United States Patent

Peacock

[15] **3,692,298**

[45] **Sept. 19, 1972**

[54] PRINTING OF CHEQUES

[72] Inventor: **Jack Peacock,** Wimborne, Dorset, England

[73] Assignee: **McCorquodale & Company Limited,** Basingstoke, England

[22] Filed: **Aug. 24, 1970**

[21] Appl. No.: **66,304**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 752,233, Aug. 13, 1968, abandoned.

[52] **U.S. Cl.** **270/12,** 101/226, 270/58, 283/58

[51] **Int. Cl.**.....**B41f 13/64,** B65h 39/02, B30b 1/00

[58] **Field of Search**.....270/1–22, 53, 58; 101/93 C, 426

[56] **References Cited**

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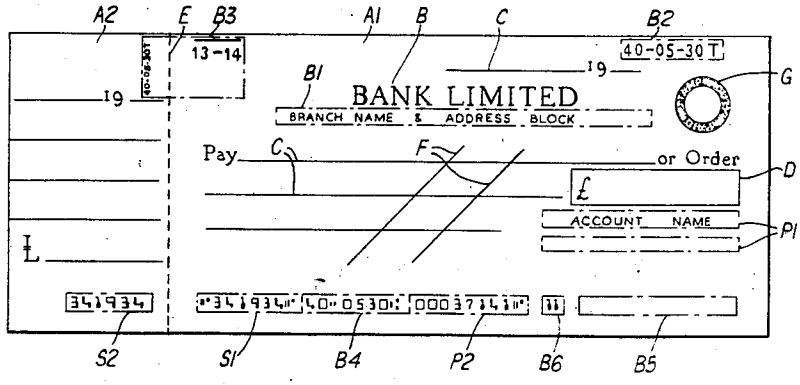
Primary Examiner—Lawrence Charles
Attorney—Kemon, Palmer & Estabrook

[57] **ABSTRACT**

To permit inexpensive printing of individual check books containing personalised checks and other documents and flexibility in the order of such documents in the check book, the unvarying information and background pattern are bulk-printed on a web or on large sheets and the web or each sheet is then cut into individual checks The personalising and bank branch information, partly in machine-readable characters (e.g. in magnetic ink) is added by passing the separated checks and other documents through a high-speed printing machine capable of being rapidly reset. The checks travel in the direction of their lengths, permitting checks of different lengths to be accommodated, and pass through a quality monitor which can check each of a line of machine-readable characters added in the printing machine.

14 Claims, 11 Drawing Figures



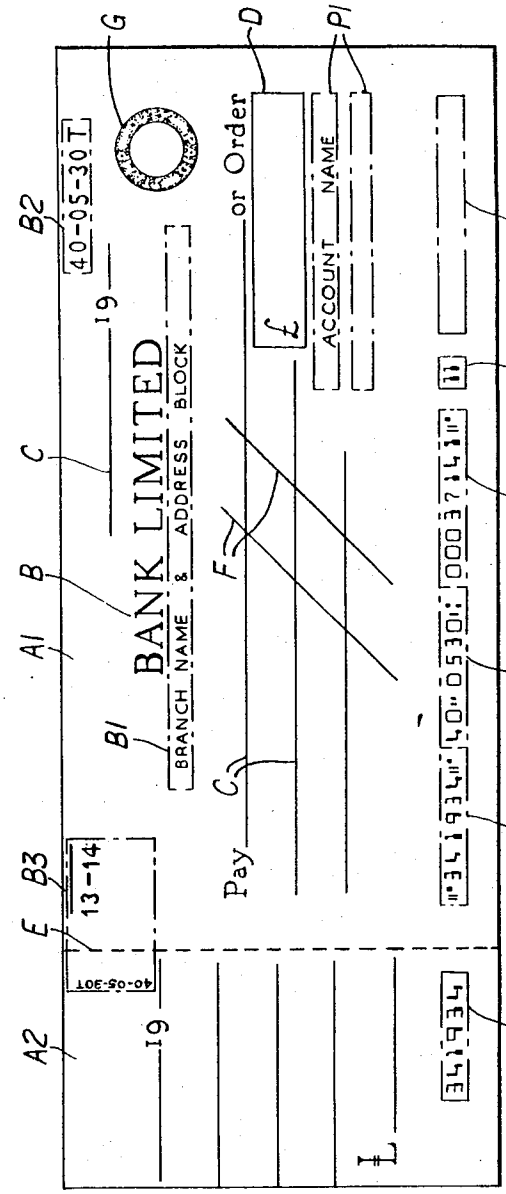


Fig. 1.

Inventor
Jack Peacock

By
Kenyon, Palmer & Eglebrook
Attorneys

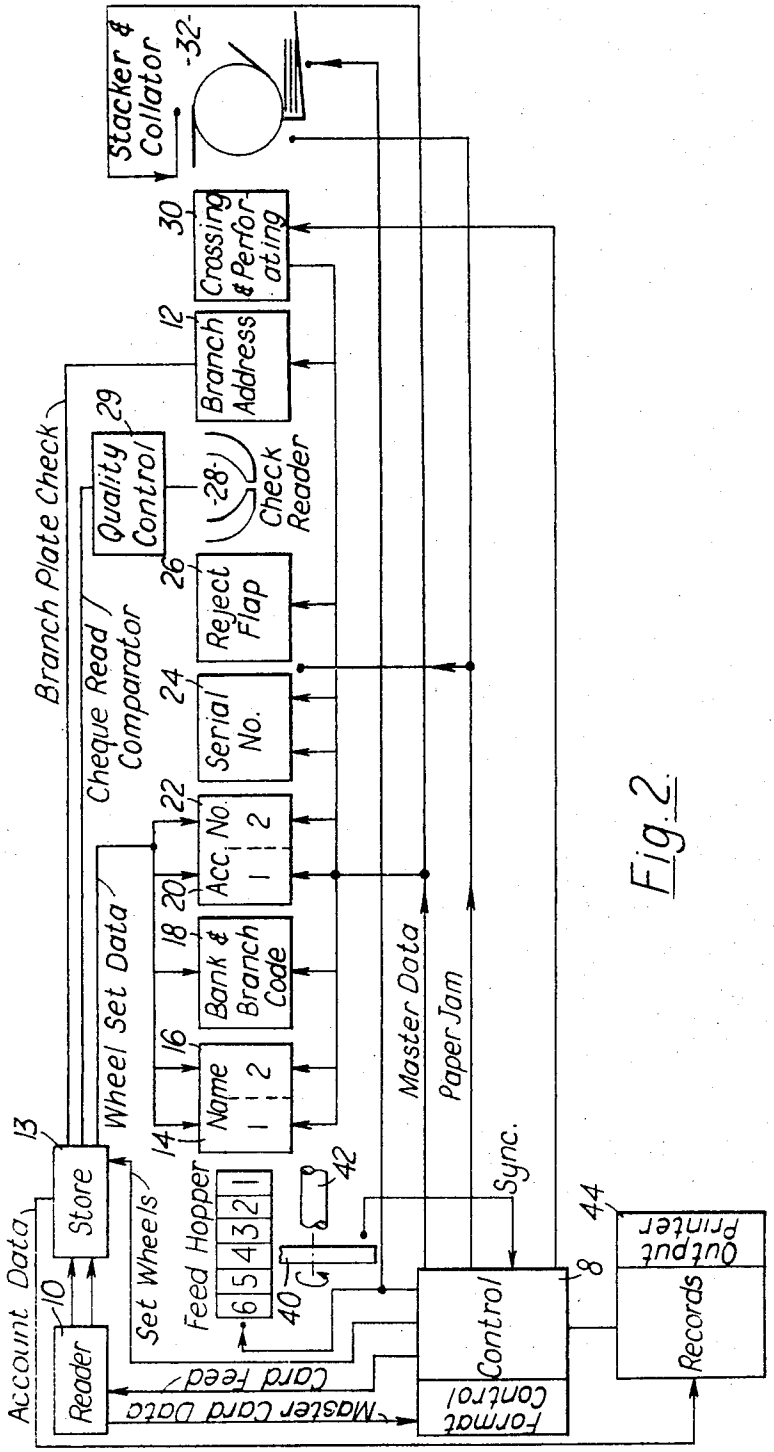


Fig. 2.

