

Nov. 1, 1966

W. E. RUDISCH ET AL

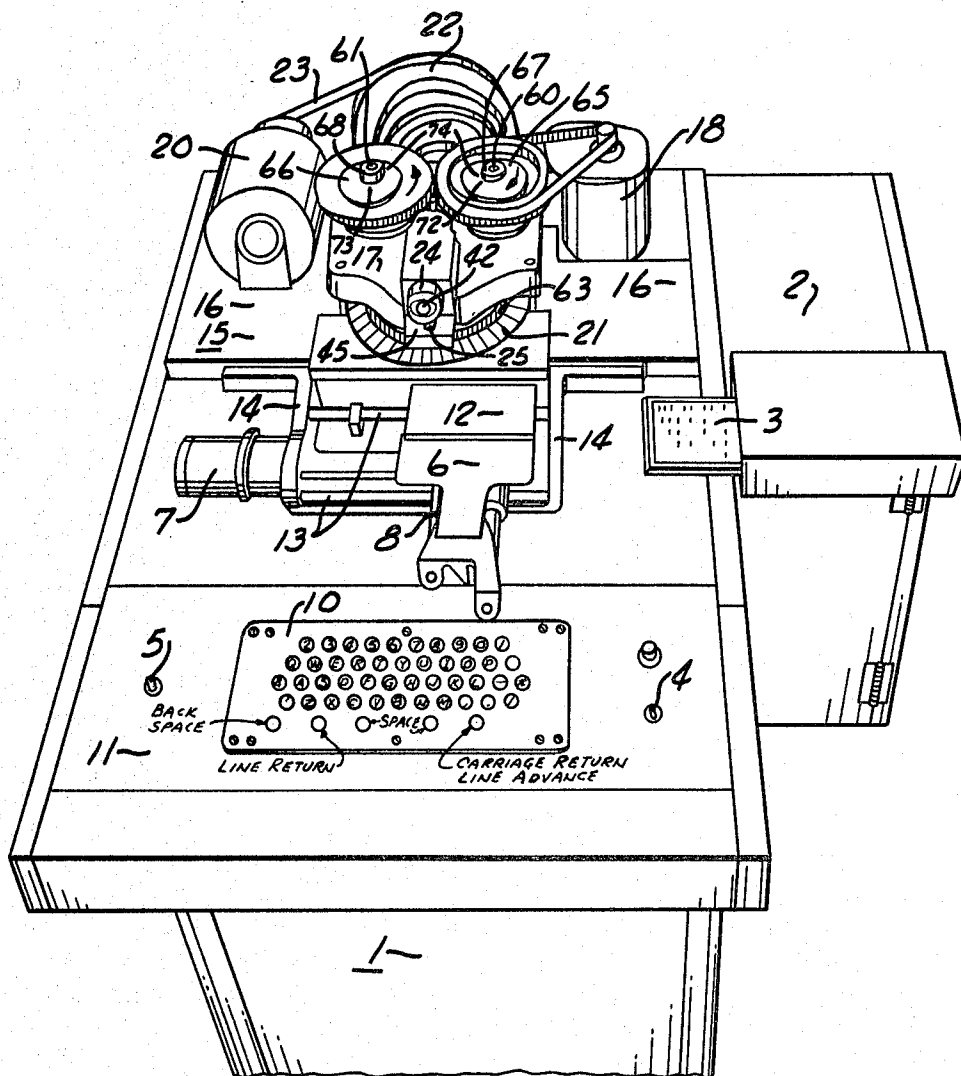
3,282,389

ROTARY IMPRINTING MACHINE MOVING SELECTED CHARACTER  
TO IMPRINTING POSITION BY SHORTEST ARC

Filed Aug. 13, 1964

7 Sheets-Sheet 1

Fig. 1



INVENTORS  
WALTER E. RUDISCH &  
FRANK D. GROSS

BY

CAROTHERS AND CAROTHERS

THEIR ATTORNEYS

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7 Sheets-Sheet 2

Fig. 2

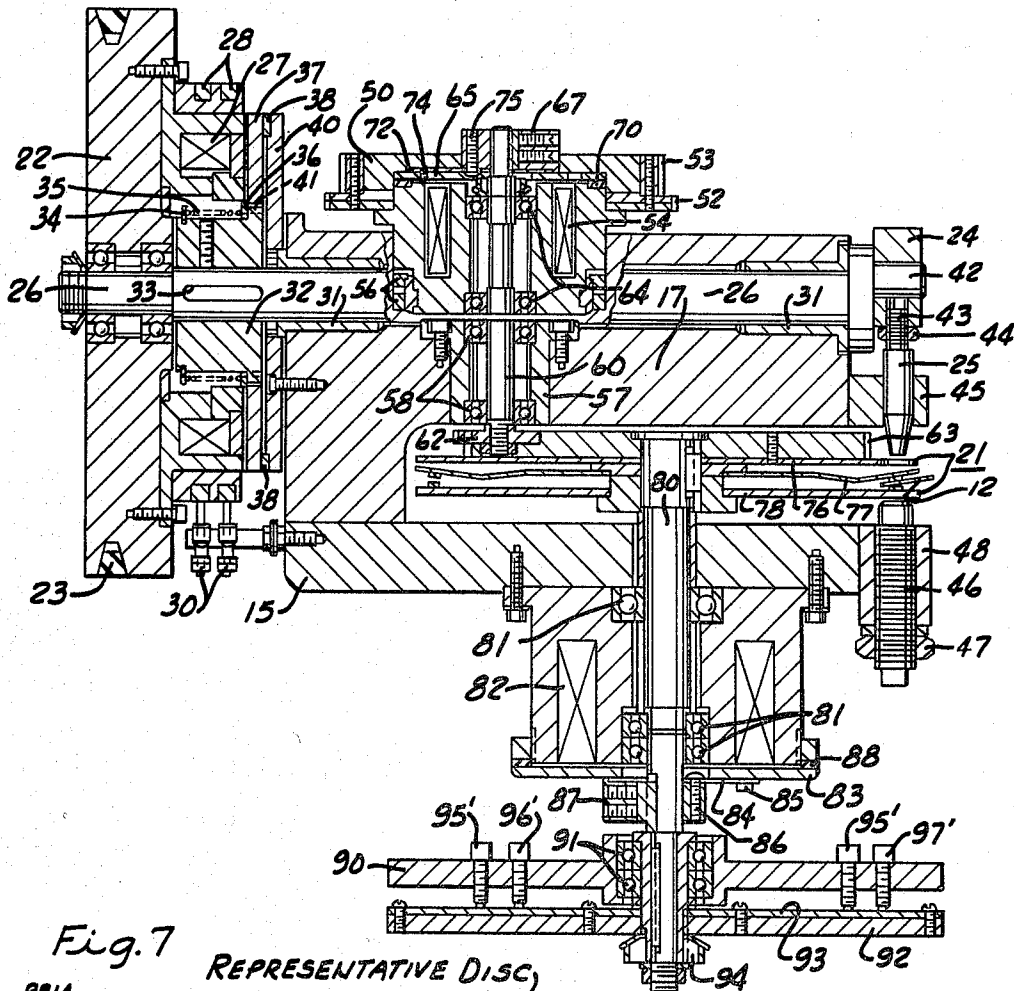
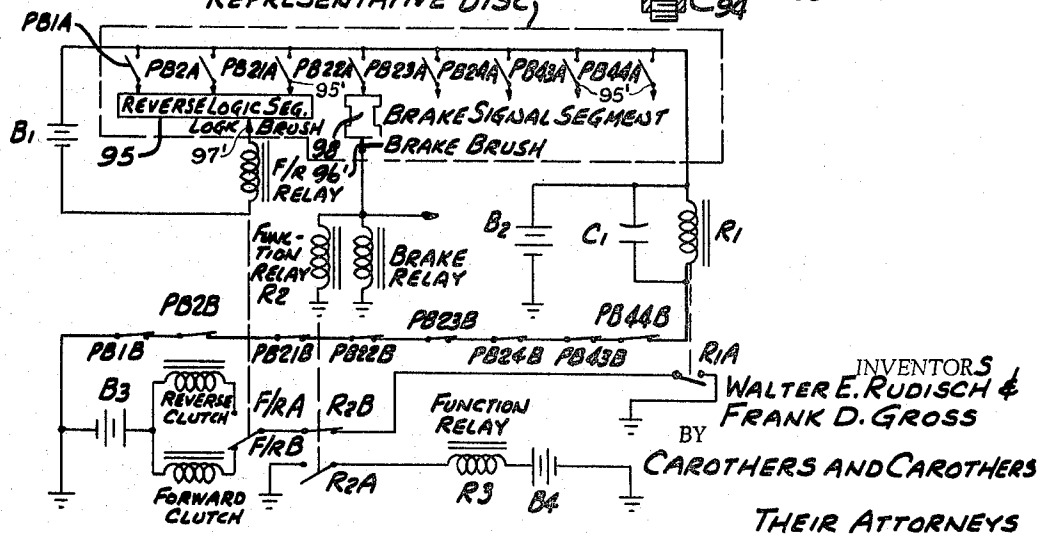


