

From the Stamp Specialist:

The Development of the Electric Eye

By Nathan Goldstein, II

(From *The Stamp Specialist 1941 Emerald Book*, #16, with new images)

Addenda to the U. S. Electric Eye Article in THE STAMP SPECIALIST EMERALD BOOK

Author's Note: The Standardization Committee of the Bureau Issues Association has just released a decision on Electric Eye terminology, which report makes minor changes in the terms as employed in this article. The changes are noted below, and it is understood that these changes will be incorporated in the Scott Specialized Catalogue. While the changes are relatively minor, they simplify considerably any possibility for misinterpretation. It is hoped that the new terms will be quickly adopted by all, and make the collection of these interesting varieties considerably easier.

The new terms are as follows:

DASHES: replaces VERTICAL DASHES. As these DASHES are confusing in the vertically arranged commemoratives, the omission of the term "vertical" will do away with any possible misinterpretation.

BAR: replaces HORIZONTAL GUIDE DASH (do not confuse this with the "horizontal bars"). The BAR appears only once in the sheet of 400, 200, or 280 subjects, centered opposite the right end of the horizontal sheet gutter. On 200 subject vertically arranged commemoratives it appears on the top sheet margin centered at the upper end of the vertical sheet gutter. (Types I, Ia, Ib, III).

CENTER SLUG: This marking corresponds to the BAR but is found at the opposite end of the sheet, Types II and III. It is in the left sheet margin and is centered opposite the left end of the horizontal gutter. On 200 subject vertically arranged commemoratives, the CENTER SLUG appears on the bottom sheet margin centered at the lower end of the vertical sheet gutter. This marking is the middle "horizontal bar" of the terminology as used in the article.

FRAME SLUGS: replaces HORIZONTAL BARS in article terminology, and is the series of markings found on the left sheet margins of the normal Type II and III sheets. In the vertically arranged commemoratives the FRAME SLUGS appear on the bottom sheet margins of the full sheet.

As plate number position has caused considerable confusion in the vertically and horizontally arranged commemoratives, a simple method follows: hold the pane with the stamps upright and the position of the plate number determines the pane position, regardless of whether the number is on the top or alongside the stamps.

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THE DEVELOPMENT OF THE ELECTRIC EYE

By

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FOREWORD: *I wish to express deep appreciation to the BUREAU ISSUES ASSOCIATION for permission to use material from the BUREAU SPECIALIST, especially that of the late H. M. Southgate and Mr. O. J. Williams. The Bureau of Engraving and Printing and Post Office Department have furnished excellent photographs and information, without which this article would not be possible. I have drawn freely from material by Mr. George C. Hahn in THE AMERICAN PHILATELIST, an unpublished article by Mr. Charles M. Schwartz, Jr., STAMPS, WEEKLY PHILATELIC GOSSIP, and many other publications. I also wish to thank the many specialists in the field of Electric Eyes for the information and assistance they have willingly given. I will be happy to aid anyone who contemplates entering this field*



1926 2¢, Scott 634 Electric Eye Printing, showing markings, including experimental plate #21150, to be discussed in this article

FIFTY-ONE years ago the Bureau of Engraving and Printing assumed the task of supplying the postage stamp needs of the nation. Since those early days all postage stamps have been manufactured by the Bureau, with sole exception of the recent "Flag" series. Up to 1923 the Bureau printed all postage stamps, except the coiled issues, on the Flat Press. Flat Presses call for hand-fed sheets, in contrast to the mechanical feeding process of the Rotary Press. In the same way, Flat Press sheets must be fed into the perforating machine singly; Rotary Press product from rolls of paper. A Rotary Press produces approximately three times as many sheets of printed stamps per day as a Flat Press. In 1923 when the Stickney Rotary Press (See Fig. 1) was first successfully employed for sheet stamp production, the resulting output of stamps was much greater and was produced less expensively.