Inventor

Jack Pocock

By

Attorneys

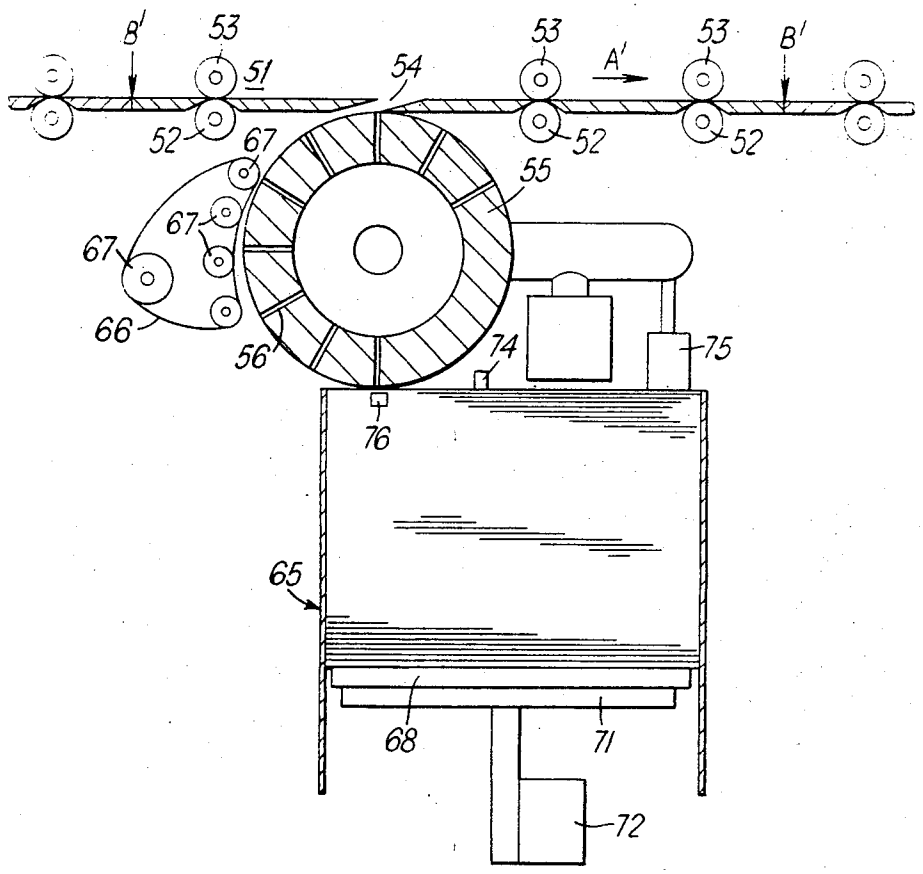


Fig. 3.

Inventor
Jack Peacock

By
Kenyon, Kenyon, Tarmey & Eastabrook
Attorneys

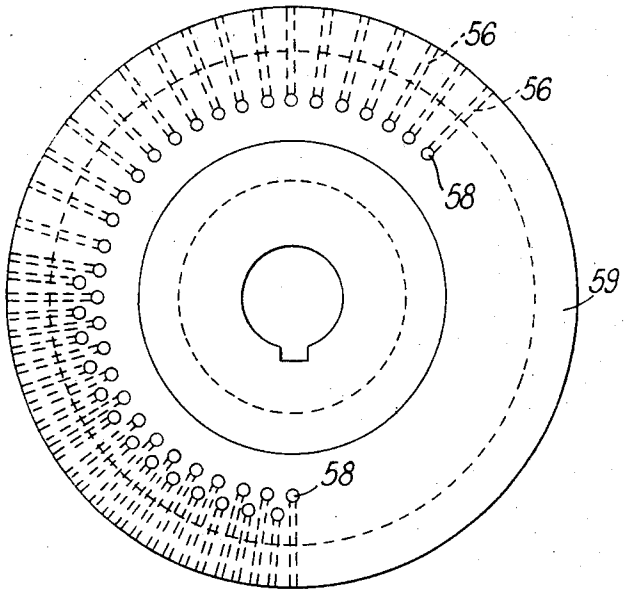


Fig. 4.

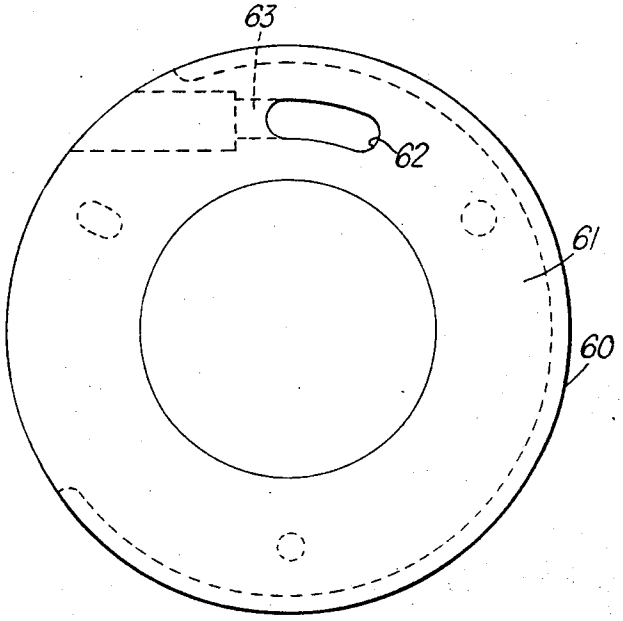


Fig. 5.

Inventor
Jack Tarrock
By
Attorneys

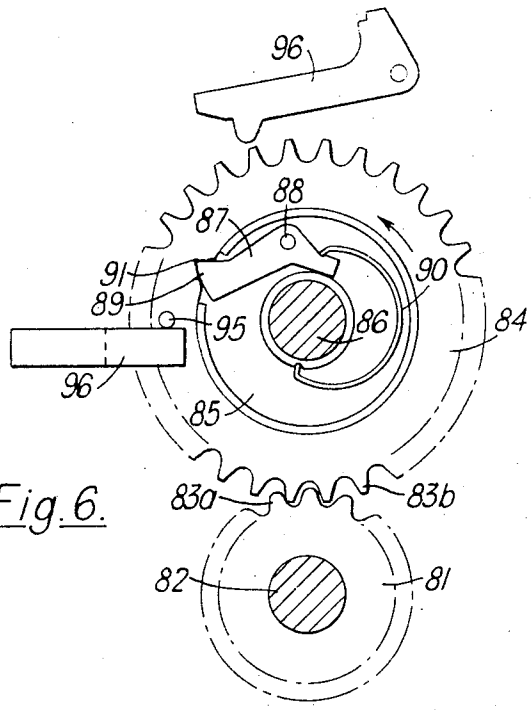


Fig. 6.