Fig. 7

REPRESENTATIVE DISC



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7 Sheets-Sheet 3

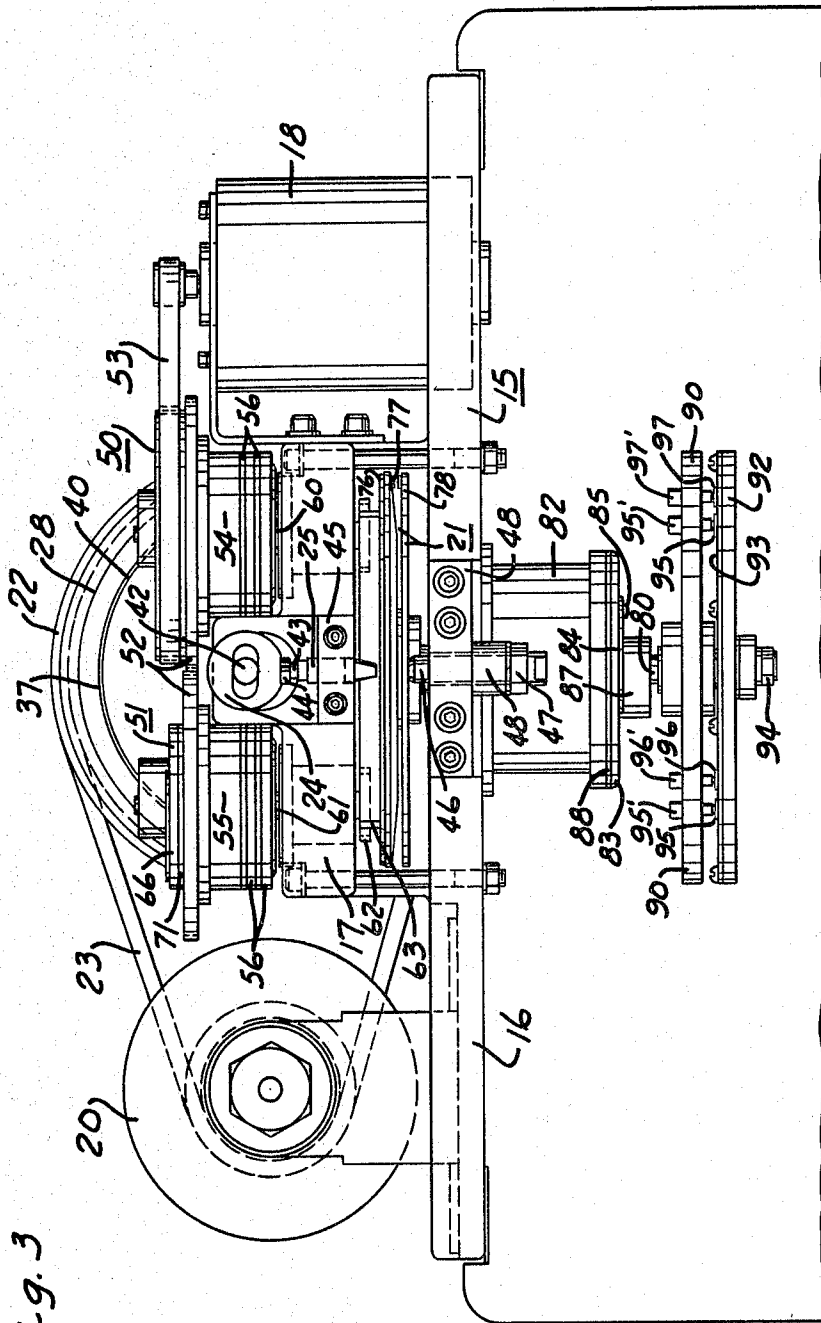


Fig. 3

INVENTORS  
WALTER E. RUDISCH &  
FRANK D. GROSS

BY

CAROTHERS AND CAROTHERS

THEIR ATTORNEYS

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7 Sheets-Sheet 4

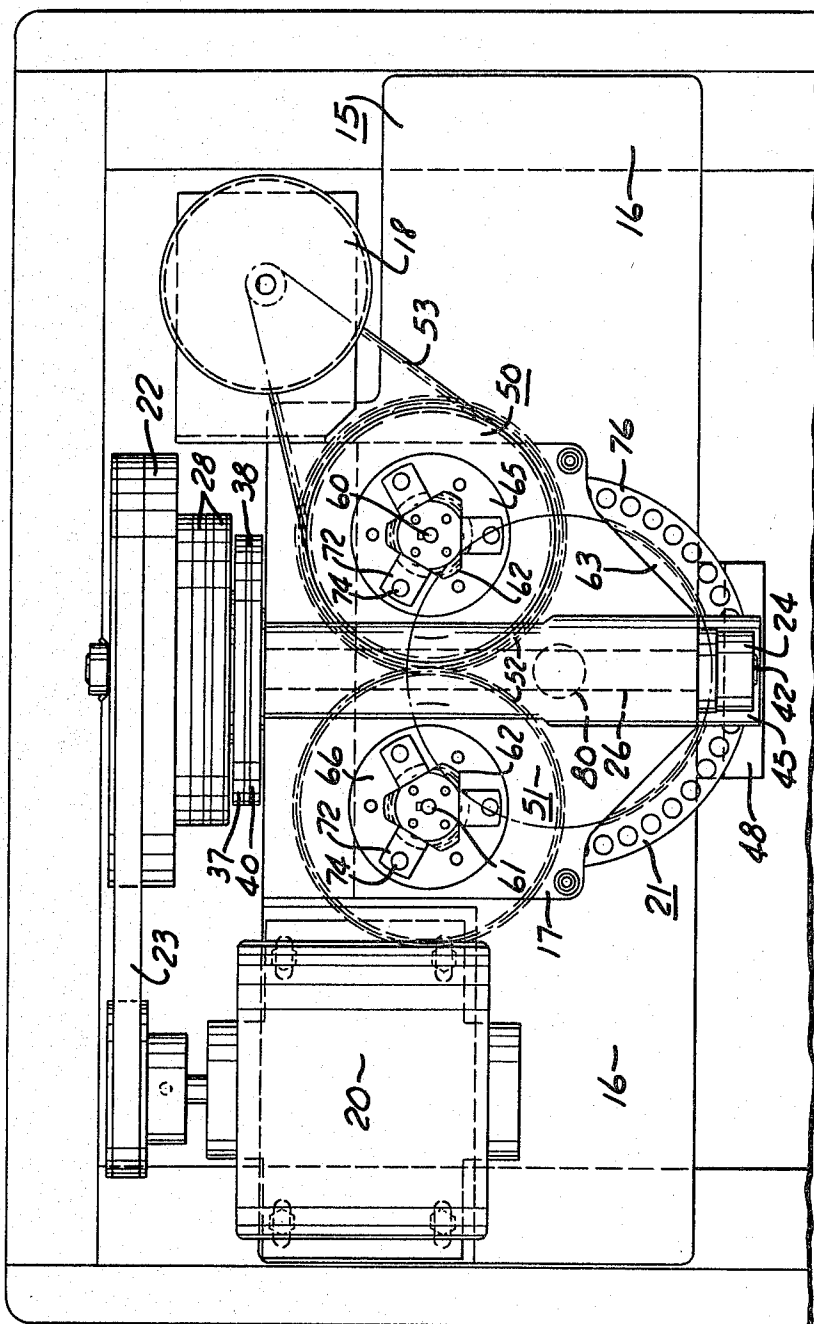


Fig. 4

INVENTORS  
WALTER E. RUDISCH &  
FRANK D. GROSS  
BY  
CAROTHERS AND CAROTHERS  
THEIR ATTORNEYS