From the outset of the Bureau's production of postage stamps a major problem confronting the Bureau was waste. Badly perforated sheets, which would not pass the Inspectors of the Bureau and were consequently destroyed, constituted a direct challenge to efficient operation. The unequal shrinkage of the paper together with the "human element" were the chief causes of faulty perforation. Several experiments were made to improve perforation, such as the Blue and Clay papers of 1909 and the 2mm and 3mm spacings. But these did not solve the problem. The shrinkage of paper cannot be accurately con-

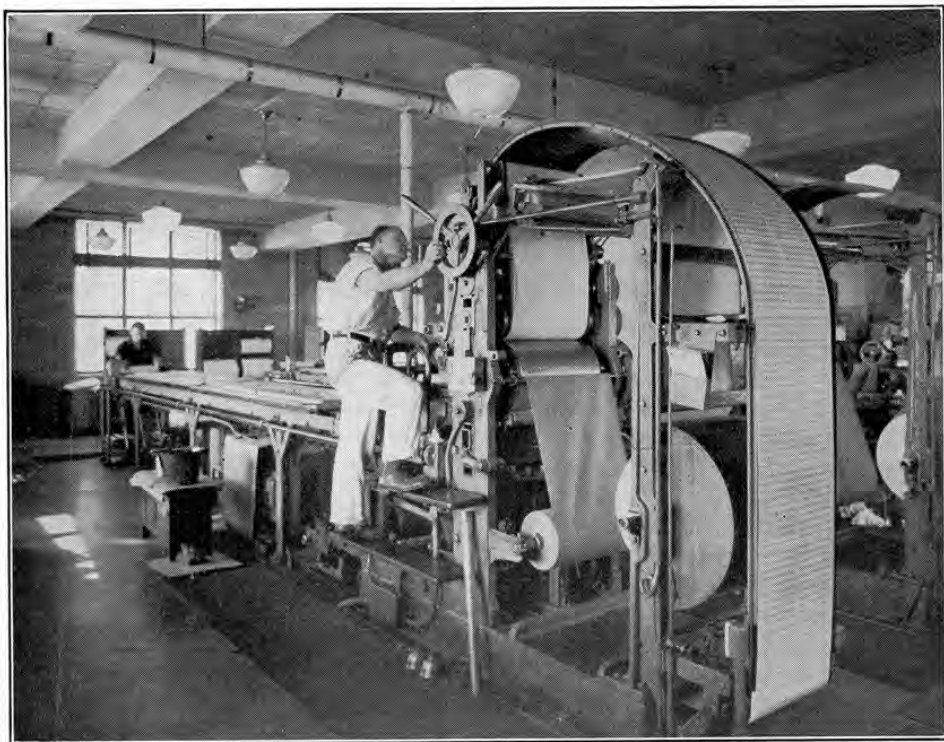


Fig. 1—STICKNEY ROTARY PRESS.

Today the Rotary Press is employed for almost the entire postage stamp production of the Bureau. Sheets for "Electric Eye" perforation are printed on these presses only.