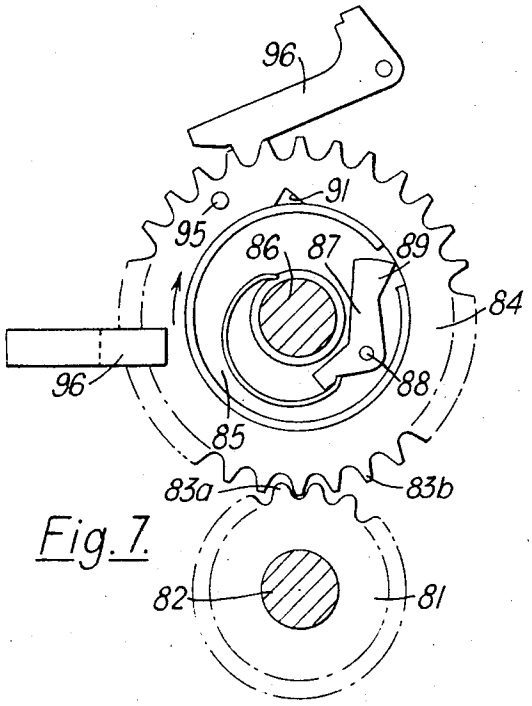


Fig. 7.

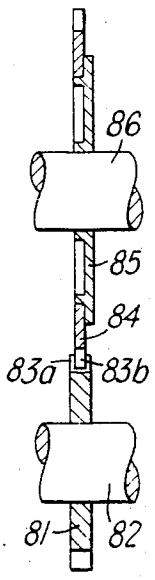
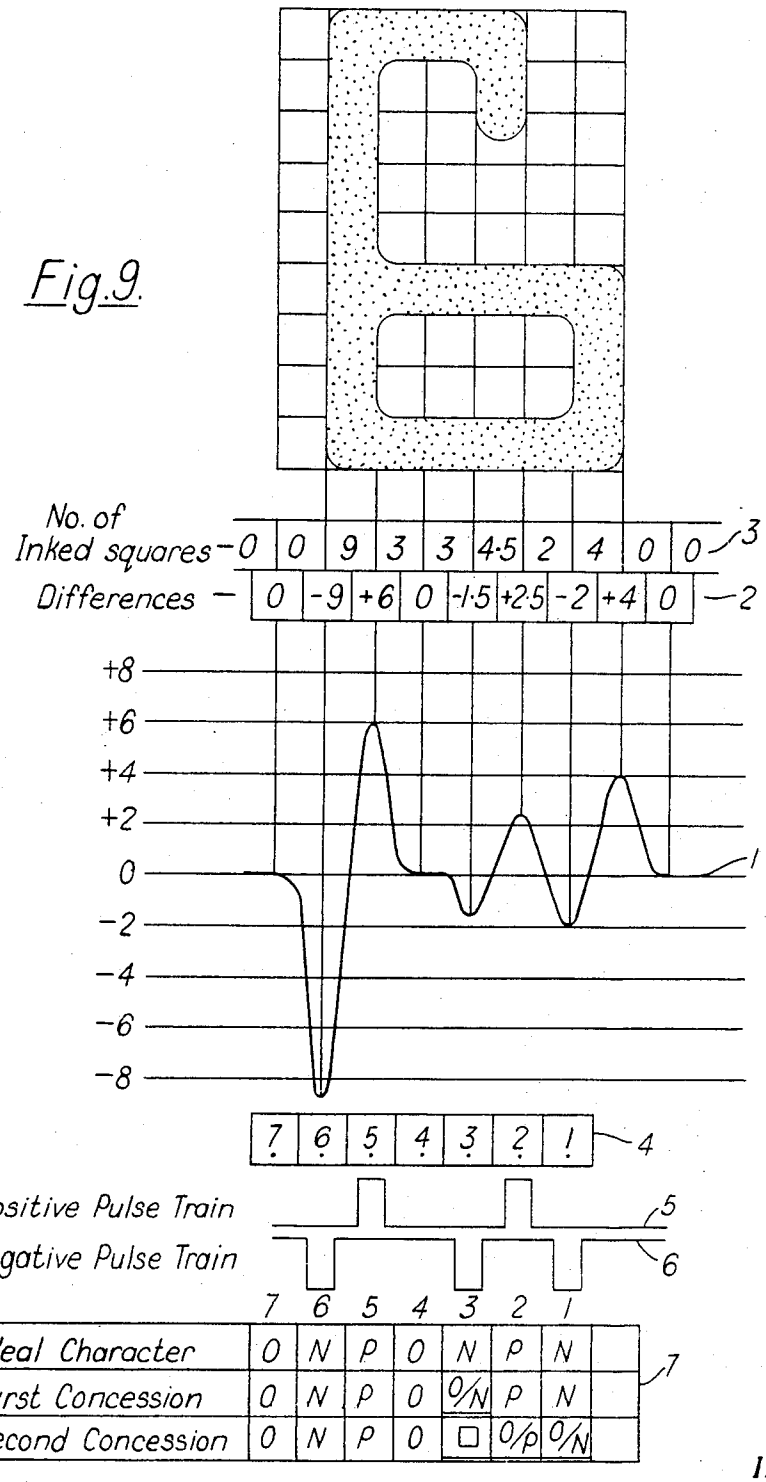


Fig. 8.

Inventor
Jack Pearce

By
Kenyon, Palmer & Eplabrook
Attorneys

Fig. 9.