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W. E. RUDISCH ET AL

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Fig. 5

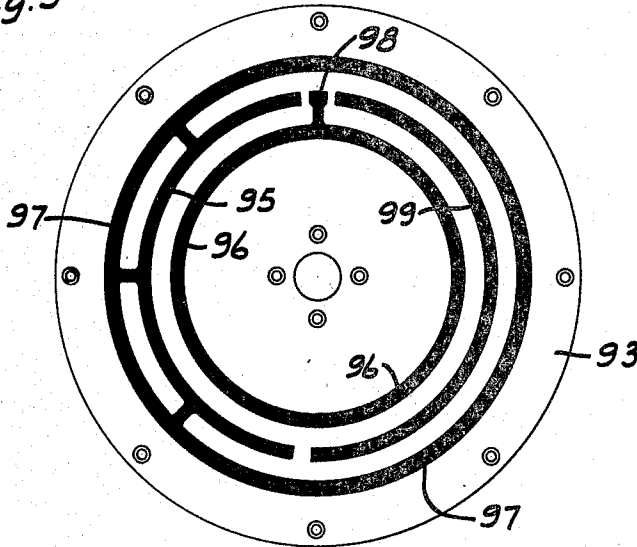
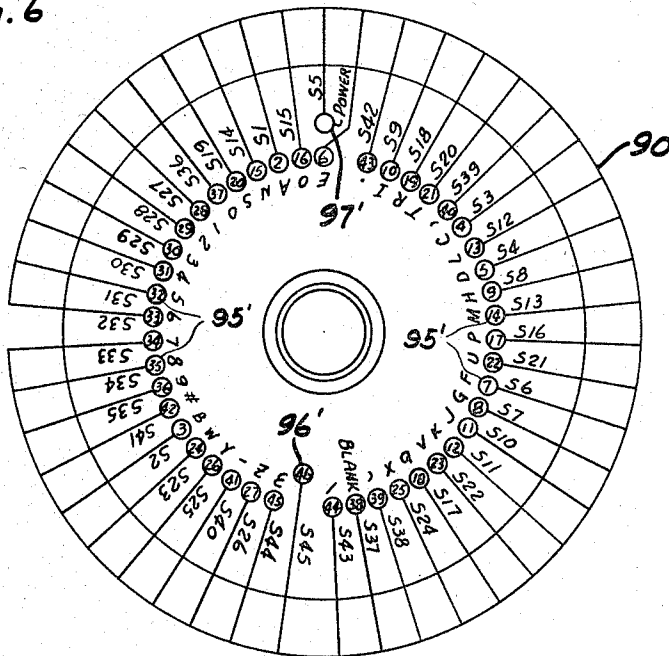


Fig. 6



INVENTORS  
WALTER E. RUDISCH &  
FRANK D. GROSS  
BY

CAROTHERS AND CAROTHERS  
THEIR ATTORNEYS

Nov. 1, 1966

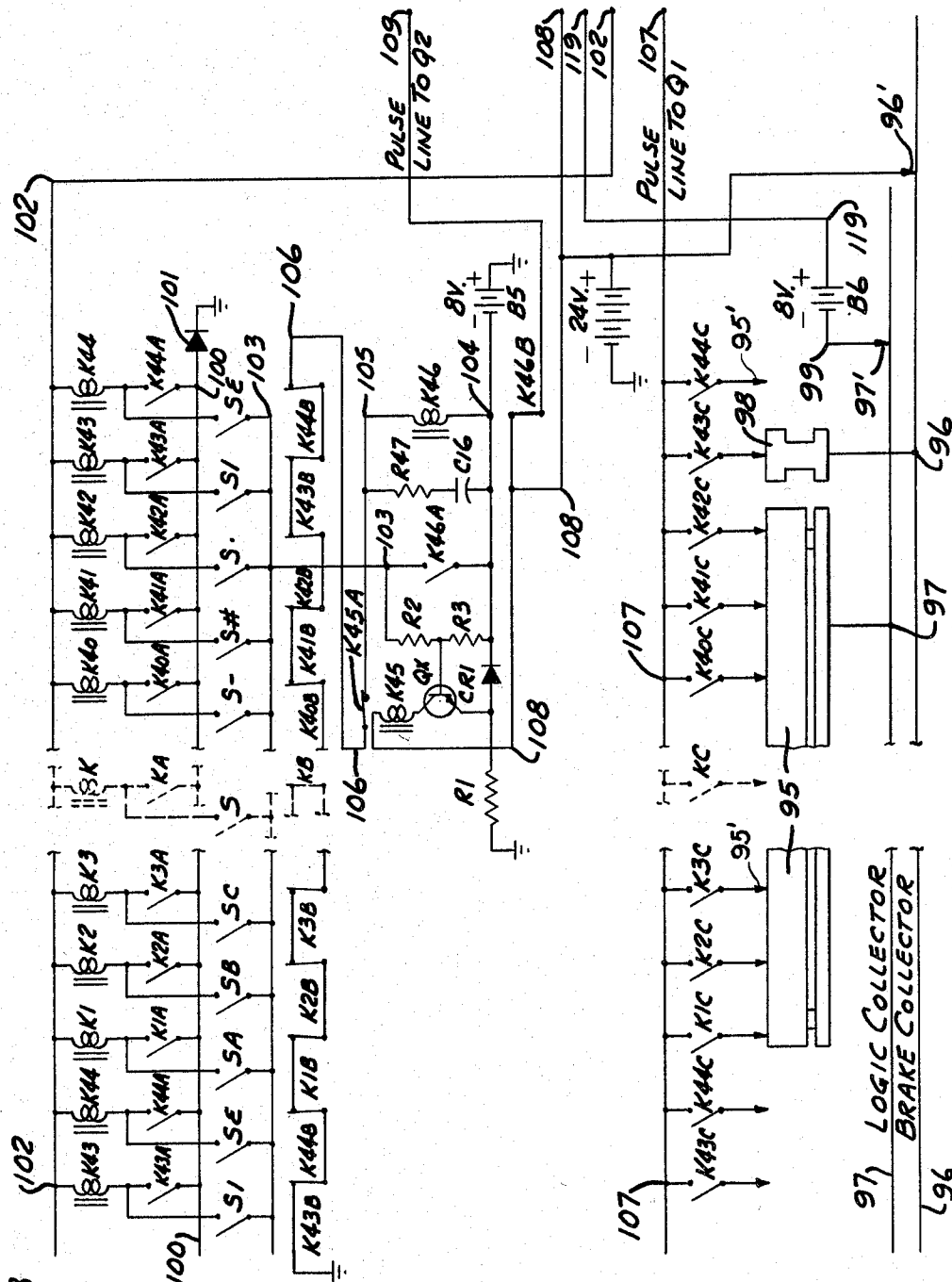
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INVENTORS  
WALTER E. RUDISCH &  
FRANK D. GROSS  
BY  
CAROTHERS AND CAROTHERS  
THEIR ATTORNEYS

