

3. An apparatus according to claim **1** where the security is a monetary bill having a portrait thereon and the portion of the bill validated is the parallel equally spaced lines in the background of the portrait.

4. An apparatus according to claim **1** where the selected area of the reticle viewed by the radiant energy detection means is masked to be about 1/16 inch in the direction of security movement and about 3/16 inch transverse to the direction of security movement.

5. An apparatus according to claim **1** where the circuit means includes

a preamplifier to receive and amplify the signal pulses from the radiant energy detection means,

means to convert the amplified signal pulses into substantially sinusoidal waveform pulses having peaks and valleys,

shaper means to convert each peak and valley of the square waveform pulse into a single, short, high amplitude signal, and

logic circuit means to count the number of high amplitude signals and indicate validation when a predetermined number of signals has been counted.

6. An apparatus according to claim **1** where a second circuit means is actuated by the validation signal from the circuit means to provide a second test in validation of the security.

7. An apparatus according to claim **1** where the means to pass radiant energy through the security and the circuit means are only actuated for about the final 1/16 travel of said means receiving the security as said means are moved into the testing area, and where the movement of said means may be at any speed of relative movement to the reticle means to achieve validation.

8. An apparatus according to claim **1** where the circuit means detects the difference between the amount of radiant energy passed through the non-printed areas and the printed areas of the security and only indicating valid signals when the difference meets a predetermined minimum value.

9. An apparatus according to claim **8** where the means to pass radiant energy through a portion of the security

emits substantially only infra-red radiation, and the radiant energy detection means is highly sensitive to infra-red radiation.

10. An apparatus for authentication of paper securities having inked lines on some portion thereof which comprises

frame means defining a testing area,

transport means carried by the frame means for movement to and from the testing area, said transport means adapted to carry a security to be validated,

reticle means carried by the frame means so as to be within the testing area and in close spaced adjacent relation to a security carried by the transport means, said reticle defining a complementary pattern to a pattern carried by inked lines on a portion of the security,

means to pass radiated energy through the security and the reticle during relative movement between the security and the reticle means,

means to detect the difference in the amount of radiated energy passed through the inked lines and the clear

portions of the security, and to present an electrical pulse whenever this difference exceeds a minimum threshold, and

means to count these electrical pulses and indicate validation when a predetermined minimum number of pulses have been counted.

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WALTER STOLWEIN, Primary Examiner

U.S. Cl. X.R.

356—71, 239