Inventor
Jack Pacock

By
Kenyon Kenyon Reilly Carr & Chapin
Attorneys

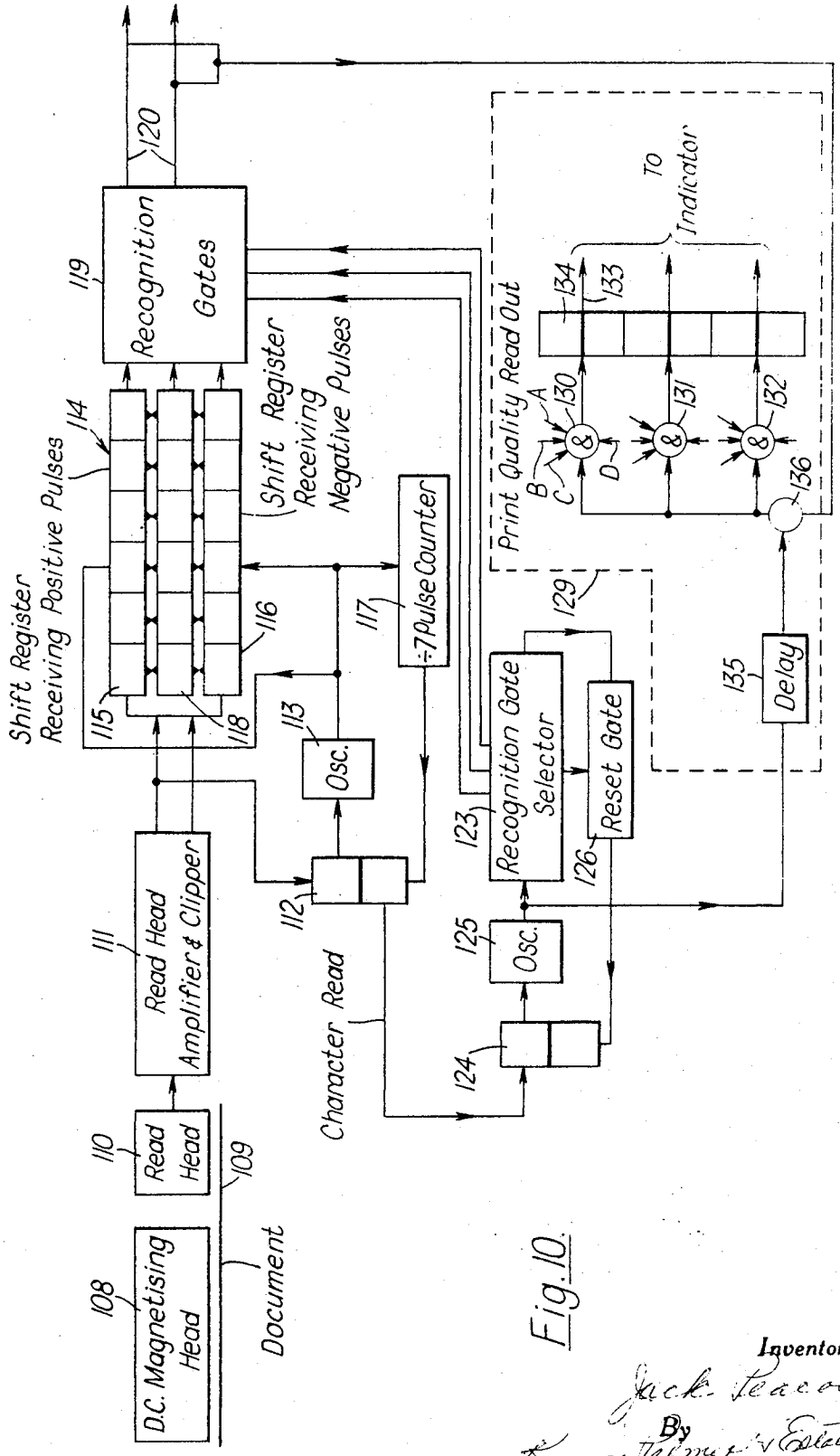


Fig. 10.

Inventor
Jack Peacock
By
Kenyon Kenyon Eshelman
Attorneys

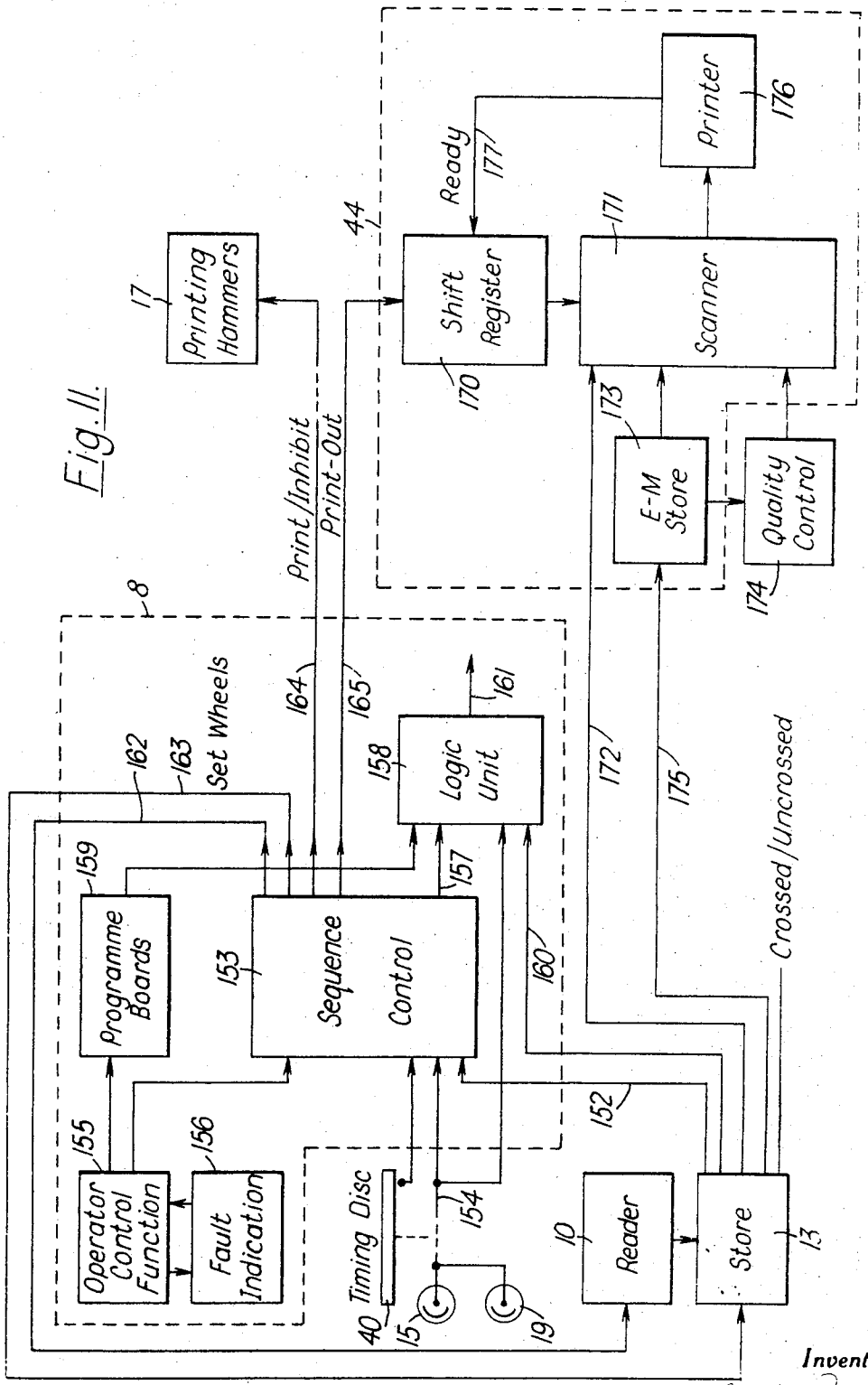


Fig. 11.

Inventor
Jack Placek

By
Kemon, Palmer & Estabrook
Attorneys

PRINTING OF CHEQUES

This application is a continuation-in-part of my prior copending application Ser. No. 752,233 filed Aug. 13, 1968, now abandoned.

It has become customary for banks to supply clients with "personalized" checks, that is to say checks carrying data identifying the client. This data enables automatic sorting of checks and normally includes the bank and branch identification, the account number of the client, a serial number and a transaction code. These details are normally printed in a machine-reading font (i.e. E 13B using magnetic ink, or CMC7) and some of them are repeated in conventional wording or figures elsewhere on the check.

The background pattern and a part of the information on checks is the same for all checks issued by that bank and the pattern and basic information can thus be bulk-printed in long runs on a web of suitable material. Another part of the information relates to the bank branch. On personalized checks, there is a third part relating solely to the customers. The production of personalized checks presents further difficulty because banks do not like to hold in stock more than three check books for any customer and in many cases they do not wish to have more than one in stock. Consequently, it is not possible to have long runs without resetting the printing machine which adds the personalization details. Sometimes these details are added to the bound check books at the bank branch with a small imprinting machine but this does not permit the rigorous quality control which is desirable in a fully automatic banking system relying entirely on the quality of the data printing on the input documents. In some cases the personalization details are added to the basic web by the check printer, although this is very expensive when the check books are being reordered one at a time. A method which has been widely used is to print the checks in bulk with all the constant information and at the same time to give them serial numbers in magnetic ink, after which the printed sheets are cut into folios of four or five checks. Litho plates corresponding in size to the folios are prepared with the branch details and from these, paper litho plates are derived. A paper litho plate bearing the branch details is fed into an electric typewriter controlled by punched cards, each of which contains all the information needed for personalizing the checks for one account holder. This machine adds to the multi-section paper plate the personalizing details in magnetic ink, these being different for each of the four or five sections of the plate. The paper litho plate is now put into a printing machine and the sheets of skeleton checks carrying the background information are overprinted in magnetic ink from the paper plate. Additional documents, such as paying-in slips and requests for new check books, are then introduced, and the sheets are then bound and cut into the four or five individual personalized check books.