**Nov. 1, 1966**

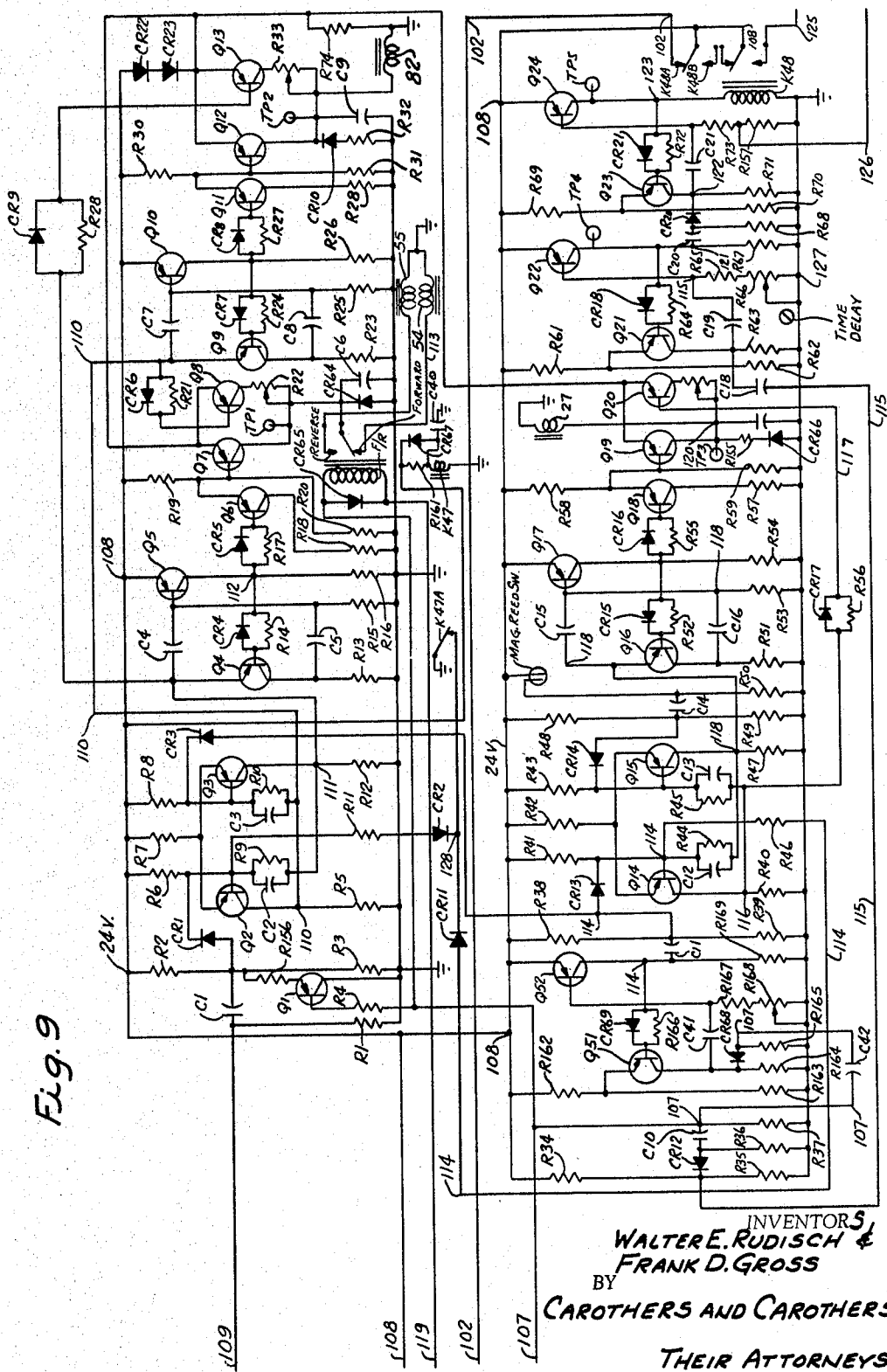
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INVENTORS  
WALTER E. RUDISCH &  
BY FRANK D. GROSS  
CAROTHERS AND CAROTHERS  
THEIR ATTORNEYS

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3,282,389

## ROTARY IMPRINTING MACHINE MOVING SELECTED CHARACTER TO IMPRINTING POSITION BY SHORTEST ARC

Walter E. Rudisch, East Amherst, N.Y., and Frank D. Gross, Freedom, Pa., assignors to The Pannier Corporation, Pittsburgh, Pa., a corporation of Pennsylvania  
Filed Aug. 13, 1964, Ser. No. 389,364  
6 Claims. (Cl. 197—6.6)

This invention relates generally to selection circuits and more specifically to a logic circuit for determining the direction of rotation of a member which when selecting a circuit discriminates the shortest rotary distance to a predetermined rotary position of the member for performing a function which may be one completing an information circuit or merely selecting an integer.

Circuits of this character may be employed in many arts such as imprinting machines and in embossing printing machines and punching machines where the letters, figures or other indicia is on the rotary member, or in a selective relay circuit such as an intermediate step in many different electronic selecting integer circuits or on a memory drum.

Circuits of this character may be mounted on a rotary disc in the form of circular voltage divider circuits the ends of which are connected to collector rings and wherein the intermediate voltage represents the reference point and is connected to a collector ring. The greater or lesser voltage selects the direction of rotation through a stationary brush for each position to be selected. This type of selection rotation must carry the divider resistance circuit on the disc which is a costly circuit initially and expensive in upkeep.

Another logic circuit of this character is obtained through the use of two series circular collector strips of the same radius, mounted on a rotary disc and each connected to a separate annular collector ring. The semicircular collector discs are engaged by stationary brushes for each position to be selected and the position of the next selected digit through its respective stationary brush engages the proper semicircular ring to determine the direction of rotation. This is disclosed in United States Patent 2,927,676.