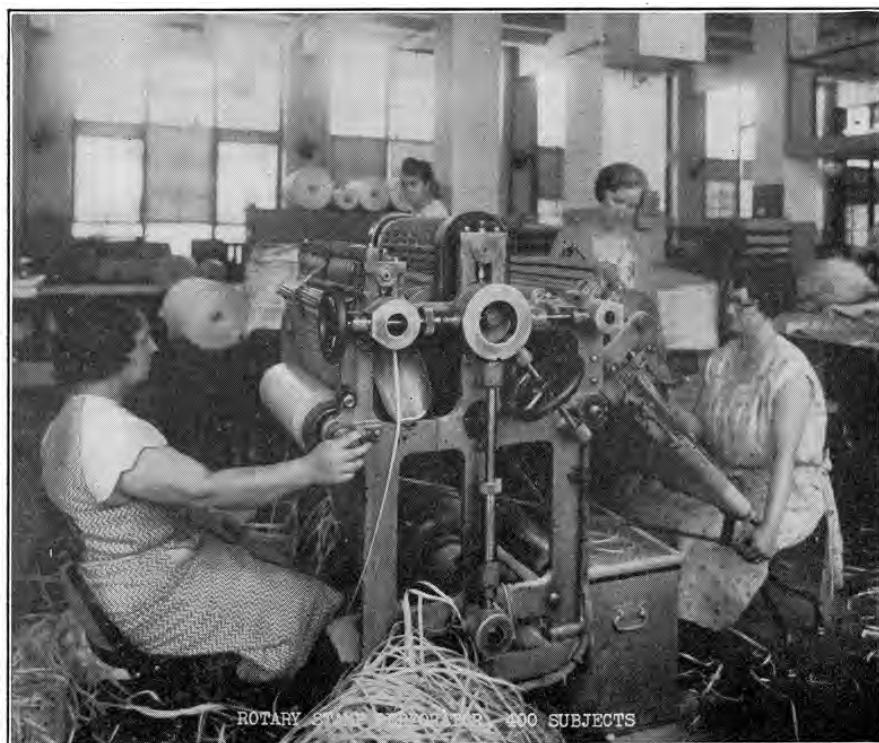


Fig. 2—MANUALLY OPERATED PERFORATING MACHINE.

To a large degree these perforating machines are being replaced by the Photoelectric (Electric Eye) perforators, now in production under contract.

trolled, but it was felt that something could be done about the “human element” problem. The perforating machines in the Bureau were operated by two persons (See Fig. 2). Each person had to rely on quick reflexes and good sight. However, constant operation and fatigue caused slower reflexes and a resultant poorly perforated product. An examination of a pad of postage stamps at any Post Office would have produced very few finely centered sheets. The even poorer sheets had been condemned by the Inspectors and destroyed. It was imperative that perforation be improved and thus the waste reduced.

Early in 1930, Mr. Henry J. Holtzclaw, mechanical expert of the Bureau, conceived the idea of photo-electric control of postage stamp perforation. Several years of experimentation followed. The General Electric Company supplied Mr. Holtzclaw with a photo-electric control suitable for adaptation to the Stickney perforator. After many trials, failures, and changes a machine emerged that offered prospects of success. On July 13, 1933 experimental plates of the 2c Washington design, then current, were assigned and numbered 21149 and 21150. These plates were certified for press usage on November 13, 1933. An initial printing of 30,000 sheets for experimental purposes only was made. Plates 21200 and 21201 were also assigned numbers, but as these were only diagrammatic plates, the stamp design not being rolled in, all impressions were destroyed. These were used to develop certain pertinent in-

formation during the development of the experimental perforator. It was sixteen months later that the Electric Eye perforator was put to work on "real" postage stamps, and the new electric eye sheets were first shipped on February 5 and 6, 1935 to some sixty-five towns scattered throughout the country. Some 9,000,000 of these electric eye stamps were sent out these first days. Mr. H. M. Southgate reported in the BUREAU SPECIALIST that February 8, 1935 was the earliest cancellation known, from both Nanticoke, Pennsylvania and Gibson City, Illinois. There is also a notation in the records of the Post Office Department of these two cancellations. These new "eye" sheets were first placed on sale at the Philatelic Agency on April 18, 1935.

An examination of the "experimental" sheets 21149 and 21150 (See Fig. 3) discloses that certain additions in the sheet margins have been made. The design of the stamp has not been altered in any way. First it will be noted that the plate numbers are opposite the third stamp from the top or bottom of the pane (depending on the pane position). Originally these plates had the numbers in the upper left and lower left corners, numbers having been omitted from the two right panes. This was necessary as it was foreseen that the numbers would intercept the controlling light ray and would energize the relays. The Bureau, however, felt it important that every pane have the identifying plate number, so a selector switch was inserted in the circuit which cut off the rays when the plate number passed. It was also found that a more satisfactory arrangement was to have the plate number opposite the third stamp, instead of at the sheet corner. The left margin numbers were shifted to a corresponding position. This arrangement continued on all Type I Electric Eye sheets. It is possible to identify plate singles of Type I as to position, upper or lower pane. The plate number of the upper pane is centered 10mm from the top of the stamp design and 12.5mm from the bottom. The lower pane number is centered 12.5mm from the top of the stamp design, and 10mm from the bottom.