The equipment on which these operations are carried out has a very small output potential and consequently the requirement in terms of operator hours is high and the labor content in the total cost is correspondingly high. Another factor adding to the cost is that a printing plate has to be prepared for each run of checks and each plate has to be run up on waste paper before the run of checks. Yet another factor tending to increase the cost of each check book is the limited handling capacity of the electric typewriter which adds the personalizing information.

We have found that high speed and low cost production can be achieved with sufficient flexibility. According to the present invention, after the bulk printing of the constant information and background pattern on the web or sheet, the printed web or sheet is cut into individual checks; an input record member bearing the information to be printed by the machine is automatically sensed and adjustable printing members at successive stations of an in-line printing machine are set in accordance with the sensed personalizing information; and the checks and any additional documents to be bound into the check books are fed individually through the printing machine, each check being arranged so that it moves in the direction of its length; and the checks and other documents which pass successively through the machine are then collated and bound to form check books.

Thus we have departed from the assumption that maximum output is achieved by printing all or substantially all of the data on a continuous web or large sheet of check paper. The use of pre-cut checks on a high speed in-line printer allows the mixing of checks, other documents requiring personalization and other documents which do not require personalization in the correct order without difficulty. The stations printing personalization details may be provided with an inhibiting device which is automatically brought into operation when a document which does not require these details arrives at the printing station. Thus selected ones of the printing stations may print on a document while other stations are inhibited.

A further advantage of feeding the checks in the direction of their length is that it permits an in-line quality control based on the sensing in turn of the printed characters. This could not easily be achieved with a web or large sheet of checks because the checks are normally arranged transversely to the direction of movement of such a web or sheet to minimize travel between imprints and to permit checks of different lengths to be accommodated without changing the web travel between imprints.

The printing members must be capable of being reset from one character to another at high speed and print wheels are suitable for adding the personalizing details, the wheels being rotated under the control of the data read from the input record member. A "total transfer" ribbon carrying a magnetic coating is used with the character wheels in the preferred machine, but it will be appreciated that these characters would be printed in a form suitable for automatic optical sensing if the reading system were adapted for optical recognition.

Preferably, the machine also has an in-line quality control and an in-line serial numbering device.

The printing of the branch name and address and the bank and branch codes can be carried out by means of a printing plate; this is because these details will remain the same for the printing of checks for a large number of customers at the same bank branch. Similarly, the overall program for a bank (for example the check book format) is set, in the preferred machine, by printed circuit boards which need only be changed in the case of a major alteration in the requirements of that bank.

Edge-punched cards are inserted into the machine to give the machine any other information not coded on the individual account cards, for example, whether open or crossed checks are required, whether counterfoils are required, and whether there are to be 30 or 60 checks in the books.

The personalization details are read by the machine from the individual account cards which may be those at present in use by the banks to control the existing machines. The print wheels can be reset to change the personalization details very rapidly by actuating mechanisms controlled by an electronic memory unit which has already stored the information read from the punched card.

In a small proportion of cases two lines of printing have to be added for the customer's name, instead of a single line, and to take this into account the machine preferably includes two in-line name printing stations to which documents requiring two lines are fed in succession. Where two or more single-line name accounts are printed in succession, the two name-printing stations are used alternately, so that while one station is printing the documents for one account the other station is being set up with the name details of the next account. These features, with the conception of feeding precut single checks into the machine, greatly increase the flexibility and speed of the system.

One example of apparatus embodying the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 shows a typical check used by British banks;

FIG. 2 illustrates diagrammatically apparatus for printing personalizing information on the checks;

FIG. 3 is a diagrammatic side elevation, partly in section, of sheet conveyor apparatus;

FIG. 4 is a view in elevation of a feed drum in the apparatus of FIG. 3, and

FIG. 5 is an end elevation of a face-sealing element for the drum of FIG. 4;

FIGS. 6 and 7 are views in elevation (in different operational positions) of a print wheel setting mechanism;

FIG. 8 is a sectional end elevation of part of the mechanism of FIGS. 6 and 7;

FIG. 9 shows a waveform for a specific E13B character;

FIG. 10 is a block schematic diagram of apparatus for recognizing E13B characters; and

FIG. 11 is a block diagram of the control circuit.

The check unit of FIG. 1 consists of two parts, a check A1 and a counterfoil A2. All checks issued by any one bank have the same security background pattern. The heading includes the name B of the bank, the name and address B1 of the branch and the branch code number B2. At B3 there is an abbreviated bank and branch code. Lines C indicate where the customer must write the date, the person or company to whom the check is to be paid and the amount to be paid. A box D receives the figures representing the amount to be paid. Further lines for the same information are provided on the counterfoil. Perforations E permit the check to be detached from the counterfoil. Some checks have no counterfoil and instead a record sheet is bound in the check book. The check shown has two lines F which "cross" the check and indicate that it can only be cashed through a bank. Some checks do not have these lines and are then "open" and freely negotiable. The customer decides whether his checks will be crossed or open. British checks also have a medallion G representing a stamp duty.

Along the bottom of the check shown is a line of numerical information all printed in characters of the form known as E 13B and all printed in magnetic ink. The magnetic ink permits machine sensing of the characters and the use of the internationally known E 13B code facilitates the recognition of the characters. The first block S1 is a serial number, different for each check; a corresponding serial number S2 is printed on the counterfoil. The next block B4 is the bank and branch code. Then comes a block P2 representing the account number, a block B6 representing the type of transaction (for example, debit or credit). Finally there is a space B5 for the bank to insert the amount in E 13B characters when the check has been presented. Under the box D is an alphabetical block P1 which is the name of the account holder.

The checks themselves may be bound in books of different sizes (for example, 30, 60 or 120) according to the requirements of the bank and the customer. The check books may also include documents other than checks and counterfoils or a record sheet. As an example, they normally include a detachable re-order form bound between checks so that the re-order form will be reached when there are only a few checks left. They may also include a number of paying-in-slips.

It will be seen that a check printing system has to have considerable flexibility, the more so because (as explained above) banks may order only one, two or three books of checks for each customer.

The security background pattern, the bank name, the lines, box and stamp duty medallion are printed in bulk in the system according to the present invention but we prefer to insert the serial numbers and the branch name and address with the personalizing information. This permits the "bulk" printing to be carried out in greater bulk and the printing of the branch information can conveniently be incorporated within the system to be described.

Thus the apparatus to be described in connection with FIG. 2 adds to the bulk printed stock the serial numbering, the branch name, address and code and the account holder's name and number. This is done mainly by print wheels but a plate is used to print the bank branch name and address because different banks require different type styles.

The apparatus shown in FIG. 2 includes a feed hopper having compartments loaded with the appropriate preprinted checks, already printed with the "constant" information (that is to say the background pattern, the bank name and medallion, etc.), order forms and any other documents to be printed and inserted in the check book. These documents are arranged so that on leaving the hoppers their longitudinal dimension is in the direction of their advancement through the machine.

The reader 10 is supplied with a master card bearing data representing the check book format, for example whether there are to be 30 or 60 checks in the book and whether each check is to be attached to a counterfoil slip; and with order cards which bear data

representing the bank and branch codes, the account number and customer's name and any other information to be printed on the checks. The appropriate branch address plate is placed in a plate holder slide in the branch address printing station **12**. When a start command is signalled, the reader **10** feeds a master card through a reading head and transmits the data derived from the master card (relating to the check book format) into a core store **13**. When the reading of the master card is complete, the core store transmits signals to set those parts of the machine concerned with the check book format. The first order card is then fed through a reading head and data from this card is passed into the core store. The information in the core store relating to the account number and customer's name and the bank and branch code is used to set up the printing wheels at stations **14, 16, 18, 20** and **22**. In this example, the stations **14** and **16** both include groups of wheels for printing the account holders name. If the account holder has a name which requires two lines, a check to be printed stops at each of the stations **14** and **16**. In most cases the account holder's name requires only one line and in such cases the printing hammers at the stations **14** and **16** are energized alternately; the station **14** prints the customer's name for all checks required for that customer to complete a given order and these checks do not receive an imprint at the station **16**. Consequently, during this time the type wheels of the station **16** can be set with the customer's name for the next order.