One of the objects of the present invention further reduces the structure and circuit by eliminating one of the half or semicircular collecting rings.

Another object provides the use of an additional circuit in the same circular radius as the directive semicircular collector segment, and which is representative of an additional function than selection. In the instance of a punching or embossing machine this additional function may be a stop such as applying a brake to arrest the rotation of the rotary disc carrying the directive circuit. Although this may be employed to stop and physically imprint, emboss or punch a number, such machines may be employed in a memory circuit on it may be the mere completion of a progressive circuit and the next consecutive indication is determined by rotary selection that may be immediately initiated so that if the disc or drum is to travel it may continue in the same direction or reverse for the next digit or signal. In some instances a brake may be employed in other instances the disc may be reversed or continue forward without applying a brake. The equipment immediately reverses or continues to complete the next function.

Another object is the provision of a rotation direction logic circuit that employs a rotary member with a semicircular collector strip to operate in combination with a circular series of stationary brushes each representing two independent functions, one a circuit that determines

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the direction of rotation depending upon the relative position of the member and whether the selected circuit through the brush engaged or did not engage the semicircular collector strip. If the selected brush did not engage the semicircular collector strip during the selection period the circuit would energize to drive the disc in one direction of rotation. If the selected brush did engage the semicircular collector strip during the selection period the circuit closed would energize a relay to complete the circuit and drive the member in the opposite direction of rotation. Since the semicircular collector strip is substantially one hundred and eighty degrees, the selection of rotation is the shortest possible travel for the rotation of the disc to the selected position.

Another object is the provision of a brake contact on the rotary selection disc in the circuit of the electrical brush for the rotary directional selection collector strip for closing the contact at the selected position to stop the rotating disc after its selected bi-directional movement. The brush that determines the directional selection may also function as the brake, to stop the member at the proper position. The completion of one circuit for direction selection and the starting of the next in an electronic series is novel. The utilization of the brush as a directional factor as well as a brake factor is novel whether it is used as an embossing or punching machine or an interconnected circuit of an electronic storing and transmitting or computing apparatus.

The simplest form for demonstrating this invention is in the embossing or punching apparatus but such application is only one use of this invention. It may be used in transfer information of computer and also long program control circuits wherein information is stored on magnetic drums which have to be scanned annularly and longitudinally to relay this information for the balance of the circuit. Thus the present circuit provides a fast rotary logic circuit for circular scanning of the drum simultaneously with a longitudinal scanning circuit to pinpoint the information and relay it to the proper operating channels to complete the function.

Another object of this invention is the adaptation of this logic circuit to a lineal scanner. If the point or indicia or information sought for is dispensed lineally whether in a straight line or a line following a specific curve that has no repeated positions such as two quarters of a sine wave, this logic circuit may also be employed to determine whether the logic of the selector is in the direction back or forward left or right. This logic circuit control is laid out lineally or annularly. It is very accurate particularly when the operation is by punched tape or cards wherein there is no chance of human error. It is very fast in its logic, selection and positioning. It has no comparison to manual operation or mere mechanical stop abutments that are inserted and withdrawn. Its accuracy is of computer standard of which it may be employed as a part for lineal and rotary scanning of a drum having standard base sequence selections contacts or a memory drum or cylinder of considerable width. The selection for this logic circuit may be displayed on a disc and the rotary as well as the radial extent would be by a dual logic circuit of this invention. Thus the use of the logic circuit of this invention may supplement different factors and stages in computer machines as well as other type of selectors employing such functions capable of being selected and completed by this invention. One factor is the use of the same brush in the logic circuit to complete one or more other circuits in the same sequence such as stopping the movement of the printed circuit and the rotary member at the selected position by applying a braking circuit but also functioning to perform the function whether printing, stamping, embossing,

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blanking out or otherwise closing another selected circuit to continue the initiated program. The same brush starts the logic circuit, sets up the brake circuit and may complete the operating circuit. Thus the single brush completes three separate and individual functions in an embossing or printing machine which is also applicable to a computing machine wherein the same brush transmits the selected information within a very short interval of time. When combined movements require two logic circuits the functions performed are thus multiplied by three as each function of each logic circuit may in combination produce or initiate a third function.

Another object is the provision of a ram actuated by a rotary crank the control of which is made through a clutch operating in combination with a continuously operating shaft having a fly wheel. The clutch being magnetic is quickly actuated and selectively operates through only one complete revolution and stops in its upper or withdrawn position. This feature provides a continuously rotating clutch magnet and fly wheel with a clutch disc that is connected to the rotary eccentric that drives the ram. When energized the clutch is attracted for one complete revolution to withdraw the ram and the spring bias on the clutch plate functions as a brake to stop the ram at the retracted position.

Other objects and advantages of this invention appear hereinafter in the following description and claims.

The accompanying drawings show for the purpose of exemplification without limiting this invention or the claims thereto, certain practical embodiments illustrating the principles of this invention; wherein

FIG. 1 is a perspective view of the top of an embossing machine comprising this invention.

FIG. 2 is a sectional view of the embossing machine comprising this invention.

FIG. 3 is a view in front elevation of the embossing machine with the keyboard removed.

FIG. 4 is a plan view of the embossing machine with the keyboard removed.

FIG. 5 is an enlarged plan view of the printed circuit disc for the rotation logic and brake circuits used in FIGS. 5 and 7.

FIG. 6 is an enlarged plan view of the brush holder with indicia brushes, the brake brush and the segment collector ring brush.

FIG. 7 is a schematic circuit diagram of an abbreviated logic circuit comprising this invention.

FIG. 8 is a diagrammatic circuit of a second operating circuit for the machine and comprising this invention.

FIG. 9 is a circuit diagram of the rotation logic circuit and relay reset circuit.

The rotary member carrying the logic determining control may be a flat disc cylindrical or spiral and a part of the member or drum that carries the information being called upon for a service, a control or further circuitry program. It may be combined such as an annular determination for one phase and a helical for the longitudinal and thus provide the combination of dual logic operations to complete a function.

The embossing machine employed to disclose this invention is mounted on the cabinet 1 which contains independent drawers that when inserted complete the circuits of the relays and the transistors that they contain into a circuit in connection with the rest of the machine. The cabinet may house as many as three or more drawers of circuitry which represents the complete embossing machine for manual operation needing only a power source as the circuitry itself provides its own direct current power supply within the cabinet.

The auxiliary housing 2 contains a computer encoder and translator which may be operated by a receiver code, a perforated or magnetic tape or a punched card as shown at 3 containing perforations that when stepped through the encoder functions to energize the readout mechanism that is directly connected to the circuitry in

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the cabinet for automatically operating the embossing machine. The switch to the right indicated at 4 will turn the machine on providing power is supplied. If placed in the automatic position the perforated card when stepped through the machine will read out all of the functions that are to be properly located and positioned on the embossed subject held by the embossing clamp member 6 which is actuated lineally by the step motor 7 and by means of the line advance through the advance motor indicated at 8 underneath the movable carriage on which the clamp 6 is mounted.

The keyboard indicated at 10 has the usual indicia commonly found in a typewriter and at substantially the same position and including a back space, a line return, two space buttons and a carriage return with a line advance at the bottom of the keyboard in the arrangement as stated. The carriage return and line return may be combined in a single button to return the clamp 6 to the position for receiving a new tag. Each of the keys close a circuit most of which are indicated in the circuit diagrams hereinafter described.