The second characteristic of these "eye" sheets is the series of small *vertical dashes* which are found in the center sheet gutter. There are forty-one dashes each about 0.25" apart. The twenty-first *dash* is located across the center line of the horizontal gutter (which separates the upper and lower panes). The first and forty-first *dash* in the sheet are one-half space (0.125") from the edge of the plate, and they match with the corresponding dashes on the companion plate of the Rotary Press. This assures the same spacing on the printed web when impressions of alternate plates are made. These *vertical dashes* were entered by first having the lines that framed the sides drawn by the diamond point of the ruling machine, cutting through the "ground" and the cross lines to cut off the dash put in. The dashes were then etched in. Measurements indicate that the normal dashes are slightly longer than the spaces. (In all but two plates, 21367 and 21368, the measurements of these dashes are not collectible, there being only slight variations). These *vertical dashes* automatically adjust the vertical perforations of the center rows only, the other rows being adjusted semi-automatically while the machine operates.

The third characteristic of these plates is the *horizontal guide dash* (sometimes referred to as "slug"). This *horizontal guide dash* is located in the right sheet margin, midway between the upper and lower right panes. In sheets

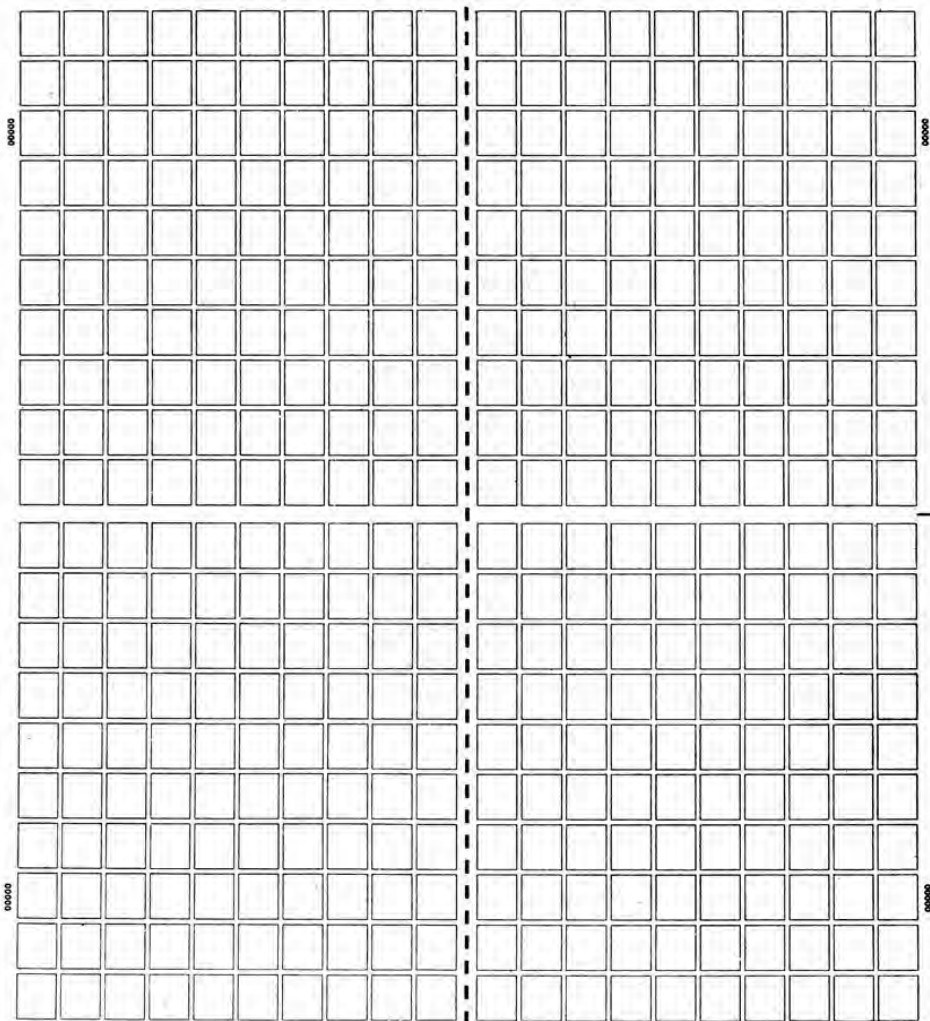