The station **18** prints the bank and branch code. This information is not included in the plate at the station **12** because it is required to print the bank and branch code in magnetic ink; the plate at the station **12** prints the branch name and address in ordinary ink.

Two printing stations are also provided for the printing of the account number. When the account name stations **14** and **16** are being used alternately, the account number stations **20** and **22** are used in the same way, that is to say the type wheels for one of the stations are set up with the account number for the next order while the type wheels for the other station are printing the account number for a given order. This arrangement permits a considerable increase in machine speed.

At each printing station there is a movable stop, a hammer and a photocell. The stops are operated synchronously to bring each document to a stop at each station. The photocells (shown diagrammatically at **15** in FIG. **11**) sense the arrival of the leading edge of the check at the station. The hammers (**17**, FIG. **11**) operate synchronously to cause the print, if all photocells **15** corresponding to those hammers have responded, indicating that a check has arrived at each printing station. However, any hammer can be inhibited by a control signal, as will be described below. Each printing station is equipped with a ribbon feeding mechanism, the feed being stopped temporarily while the wheels are being set. The ribbons at stations **18, 20** and **22** have a magnetic coating and are of the "total transfer" kind and consequently a known amount of magnetic coating is transferred at each imprint. Those at stations **14** and **16** carry ordinary ink for the account holder's name.

The printing station **24** includes a serial number generator. This includes print wheels for printing a serial number on the check and a separate set of print wheels for printing the same serial number on a counterfoil, where the counterfoil is attached to the check. The wheels are indexed to advance by one after each print. This indexing is controlled by signals from the hammer cocking mechanism at this printing station. The ribbon at the station **24** also carries magnetic ink.

The station **26** contains a reject flap. Documents fed from the feed hoppers are sensed at each station by a photocell. A photocell signal representing the arrival of the leading edge of the check permits the late arrival or non-arrival of a check at the station to be sensed. If the check does not arrive at the sensing point at a specific time, it is known that it is not maintaining a required average velocity. This means that the document has been slowed or stopped. To prevent other documents being fed on top of this earlier document, the feed is stopped immediately and any checks which pass through are diverted through the "escape" station **26**. The reject flap at the station **26** which diverts these documents is controlled by a signal from a control unit **8**.

A station **28** contains a reader which senses the characters printed in magnetic ink at the preceding stations **18, 20, 22** and **24**. As the documents travel in the direction of their length, each character can be sensed in turn. The resulting electric signals are sent back to a quality control unit **29**. This unit also draws data from the store so that parity checks with the information from the punched order card can be made. Standard quality monitors are available which assess the quality of the print on the basis, for example, of signal strength, character dimensions, edge quality, holes within the character, etc.

Reference has already been made to the station **12**, containing the branch plate holder. The remaining station **30** is for crossing and perforating the checks, where these features are required.

At the output end of the machine there is a stacking and collating unit **32** which stacks successively received checks and other documents until an order is completed. The stacked documents representing the completed order are then fed to a conventional stitching and binding machine (not shown).

The order in which documents are fed from the compartments of the feed hopper to the transport system is determined by the check book format. For example, it may be required that the first documents in each check book shall be paying-in slips. These may be followed by **25** checks, followed by an order form for ordering a fresh check book, followed by five further checks. The paying-in slips, the checks and the order form will be loaded into different compartments of the feed hopper. Further documents which do not require printing may be added at the stacking and collating unit; for example, cover sheets may be added here. Documents added at this point do not pass through the printing stations and hence do not delay the operation of the machine.

Documents which do not require the personalizing details and which have to be arranged between personalized documents pass through the printing stations but they carry a small mark which is sensed by a further photo-electric cell (**19**, FIG. **11**) and the resulting

signal from the latter inhibits the hammer release solenoids.

The control unit **8** is responsible for the order in which the various tasks are carried out and includes circuit boards representing different formats and pulse generators for initiating operations within the machine. These circuits are standard units for generating pulses or carrying out the switching and logic functions required. The unit **8** supplies signals to the reader **10** to cause successive order cards to be read and signals to the store to cause the wheels to be set when a complete set of data has been read from an order card and has been transferred to the store. When the wheels have been set in response to trains of pulses indicating the required extent of rotation, the control unit transmits the start pulse to the paper feed system at the feed hopper and transmits a corresponding signal to the stacking and collating unit. It also supplies the latter with format information to cause the stacked documents to be fed out when an order has been completed.

Synchronizing pulses for the control unit **8** are provided by a timing disc **40** on a shaft **42**.

Finally, the control unit supplies data to an output printer **44** which prints a record of the orders completed and of the print quality assessment. The details of the orders are supplied to the printer **44** from the store.

It is not essential for the serial number on the counterfoil to be printed in magnetic ink but there is one advantage to be gained from using magnetic ink for the counterfoil serial number as well as for the check serial number. The signals from the reader **28** representing these two numbers can be compared to ensure that the number printed on the counterfoil by its type wheels is the same as that printed by the other type wheels of the station **24** on the check.

In one machine which we have built the plate holder for the branch plate is double-sided, enabling the operator to insert a new plate into the holder while an existing order to being carried out. Thumb wheel switches alongside the plate holder enable the operator to set up the last three digits of the branch sorting code. The punched order cards also carry the branch code information and the machine is stopped if the code information read from a card does not agree with that set up on the thumb wheel switches. The machine continues when the holder is turned to bring the correct plate into printing position.

If desired, checks may be passed through a "doubles" detector station which senses the presence of two superimposed checks and automatically diverts one of them into a reject channel. Standard "doubles detectors" are commercially available.

It will be seen that the feeding of individual checks to a series of printing stations greatly increases the flexibility of a check printing system. It enables documents other than checks to be introduced between checks without difficulty. It reduces costs because there is no need to prepare a separate printing plate for each run of checks and there is no need to have a preliminary run on waste paper. Furthermore since the positioning of the print at the various stations is controlled by reference edges of the check (one of these being the leading edge and the other being the top edge of the check) the details added at these stations are always in the same position in relation to these reference edges. Because of this and because the checks are fed in the direction of their lengths, checks of different lengths present no problem. Moreover the longitudinal feeding permits a quality check on every character printed.

A suitable sheet feeder is shown in FIG. **3** of the accompanying drawings, which will now be briefly described. The sheet feeder system is more fully disclosed and is claimed in U.S. Pat. No. 3,572,686 in the name of A.G. Day. In FIG. **3**, a conveyor track **51** for feeding the sheets of paper in the direction indicated by the arrow A is sub-divided into modular lengths, one such length being indicated between the point B, each length having a different feed hopper. Each length is equipped with continuously driven rollers **52** which project through the upper surface of the track **51** opposite freely rotatable spring loaded pressure rollers **53**. Each modular length of the track **1** has an inclined throat **54** forming a passage through the track above a suction feed drum **55**, a part of the circumference of which is formed with suction ports at the ends of the channels **56**. As shown in FIG. **4**, the channels **56** join with suction feed bores **58** parallel with the axis of rotation of the drum, the feed bores **58** forming ports in the sealing face **59** of the drum. Against the face **59** is pressed the surface **61** of a stationary sealing plate **60**. This surface contains an elongated aperture **62** with which is connected to a vacuum feed bore **63** extending to a port in the periphery of the plate **60**. The radial positions of the bores **58** and the aperture **62** are so arranged that as the drum **55** rotates suction is applied successively to the bores **58** and therefore to the suction ports **56**.