The keyboard 10 is supported by the plate 11 on top of the cabinet 1 and the plate to be embossed is indicated at 12 which is clamped in place by the clamp member 6 riding on its carriage. It travels back and forth on the rod ways 13 which are in turn supported by the brackets 14 and carry the stepping motors including the motor 7, bolted as indicated to the main base 15 of the embossing machine.

The embossing machine is shown in detail in FIGS. 2, 3 and 4 and in conjunction with FIG. 1 demonstrate that the base 15 has the lateral extensions 16 that are secured to the cabinet by the bolts as indicated but this section of the machine represents that part having the mechanically movable sections that comprise one part of this invention. The base 15 also is provided with an integral C-shaped portion 17 which overhangs the central part of the base 15 and provides for support of the embossing wheel and the parts associated therewith. The top portion 17 contains the bearing members carrying the several shafts making up the rotary drive of the embossing machine.

The lateral or side portions 16 are made integral with the top center portion 17 and support the unidirectional rotary motors 18 and 20. The motor 18 provides initial power that rotates the embossing wheel indicated at 21. Whereas the motor 20 is the embossing motor that drives the fly wheel 22 through the belt 23 rotating the rotary cam 24 that actuates the plunger 25 for embossing the metal member 12. Thus by lifting the sides 16 and the top 17 as a unit the whole of this structure may be raised free of the embossing wheel as the only connection therewith are through the small driving wheels.

As shown more clearly in FIG. 2 the fly wheel 22 is rotatably mounted on antifriction bearings on the shaft 26 and this fly wheel has bolted thereto the housing for the electromagnetic clutch 27. This housing carries the collecting rings 28 for controlling the circuit of the electromagnet 27 which rings are energized through the brushes 30 that are connected to the suitable circuit timely energized for this purpose. The shaft 26 is journaled in the forward and rear sleeve bearings 31 mounted in the upper portion 17 of the frame.

The hub 32 is secured by the key 33 to the shaft 26 and it carries the fixed abutment ring 34 that retains one end of the helical spring 35 the other end engaging the movable abutment ring 36 that controls the axial movement of the clutch disc 37 which is preferably made of magnetic material so as to be attracted by the electromagnet 27 when energized through the commutators or slip rings 28 to be drawn toward the electromagnet and be held thereby. When released by opening the circuit through the electromagnet circuit 27 the helical spring 35 forces the clutch disc 37 through the movable abutment ring 36 into direct engagement with the sta-

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tionary brake ring 38 of friction material that is mounted on the stationary brake disc 40 that is bolted directly to the upper section 17 of the frame as shown in FIG. 2. Thus the clutch disc 37 when released functions as a brake against the braking ring 38 to maintain the shaft 26 stationary unless energized by the electromagnet 27. The drive from the clutch disc to the shaft 26 is through the gear-like spline between the clutch disc 37 and the hub 32 as indicated at 41. This spline connection assimilates an internal and external meshed gears which allows the clutch disc to move axially a sufficient distance when attracted by the electromagnet 27 to be free of the stationary brake ring 38 and thus rotate the shaft 26. The timing of the operation of the energization of the electromagnet 27 is such to allow the electromagnetic clutch 27 to be energized to produce only a single revolution at each pulse which positions the crank pin 42 on the front of the shaft 26 in its upper or retracted position when the brake is applied to stop the shaft 26.

When the eccentric pin or crank pin 42 is held in its upper position as shown in FIG. 2 by the cam follower 24 the hammer or ram 25 that performs the imprinting or embossing is clear of the embossing wheel 21 and its guides. The hammer or ram 25 is threadably connected to the cam follower 24 by the threaded pin 43 held by the lock nut 44. The hammer or ram 25 must pass through the stationary guide 45 which is bolted or otherwise secured to the upper section 17 of the frame as illustrated in FIGS. 1 and 3.

The weight of the fly wheel and the speed reduction from the motor pulley to the fly wheel is sufficient to operate the ram 25 through the imprinting or embossing or punching cycle at a very fast speed without the loss of power for the work that the ram 25 has to perform. The motor 20 is adjustable on the side 16 so as to function as a takeup for the belt 23.

Below the imprinting or embossing wheel 21 an anvil 46 is adjustably threaded and locked in place by a lock washer and jam nut as indicated at 47. The end of the anvil is squared to permit it to be positioned at the proper height relative to the embossing wheel 21. The anvil is threaded in a small casting 48 that is bolted or otherwise secured to the frame as indicated at FIG. 3.

The rotation of the imprinting or embossing wheel 21 or other rotary member that is to be controlled, is as previously stated, maintained through the continuously operating unidirectional motor 18 that drives the rotary assembly 50 in a clockwise direction and the rotary assembly 51 in a counterclockwise direction owing to the fact that these two members are connected by the intermeshed similar gears of the same size indicated at 52. The belt that drives the member 50 is preferably a tooth-type belt as indicated at 53. Each of the rotary assemblies 50 and 51 as more clearly illustrated in FIG. 2 have their gears 52 secured to the electromagnetic clutch housings 54 and 55 each of which has an exterior set of collector rings 56 that are insulatingly supported on the exterior of the housings and are arranged to be engaged by a suitably supported set of brushes mounted on the upper section 17 of the frame. These brushes are not shown. A sleeve 57 is mounted in the casting 17 on each side of the shaft 26 for supporting antifrictional bearings 58 that carry the respective shafts 60 and 61 for the respective rotary assemblies 50 and 51. The bottom of each of these shafts carry a pinion gear 62 that meshes with an external gear 63 secured to the embossing wheel 21. When this top assembly is lifted these gears merely become disengaged from the gear 63. This gear 63 is clearly shown in FIG. 1 and is also illustrated in FIGS. 2 and 3. Thus the pinion gears 62 for the shafts 60 and 61 are at all times in mesh with the gear 63 that forms a part of the embossing wheel 21.

Another set of antifrictional bearings 64 support the respective shafts 60 and 61 in their respective housings

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of the electromagnets 54 and 55 which is secured to the rotary assemblies 50 and 51 respectively. Thus the shafts 60 and 61 may have relative movement not only to the frame section 17 but also relative to their respective electromagnetic clutches 54 and 55. Since these electromagnetic clutches are rotating at all times the respective shafts 60 and 61 are only rotated when selected by the respective electromagnetic operating mechanism 54 and 55. This is controlled through the clutch plates 65 and 66 which as shown in FIGS. 1 to 4 inclusive and more particularly in FIG. 2 are secured to the cylindrical bosses 67 and 68 which in turn are secured by Allen screws to their respective shafts 60 and 61.

Each clutch disc 65 and 66 is magnetic material and is provided with a definite air gap between the electromagnetic coils and the disc but when the electromagnetic coils are de-energized the clutch discs 65 and 66 are free and without frictional engagement with the friction bands 70 and 71 shown respectively in FIGS. 2 and 3. The spider type leaf springs 72 and 73 have their triangular apices secured to their respective clutch discs by the screw members 74 whereas the inner portion is secured to the underside of the cylindrical bosses 67 and 68 by the screw members 75 as shown in FIG. 2. Thus the clutch discs or plates 65 and 66 are movable vertically through the flexing of the springs 72 and 73 which attach these discs to the respective cylindrical bosses 67 and 68. When the electromagnet 54 and 55 are de-energized these discs ride free of engagement from the friction material 70 and 71 but when the respective electromagnet is energized then the clutch disc engages the friction material to lock the same therewith and cause the respective shaft 60 or 61 to rotate. Thus depending upon which electromagnet 54 or 55 is energized determines the direction of rotation of the imprinting or embossing wheel. The circuit energizing these electromagnets is, of course, made so that it is impossible to energize them simultaneously. Here it should be shown that no countershaft is employed which simplifies this embossing structure over that of the previous disclosure and represents an important novel improvement of this invention.