Fig. 3—“EXPERIMENTAL ELECTRIC EYE” sheet layout (Type I), 400 subject, Rotary.
 (1) Plate numbers are opposite third row from top or bottom, depending on pane.
 (2) Vertical Dashes centered in the central sheet gutter between the right and left panes.
 (3) Horizontal guide dash in the right sheet margin, mid-way between the upper right and lower right panes. (Note: above diagram shows markings in relation to the printed sheets, and not the plates from which sheets were printed).

21149 and 21150 the *horizontal guide* is 0.06" wide and 0.5" long. The *guide* extends horizontally across the right sheet margin, starting at a point in line with the right frame lines of stamp 100 of the UR pane and 10 of the LR pane. This *guide* is composed of solid color. The *horizontal guide dash* controls the horizontal perforations. Each *guide* represents a complete revolution of the horizontal perforating cylinder.

With a picture of the sheet layout of Type I Electric Eye plates, an examination of the "experimental model" perforator (See Fig. 4) will show the manner in which the markings in the sheet margins activate the machine and



Plate Blocks of 10 from the Experimental plates, #21149 and #21150



Above, First Day of Issue at the Washington, D.C., Post Office, signed by D.C. Postmaster W.W. Mooney

Right, Mooney seen here in another landmark event, selling the first pane of stamps of the first duck stamp, Sc. RW1, to Ding Darling, the force behind the creation of the Hunting Permit Duck Stamp program