Below the drum **55** is a hopper including a magazine **65** from which the drum draws sheets to be passed through the throat **54** to the upper surface of the track **1**. At the side of the drum **55** there is a belt **66** passing over pulleys **67** which assists in driving the successive sheets into the throat **54**.

The hopper unit includes a movable base plate **68** and a jack-plate **71** connected to a lifting mechanism **72**. The operation of the lifting mechanism is controlled by a feeder device **74** responsive to contact with the top sheet. A blast nozzle **76** keeps the uppermost sheet in a more or less floating state to counteract any tendency for the second sheet to participate in the feed movement of the top sheet. A suction operated holding foot **75** retains the uppermost sheet of the stack in position until the suction at the foot **75** is released at a predetermined instant. The uppermost sheet is pulled towards the drum **55** by the suction at the ports in the periphery of the drum but slides over the drum surface until the suction is released at the holding foot **75**.

The valves which control the application of suction to the drum **55** and the foot **75** are controlled by a program in control unit **8** which ensures that sheets from different hoppers are fed on to the track **51** in the correct succession.

FIGS. **6**, **7** and **8** illustrate the wheel setting mechanism for the print wheels. This wheel setting mechanism forms no part of the present invention and is more fully described and claimed in U.S. Pat. No. 3,545,291 in the name of Alan Sydney Holdsworth.

In FIG. **6**, a print wheel **81** journalled on a spindle **82** has disposed around its periphery elements of uniform

pitch (not shown) carrying print type. The print wheel is formed with teeth **83***a*, one tooth for each print type element, which mesh with teeth **83***b* on a setting wheel **84**. The setting wheel **84** is mounted for rotation on a hub **85** secured to a driving shaft **86**. On one side of the hub a pawl **87** is pivoted on a pin **88**. A tooth **89** at the end of the pawl **87** is urged by a wire spring **90**, acting on the other end of the pawl, against a bearing surface on the inside of the setting wheel **84** so that when the setting wheel assumes a particular angular position the tooth will enter a notch **91** (as shown in FIG. **6**) formed in the bearing surface. This is the zero or datum position of the setting wheel, further anti-clockwise rotation being prevented by a stop **95** on the wheel which engages a finger **96**. To set the print wheel the shaft **86** drives the hub **85** in a clockwise direction and the hub takes with it the annular setting wheel **84** by virtue of the engagement of the tooth **89** in the notch **91**. When a required type character reaches the printing position, a setting latch **96** is allowed to fall so as to engage the appropriate tooth gap of the setting wheel to prevent the setting wheel from rotating further. The hub **85** continues to rotate, the tooth **89** riding out of the notch **91**. When printing has been effected and the print wheel is to be reset the drive direction of the shaft **86** is reversed and the setting latch **96** is withdrawn. The hub **85** then rotates in an anti-clockwise direction, initially independently of the setting wheel **84**. When the tooth **89** comes into register with the notch **91** it engages the notch and the hub **85** then carries with it the setting wheel **84** until the wheel **84** (and therefore the print wheel) reaches the datum position.

As shown in FIG. **8**, the width of the setting wheel and hub assembly is much the same as the width of the print wheel **81**. Thus a number of print wheels, each with its associated clutch mechanism, can be assembled side by side, the hubs **85** for all the printing wheels being mounted on a common driving shaft. For setting purposes, this shaft is rotated in a clockwise direction from the datum position and each setting wheel is stopped at its required position, independently of the other setting wheels, when its setting latch **96** enters a tooth gap in the setting wheel.

The finger **96** is repeated for each setting wheel, the fingers forming a comb. FIG. **10** shows a quality control circuit which can be used for the unit **29** of FIG. **2**. The details of this circuit form no part of the present invention and have been more fully described in U.S. Pat. No. 3,571,793 to R.H. Britt. For the purposes of the present explanation it will be assumed that the print to be read is in the form known as E13B. This character form is in common use for printing data on bank checks. When a character printed in magnetic ink passes an electromagnetic reading head, the reading head develops a signal representative of the changes of magnetic flux which occur during the passage of the character. E13B characters are arranged to fall within an imaginary matrix 9 units high and 7 units wide, so that as the seven strips pass across the reading head the maximum change of area for any character is 9 units. For example with the E13B character **6** shown in FIG. **9** there is an initial change (reading the line **3** from right to left to obtain differences shown in the line **2**) from zero of 4 units of area, then a negative change of 2 units of area and so on, these changes being reflected in the waveform **1** of FIG. **10**. By squaring the elements of this waveform in the seven periods shown in line **4** and neglecting the pulse amplitude variations, positive and negative pulse trains can be built up, as shown at **5** and **6** and these are sufficient to distinguish the scanned character from any other characters in the E13B series. Scanning of the character takes place from right to left and the first element is ignored for identification purposes since it is always positive, whatever the character.

The ideal character is shown in the top line of table **7**, in which N and P represent negative and positive respectively and O represents zero, that is to say no change. It is found that it is possible to give concessions for certain signal elements while retaining sufficient information to recognize any character. For example, element **3** in waveform **7** is negative but reference to line **2** will show that the value of the negative change is less than 2. As a first concession (shown in the second line of table **7**) this element may be considered to conform with the acceptance level if it is "not positive," that is to say either zero or negative, as shown in the second line of table **7**. The third line of table **7** shows a second concession in which the first element is accepted if it is not positive, the second if it is not negative, and the third will be accepted whatever its state (or in other words is ignored for identification purposes), this being represented by the square symbol.

Referring to FIG. **10**, a document **109** bearing the E13B characters passes under a D.C. magnetizing head **108** and a reading head **110**. The signal from the reading head is passed to an amplifier and clipper **111** which converts the positive and negative peaks of the A.C. waveform to positive and negative pulses (see FIG. **9**) which are separated to form two pulse trains and these are applied to a shift register **114**. The first positive pulse (which is ignored for recognition purposes) is applied to a bistable circuit **112** which triggers an oscillator **113** to commence feeding stepping pulses to the shift register **114**. The shift register **115** receives the positive pulses and the shift register **116** the negative pulses. The pulses delivered by the oscillator **113** are counted by counter **117** which, on achieving a count of 7, delivers an output to switch over the bistable circuit **112** and thereby to inhibit the production of further pulses by the oscillator **113**.

The stored contents of the shift register **114** are sampled by recognition gates **119** which deliver an output to one of a number of recognition wires **120**, there being one such recognition wire for each of the E13B characters. Thus a signal on a particular line **120** means that the corresponding character has been recognized. When the bistable circuit **112** switches over in response to an output from the counter **117**, a character read signal is applied to a bistable circuit **124** to start an oscillator **125**. Pulses from the oscillator **125** are applied to a recognition gate selector **123** which sets the recognition gate **119** sequentially to three states respectively representative of "second concession" acceptance, "first concession" acceptance and "ideal character" acceptance, a recognition signal being delivered on line **20** whenever a character passes the selected acceptance level. When the selector **123** has completed its recognition gate setting sequence it applies an output pulse to the reset gate **126** which resets the bistable circuit **124** and so stops the oscillator **125**.