The imprinting or embossing wheel 21 as illustrated in FIG. 2 is made up of four different parts: first, the gear 63; next, the aligner member 76 which is attached to the gear 63; third, the female embossing wheel 77; and lastly, the male embossing wheel 78. The hammer 25 is tapered so that when it enters the hole in the aligning wheel 76 it will insure the proper position of the male and female die members. Further movement of the hammer or ram 25 depresses the female die selected against the top of the imprinting or embossing plate 12 and forces the same against the male die so as to emboss the plate 12 against the anvil 46. When the frame with the sides 16 and the top 17 is removed from the cabinet, this imprinting or embossing wheel is exposed so as to be readily changed. The imprinting or embossing wheel 21 is held on the shaft by the same lock nut assembly used on the bottom of the shaft 80.

Each of the members 63, 76, 77 and 78 are secured together and are keyed with the hub to the shaft 80 carried by the antifrictional bearings 81 mounted in the bore of the brake housing 82 secured to the underside of the base casting 15 as illustrated in FIG. 2. As shown in FIG. 2 the male die member is raised from the top surface of the plate on the opposite side from the anvil. Whereas the female portion of the die is on a section of an independent finger which finger is independent of each other indicia marking the 44 characters and when struck by the anvil will swing down to engage the plate 12 to be marked at which position the male and female portions of the die will be substantially parallel to each other to effect a good imprinting or embossing in the plate 12. The movement of the hammer 25 also carries

the plate 12 downwardly with it and, when it releases, the plate is brought back up so as to free the plate 12 from the male section of the die.

As previously stated the rotary shafts 60 and 61 are selectively rotated by the logic circuit of this invention to proceed the shortest distance within the 180° for the next consecutive character to be imprinted or embossed. When the character arrives at the proper position the respective clutch disc 65 or 66 is released and the electromagnetic brake 82 is energized to stop the imprinting or embossing wheel 21 at the proper position and permit the function to take place. This brake disc 83 is carried by a similar triangular leaf spring 84 secured by the bolts 85 to the disc 83 and by the bolts 86 to the cylindrical boss 87 that in turn is secured to the shaft 80. Thus the brake disc 83 which is of magnetic material is held free of the friction material 88 when rotating but when the electromagnetic brake 82 is applied the coil draws the disc against the brake material 88 and quickly arrests the motion of the imprinting or embossing wheel. This electromagnetic embossing wheel brake 82 will be discussed with relation to the logic circuit.

Below the electromagnetic brake 82 for the imprinting or embossing wheel 21 a brush holder 90 is supported from the underside of the base 15 by an extension arm or arms and its central portion may be provided with the antifrictional guide bearings 91 to steady the brush holder relative to the rotary disc 92 secured to the shaft 80 and carries on its face the printed circuit indicated at 93. This logic disc is secured by means of the key and locking structure indicated at 94 in FIG. 2 relative to the shaft 80 so that it rotates therewith at all times. Thus the logic disc carrying the printed logic circuit is fixed on the shaft 80 relative to the indicia of the dies making up the imprinting or embossing wheel 21 and the brushes 95' indicated in the circular arrangement or path represent respectively the stationary counterpart of each of the indicia found in the dies of the imprinting or embossing wheel 21 and on the printed circuit is the segment 95. Whereas the single brush 96' in the inner circle represents the brush that operates the electromagnetic brake 82 and engages the circular ring 96 when the selected brush 95' engages said reference section 98. The outer circular ring 97 of the printed circuit represents the collecting ring for the independent brushes 95' in the circular path of the segment 95 and of each independent brush and the brushes are employed not only in the logic circuit for each of the characters but also function as the brake brush for that particular integer and also functions the third circuit for the operation of the function. These brushes are illustrated in a diagrammatic showing of the brush holder illustrated in FIG. 6. The printed circuit of the disc rotation logic and brake circuit is illustrated in a plan view in FIG. 5 wherein the inner circular collector ring 96 represents the collector ring for the brake brush. This collector ring is provided with a single electrical conducting segment at 98 in the intermediate circular path of the or reference segment for the logic circuit. It will be noted in FIG. 5 that the intermediate circular path 95 is less than 180° and the gap or space between the brake circuit 98 and this semicircular segment 95 for the logic circuit, is only 3.405°, whereas the radial extent of the brake sector or reference segment 98 in the segment 95 of the logic circuit extends approximately 5.45° and the semicircular segment 95 extends through approximately 167.06° which is sufficient to form the logic circuit of this invention. As used in this specification that segment 95 of the printed circuit representing the intermediate path functions only in the logic circuit through its collector ring 97. The single brake portion and reference segment is interjected in this same circular path and indicated at 98 is employed by the logic brushes and has its own collector ring 96.

The opposite portion indicated at 99 which represents the counterpart of the semicircular segment in that same path and may represent a portion of the printed circuit which would not be connected to anything and would be merely applied to the disc so that substantially the whole of the intermediate circular portion would provide a similar riding surface for all of these brushes as the disc 92 is rotated. This would be strictly for the purpose of providing a substantially uniform engaging surface for the brushes in that circle.

As shown in FIG. 6 the stationary brush holder 90 carries a brush 95' for each indicia as indicated by the indicia inserted therein and the logic collecting ring brush 97' is indicated to be in line with the exterior annular path of the collector ring 97. Whereas the brake brush collector is indicated at 96' and engages the brake collector ring 96 as indicated in FIG. 5. The particular arrangement of these brushes 95' representing their respective indicia is of patentable importance in the selection of the direction of rotation of a logic circuit engage the arcuate sector 95 and the reference segment 98. A shorter distance and an ultimate quicker dispatch in imprinting or embossing or otherwise carrying out the function represented by this indicia is enhanced by this specific arrangement of the indicia.

FIG. 7 is an abbreviated logic circuit which employs a substantially semicircular contact segment 95 for the logic circuit and a relatively small contact segment 98 as the brake segment which may be mounted on a rotary disc as shown in FIG. 5 or employed lineally as shown in FIG. 7 wherein the contact segments may be reciprocated to complete the circuit. The contact segment 95 is connected directly to the F/R relay which is the forward-reverse relay, the opposite end of its operating coil being connected to a source of power such as the battery B1 the positive end of which is connected to the front contacts of the relay type push buttons PB1a to PB44a. These push buttons are magnetically held as a relay or they may be made to actuate auxiliary relays as in the other circuit. Each push button PB has its back contact respectively as PB1b to PB44b all of which are connected in series one end of which is connected to ground adjacent the PB1b back contact and the opposite end being connected to the R1 relay which is a normally energized relay and when de-energized delays in dropping out to close its front contact R1a. The operating coil of the relay R1 is provided with a condenser in multiple therewith to produce the delay in dropping out when the relay is de-energized. The opposite end of the operating coil R1 relay is connected to the positive side of the battery B2 and the opposite end of the battery B2 is connected to ground. Thus the energizing circuit of the R1 relay is through each of the normally closed back contacts PB1b to PB44b connected in series as illustrated.