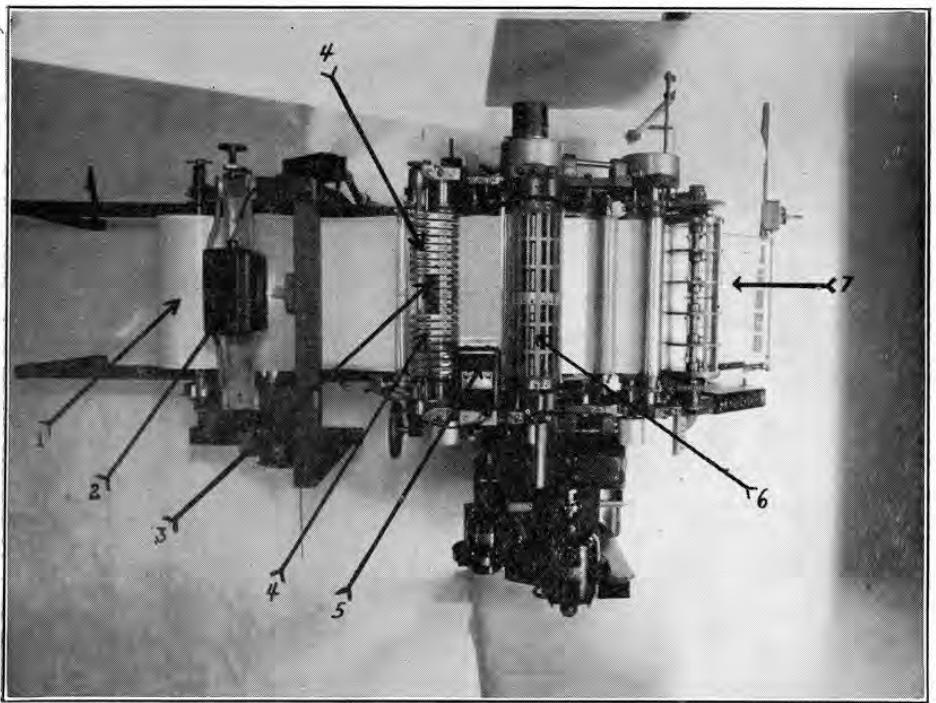


Fig. 4—EXPERIMENTAL ELECTRIC EYE PERFORATOR.

Roll of printed paper (1) is threaded through the perforator. Dual scanning heads (2) react to the vertical dashes of sheet and control the six center (3) vertical rows of perforation; the outside perforating wheels (4) are regulated manually. Photoelectric Cell (5) intercepts the horizontal guide dash and controls the horizontal perforating wheels (6). The sheets are then cut and stacked at the end of the machine (7).

control the perforation. As shown on Figure 4 the web of printed sheets moves from the left to the right through the perforator. Dual scanning heads (2) are housed just to the right of the roll of printed paper (1). These two photoelectric cells watch both sides of the series of *vertical dashes*. The slightest variation, accurate to 0.01", is transmitted automatically to a distributing motor which moves the web of paper to the right or left, correcting the vertical perforation. On this machine only the two rows adjacent to the vertical gutter (the six center perforation wheels [3]) are controlled by the electric eye. The outside rows (the eight outer wheels [4]) are independent of the "eye" and are adjustable individually by the operator. Unequal shrinkage of paper made this hand adjustment necessary. There is also a photo-electric cell (5) which is placed so as to intercept the *horizontal guide dash*. This *horizontal guide* interrupts the "eye" upon each complete revolution of the horizontal perforating wheel (6) and improper registration is transmitted to a relay which will speed up or retard the flow of paper to correct the perforation. In as much as these stamps do not differ from the regular 400-subject product in design, a mint copy "may generally be distinguished by the characteristic gum breaker markings. The breakers are of the herring bone type, spaced 0.21" (3mm) measured at right angles to the breaker line. Looking at the back of the left

hand panes the breaker marks slant down from left to right at a 2 degree angle. On the back of the right panes the breaker marks slant up from left to right. This breaker was used only on this perforator."¹ Perforation improvement was noticeable from the start. Waste was cut from 12 to 15% to from 6 to 8%, which is an appreciable amount. The Bureau considered the experiment a success, and work was started on the construction of a larger and improved Photo-Electric Perforating machine.

On March 21, 1935 plates 21367 and 21368 were certified for press usage. Shipments of stamps from the first two plates, 21149 and 21150 (Type Ia), had been made just a month prior to the assignment of these plates. Experimentation was continuing, and slight changes were made in the layout of this plate. The plate numbers remained in the same position. The *vertical dashes* were of the same thickness (approximately), but the spacing is quite different, and is collectible. The spacing also indicates the method of laying down the *vertical dashes*. On these plates the dividers were spaced apparently a bit too wide. "Starting with the twenty-first or center dash this excess accumulated, until by the time the second dash from the top and bottom of the plate was reached, there was insufficient room left for the two dashes and the last full and the half space. Normally there should be 0.87" for these dashes and spaces (two dashes 0.25" each, one space 0.25" and half space 0.12"). Apparently the top half of plate 21367 was laid down first as the 0.87" space has been reduced to 0.67" which was filled with dashes 0.18" and 0.17" long and spaces 0.17" and 0.15". On the lower half of this plate, the available space increased slightly to 0.7" and we find dashes 0.18" and 0.17" as before but spaces 0.17" and 0.18". Plate 21368 was slightly more closely spaced for the eighteen dashes each side of the center, as the top half has 0.8" left, which is dashed 0.23" and 0.19", with spaces 0.22" and 0.16". The bottom plate is almost the same, the 0.79" space having two dashes 0.22" and the spaces 0.22" and 0.13".²