Gates 130, 131 and 132 are each interconnected with the recognition gate selector 123 by terminals A, B, C and D. The gate 130 may have its connections A, B, C and D so connected to the recognition gate selector that when the latter is in its "second concession" recognition state and a recognition signal has been applied from line 120 through AND gate 136 to gate 130, a signal is applied over line 133 to a printer. The AND gate 136 also requires a pulse from oscillator 125 (the pulse which has set the selector 123 into its second concession recognition state) and this is delayed by delay element 135 to allow time for the selector to operate and for a character recognition signal to appear on line 120.

Gates 131 and 132 operate in a similar manner to indicate "first concession" acceptance and "ideal character" acceptance.

The control system and records section are shown more fully in FIG. 11. The reader 10 reads data from the master card and individual order card and corresponding information is applied to a store 13. The store supplies sequence data, paper feed logic data, master data for the print-out, account data, and data relating to crossing and perforation of the check.

The sequence data is supplied by way of line 152 to a sequence control unit 153 within the control unit 8. The sequence control unit also receives synchronizing data from the timing disc 40 and data over line 154 from photocells 15 at the printing stations relating to the position of the documents on the track and from the photocell 19 if the operation of the printing hammers is to be inhibited. Finally, the sequence control 153 receives signals from the operator control function unit 155, this data relating to the starting and stopping of the check feeder, the resetting of warning indicators, and so on. In addition, the operator control function unit is connected with a fault indication and power interlock unit 156 containing these warning indicators.

The sequence control unit applies sequence control data over line 157 to the logic unit 158, which controls the paper feed and includes counters for counting the documents which are sent as they pass the various stations, to determine when the correct number of documents for a book has passed; this data is conditioned by the master data supplied by the store to the sequence control unit.

The logic unit 158 also receives directly information from program boards 159. These program boards carry certain data which is rarely changed, for example data relating to the general format required by a particular bank. These program boards have output signals controlled by easily changed wire links. If alternative programs are required, alternative program boards are wired into the apparatus. Other data relevant to a particular order (for example number of books and book style) is derived from the reader 10 and store 13 and is applied over line 160 to the logic unit 158. In addition, the logic unit receives from line 154 the signals derived from the track photo-cells and relating to the position of the documents on the track. With this input data, the logic unit 158 controls the hopper feed by way of line 161.

The sequence control unit supplies output signals over line 162 to the card reader 10, output signals over line 163 to the store, to call up the data to set the print wheels, and print/inhibit output signals over line 164 to the print stations. A further output signal over line 165 supplies print-out data to the record unit, to be described. The print stations are mechanically synchronized, so that it is necessary to present only one synchronizing output to the control system to identify the position of the mechanism at which the paper can be fed. The output signals from the sequence control are electrically interlocked to ensure that one stage of the machine sequence is complete before the next can begin. The sequence of output signals is such that the machine functions take place in the following order: input from operator control, feed card, set wheels, switch-on print heads, and feed paper. The paperfeed logic unit controls the number of and the order in which the documents are fed, to conform with the master data from the store and the information derived from the program boards.

Turning now to the records unit, the print-out data on line 165 on the sequence control unit is applied through a shift register 170 to a scanner 171. The scanner also receives over line 172 the master data derived from the card reader and has two further inputs. One of these is from a store and indicator unit 173, the store of which is electro-magnetic. The unit 173 controls the operation of the quality control 174 and the quality control provides the last input for the scanner 171.

The reason for the electro-magnetic store is as follows. In the installation which is being described a low speed printer was used and this required serial input data and a print command. The master data and the quality control information have outputs which are maintained until the printer can respond. The accounts data applied to the electro-magnetic store over line 175, however, is read out from the store at the time of wheel setting and does not persist for long enough for the output printer to operate. Consequently, this information must be stored and in the apparatus shown the storage medium is in the form of electro-magnetic counters with read-out contacts.

The scanner scans the master date, quality control information and account data and, under the control of the print-out signal from the shift register, presents the data in turn to the output printer terminal 176. The printer terminal automatically steps on and tabulates the data according to a program inherent in the print-out machine. The scanner, and hence the rate at which data is entered by the printer, is controlled by a "ready" signal applied to the shift register 170 from the printer itself, and by the print-out signal over line 165 from the sequence control unit.

Print-out of account information begins during the print operation but continues until after the end of the print operation in order to have the quality control information available.

I claim:

1. A method of preparing personalized checks, including bulk printing constant information and background pattern on check paper, cutting the bulk-printed paper into individual checks, automatically reading an input record member bearing personalizing data to be printed on the checks, setting adjustable printing members at successive stations of an inline printing machine in accordance with the sensed personalizing information, feeding the individual checks

and other documents to be inserted in a check book in order from station to station of the printing machine with the checks and other documents arranged so that they move in the direction of their lengths, stacking the documents which pass successively through the printing machine, and collating and binding them to form a check book.

2. A method in accordance with claim 1, including reading at a monitoring station each in turn of the characters applied to the checks at the preceding stations and comparing the resulting signals with the signals derived from the input record member.

3. A method in accordance with claim 1, including advancing through the printing machine a document which is to be bound in the check book but which does not require to be printed at each of the printing stations, and inhibiting the operation of those stations where printing is not required.

4. Apparatus for preparing personalized checks from check stock bulk printed with constant information and background pattern comprising: a printing machine including a document feeding unit for checks and other documents to be inserted into check books, a reading device for reading input record means giving details of the required printing and format, a number of printing stations each including one or more print wheels, and means for setting up the print wheels in accordance with the variable data read from the record member, means for individually feeding the checks and other documents to be imprinted to each of a number of printing stations in succession, with the longitudinal axes of the documents parallel to the direction of feed movement, detector means for sensing the presence of a check or other document at a printing station and controlling the timing of the printing operation at that station, and collating means for gathering the individual precut checks and other documents which have passed through the machine into the assembly required for the check book.

5. Apparatus in accordance with claim 4, in which the document feeding unit includes a number of compartments for documents of different kinds and means responsive to control signals for releasing documents from different hoppers in the order defined by the control signals.

6. Apparatus in accordance with claim 4, including at each station a stop member, and further including means for raising the stop members of all the stations in synchronism into the path of the documents, whereby each document is brought to a stop at each station.

7. Apparatus in accordance with claim 4, including at each of the said stations a printing hammer and further including means for operating all the hammers in synchronism.

8. Apparatus in accordance with claim 7, including at one or more of the stations a photo-electric device for detecting marks on documents indicating that that station is not required to operate on that document, and means responsive to a signal from the said photo-electric device to inhibit the operation of the hammer at that station.

9. Apparatus in accordance with claim 4, including at each station a photo-electric device which senses the leading edge of a document and means responsive to the output of that photo-electric device for stopping the release of further documents from the document feeding unit if the said leading edge is not sensed within a predetermined time.

10. Apparatus in accordance with claim 9, further including a reject station for diverting any documents which are passing through the stations when the document feeding unit is stopped.

11. Apparatus in accordance with claim 4, in which at each station printing is effected through a ribbon of the "total transfer" kind.

12. Apparatus in accordance with claim 4, including a further station at which printing is effected by means of a plate bearing the name and address of the branch of the bank at which the customer's account is held.

13. Apparatus in accordance with claim 4, including two printing stations for printing the name of the customer; means whereby these two stations operate in turn on each document when a two-line name is to be printed; and means whereby, when a one-line name is to be printed, one of the said stations prints the name while the other is being set in accordance with the name required for the next order to be fulfilled.

14. Apparatus in accordance with claim 4, including a printing station for printing a serial number on each check, each station having means for advancing the serial number by one each time a check is printed.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,692,298 Dated September 19, 1972

Inventor(s) Jack Peacock

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority Data

August 16, 1967 Great Britain 37806/67

Signed and sealed this 20th day of February 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

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