On these Type Ib plates (21367 and 21368) the *horizontal guide dash* is the same size as on Type Ia, 0.06" and 0.5" long. However, whereas Type Ia *guide* is composed of a solid line of color, Type Ib *guide* is composed of a series of closely engraved vertical lines, which are the width of the *guide*, 0.06". They give the appearance of a solid line, and the change was apparently made due to the difficulty in drying the ink on the Type Ia *guide line*. There was no difference in the action of the photo-electric cell on either of the *horizontal guide dashes*.

Plates 21367 and 21368 went to press on March 21, 1935 and continued in use until cancelled on December 26, 1935. These two plates are the only ones in the Type Ib classification, and the irregularity in spacing of the *vertical dashes*, and composition of the *horizontal guide dash* are the means of identification.

On June 6, 1935 plates 21399 and 21402 were certified for press usage, and first went to press the following day. These plates are classified as Type I (being the finally accepted layout), and all plates assigned for use on the

¹ BUREAU SPECIALIST, March 1939, H. M. Southgate.

² BUREAU SPECIALIST, March 1939, Fourth Bureau Series Electric Eyes, H. M. Southgate.



Portions of plate 31368 (darker red) and 21150
Left, comparing plate #s; right, comparing vertical dashes

“Experimental Model” perforator are of this type. In all there are twenty-four plates in this group: 21399, 21402, 21411, 21416, 21417, 21418, 21419, 21420, 21421, 21422, 21423, 21424, 21437, 21438, 21441, 21442, 21447, 21448, 21676, 21677, 21678, 21679, 21688, 21689. Plate numbers continue in the original position, opposite the third stamp. The *vertical dashes* are rather uniformly spaced, and there is no collectible variation. The *horizontal guide dash* has again been altered, after Type Ib has been in use for less than three months. The *horizontal guide dash* is again of solid color, however, the width of the line has been reduced from the 0.06” of Types Ia and Ib to 0.03”, the length remaining 0.5”.

These plates continued in use until the issuance of the Presidential Series, in 1938, rendered them obsolete. The last of these plates was used for less than five months when the new series was issued.

All 400 subject plates prior to 21676 (the last of the 2c Washington “eyes” being 21448) had the plate number entered 0.07” from the stamp design. As perforation often cut into the plate number, beginning with Plate 21676 the number was moved farther from the stamp design, and was entered 0.14”. Also on plates 21441 and 21447 the *vertical dashes* were transferred and not etched, as had been the procedure to this time. There is no apparent difference due to the rolling in of the dashes.

Precancels were also printed from the “eye” plates, and shipments were not made until October 2, 1937 when a supply was sent to Harrisburg, Pennsylvania, followed shortly by shipments to other points. About the middle of November 1937 a precancelled “eye” was reported from Bridgeport, Connecticut. In all twenty-one Bureau precancels, have been reported from Type I “eyes.” They are: Boston, Brooklyn, Los Angeles, Bridgeport, Chicago, Des Moines, Detroit, Minneapolis, Saint Louis, Albuquerque, Buffalo, New York, Cleveland, Seattle, Milwaukee, New Haven, Baltimore, Cincinnati, Dayton, Harrisburg and Richmond. By far the scarcest “eyes” are Richmond and New Haven. These items make very interesting additions to a specialized “eye” collection.

In January 1938 four plates: 21786, 21787, 21788, 21789, were assigned, and were of the 2c Washington design. These plates were of a new design and were designed specifically for the newly constructed “Pilot Model” Electric Eye Perforator (See Fig. 5). This perforator was of better design and several improvements had been incorporated. General Electric Company worked closely with the Bureau’s Mr. Holtzclaw. All vertical perforations were photo-electrically controlled, eliminating the manually adjusted outside rows. The *vertical dashes* continued as the operative markings for these perforations. The *horizontal guide dash* was completely omitted from the plate layout of this new design, Type II (See Fig. 6). In the left sheet margins of the printed sheets a series of *horizontal bars* were added. Horizontal perforation is controlled by these *bars*. It was found that the *horizontal guide dash* was an inadequate control for the perforations, for with the rapidity of movement of the web of printed sheets, a closer check was needed. The “eye” was moved to the opposite side of the perforator, so as to register the distinctive new bars in

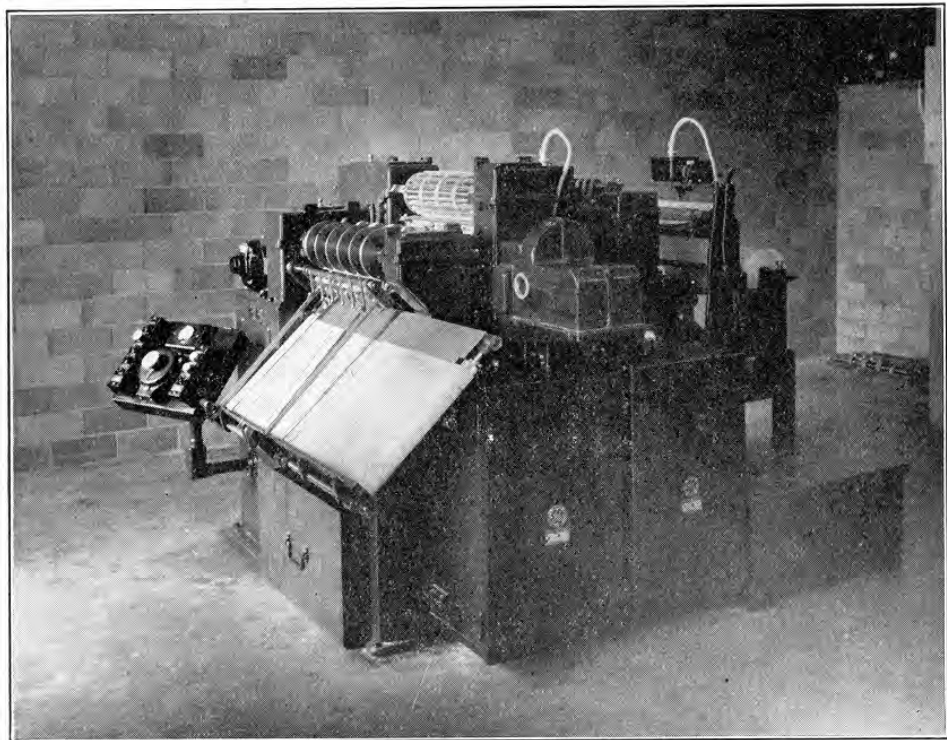


Fig. 5—PILOT MODEL ELECTRIC EYE PERFORATOR.

This machine contained several improvements not found in the "experimental" perforator. Developed by the Bureau with aid of General Electric Company. Horizontal perforations are controlled by the new horizontal bars in the left of the printed sheet margins. Vertical dashes control all rows of vertical perforation. Type II (and later Type III) sheets only can be perforated on this machine.

the left sheet margins. There were nineteen of these *horizontal bars*, each 0.03" in thickness, 0.32" in length, and spaced 0.18" from the edge of the stamps. Each *bar* is lined with the top edge of the stamp in the left vertical row. Stamps number 1 of each pane do not have a corresponding *bar*. The tenth bar is located in the exact center of the horizontal gutter separating the upper and lower panes. Plate numbers have been returned to their original positions, opposite the corner stamps in each pane. It will be noted that the upper and lower left plate number blocks also contain the horizontal bars, thus differentiating them from the right pane plate number blocks.

The four plates assigned to the Washington design two-center were rendered obsolete with the issuance of the Presidential Series, and were never sent to press. These four plates were cancelled on June 24, 1940.

To be continued