The battery B2 also supplies energy to the front contacts a of the push buttons PB1a to PB44a for supplying energy through the selected PBa contact which circuit is completed through the contact segment 98 indicated as the brake and signal segment which is directly connected to the brake and thence to ground to complete the circuit and is also connected to the function relay R2. When the selected contact PBa engages the brake and signal segment 98 which energizes the brake to stop the movement of the logic disc it also energizes the function relay R2. Thus the push button members in this circuit function not only to determine the direction of the logic but also energize the brake and function relays. If the selected push button contact engages the reverse logic segment 95 through a brush, the F/R relay will be energized to close the front contact F/Ra and connect the reverse clutch from the battery B3 through the F/Ra contact through the back contact R2b and the front contact R1a to ground to complete the circuit for the purpose of energizing the reverse clutch and rotate the disc in the reverse direction. If the selected push button contact is

connected to a brush that is not engaging the reverse logic segment 95 the F/R relay remains de-energized and its back contact F/Rb energizes the forward clutch from the battery B3 through the F/Rb contact and the back contact R2b and the front contact R1a to ground. As previously stated the front contact R1a of the R1 relay acts as a time delay in dropping out to actuate the clutch either forward or reverse and thus when the push button PB contact is closed the R1 relay becomes de-energized by the opening of the corresponding back contact of the selected push button relay. However, the front contact R1a remains open a sufficient length of time to energize the proper clutch member and move the disc to position the brake segment 98 in engagement with the brush that is selected. At this time the R1a front contact opens to interrupt the clutch circuit and the R2a contact then closes to complete the function to energize the function relay R3 through the battery B4. The same impulse that energizes the brake and function relay R2 provides a signal to release the push buttons. This, of course, again re-energizes the relay R1 and its normally closed front contact R1a again closes.

In view of the fact that the F/R relay is energized only when the brush engages the reverse logic segment 95 and the brake and the function R2 relay are energized when the brush engages only the brake and signal segment 98, a plurality of separate circuits can be made through the front contacts of the push buttons PB1a to PB44a and these segments.

Since the F/R relay is an ordinary relay its front contact functions to energize the reverse clutch and if this segment 95 is not engaged, then this relay merely remains de-energized so that the forward clutch is energized to operate the logic disc and bring the selected push button into contact with the brake and signal segment 98.

This logic circuit is materially reduced in elements and is materially simplified yet it provides a very accurate and positive logic circuit for controlling any selection of the direction of movement for the rotary or lineal logic circuit for selecting only the shortest distance to the brake and signal segment 98 which is an ultimate position of selection of the logic circuit for the closed push button contact. If the indicia is repeated there is no movement of the logic disc.

A more complex circuit of this character is illustrated in FIG. 8 wherein each of the push buttons S shown are indicated with a sub-symbol of the character which they represent as found on the keyboard in FIG. 1 and the brushes of FIG. 6. The push buttons S between K relays K3 and K40 are repetitious and, therefore, have been indicated collectively by dotted representation. The push button circuits as closed by these keys are not shown in consecutive order but in the order in which the symbols are arranged in their connection to the brushes engaging the semicircular contact of the logic circuit. Each push button is connected to energize one of the series of K relays indicated as K1 to K44 inclusive. When one of the push buttons S is closed, it energizes its corresponding K relay and this relay in turn closes its corresponding front stick or holding contact a to connect line 100 through the diode 101 to ground. The line 102 is provided with twenty-four volts through another relay contact and is connected to one side of the operating coil of each of the K relays. K46 relay is energized through a series circuit including a normally closed back contact B of each of the K relays and the contact K45a as shown. Each of the push button S contacts are connected to the line 103 which may be supplied with a -8 volts through K46a from the battery B5 the other side of which is ground. Thus when any one of the push button S contacts is closed the corresponding K relay is initially charged with thirty-two volts. However, when the stick or holding contact Ka of the K relay closes, it holds the respective K relay energized on only twenty-four volts. As soon as a selected K relay is energized

its back contact b opens. The back contact b of each of the K relays upon opening de-energizes the K46 relay from its negative eight volts in the line 104 through the operating coil of the K46 relay and thence through the line 105 and the normally closed front contact K45a and thence through the line 106 and through each of the back contacts of the K relays to ground.

When any one of the keys S1 to S44 on the keyboard is closed, its respective K relay will be energized through K46a contact and which is a normally open contact that is closed by reason of the fact that the K46 relay is normally energized. The selected K relay that has been energized will retain its energization on its own stick or front contact Ka. At the same time, K46 will become de-energized since its whole circuit is maintained through the series of back contacts of each K relay which is broken by the energization of the K relay. As K46 de-energizes, K46a opens and the current through the resistance network R2 and R3 will bias the base of the transistor QX positive with respect to the emitter thus, causing QX to become energized and become turned on causing relay K45 to become energized by the negative 8 volt B5 battery and open its normally closed back contact K45a. This will interlock the keyboard limiting the flow to the common 103 of the keyboard through the series circuit R2 and R3 thus, preventing any other relay from having sufficient voltage to energize the same while the selected K relay, previously energized, has an opportunity to complete its function.

To reset this condition, positive voltage on line 102 must be interrupted to cause the originally energized K relay to be de-energized through its stick contact to the ground. This is accomplished as seen later by the reset relay K48 in transferring its front contact K48a to K48b to disconnect the 24 volt supply from line 102.

When the circuit R2 and R3 in series ceases thereby causing the bias on QX to flow negative with respect to the remitter and turn off QX which de-energizes K45 which again energized K46.

The act of depressing the push buttons to energize a circuit relay K functions to open the contact or de-energize relay K46 and open its contact K46a which shunts R2 and R3 and thereby changes the state of this circuit to bias QX and cause it to fire and energize K45 which opens back contact K45a and the series circuit through the back contacts of all the K relays and thereby prevents K46 from becoming energized until after the selected function has been completed.

Each K relay has a second front contact designated as Kc and it is this contact that functions to complete the circuit through the F/R relay or forward-reverse relay in FIG. 9 from a positive circuit of B6 through the operating coil of the F/R relay to the line 107 and thence to the selected front contact Kc of the K relays. The selected Kc contact is either in engagement with the substantially semicircular contact segment 95 or it is out of engagement therewith and as in the previous circuit of FIG. 7 if it is in engagement with the contact segment 95, the circuit will be completed through the annular collector ring 97 and its corresponding brush 97' to negative side of B6 thereby completing the circuit to the F/R relay and since this F/R relay is energized the reverse clutch will be energized to reverse the direction of rotation of the disc carrying the contact segments 95 and 98. It will, of course, be assumed that the movement of the disc is such that the contact segment 98 will move to the left in FIG. 8 until it engages the selected closed circuit produced by the Kc front contact of the selected K relay and thence to complete a circuit from the line 107 to the brush 96' and segment 98 for the purpose of operating the brake.

The K46 relay is a start relay and it is provided with a time delay in opening as indicated by the resistance 47 and the capacitor C16. The contact K45a which is a

back contact normally closed will de-energize the K46 relay when K45 becomes energized.

K46 is normally energized and keeps the transistor Qx biased off through the front contact K46a to the common of the relay bank and line 103. Front contact K46a also supplies -8 volts to the keyboard common.

Thus the de-energization of K46 relay is the start of the function.

When K46 is de-energized it closes its contact K46b and positive twenty-four volts in line 108 to the pulse line 109 thence through condenser C1 and diode CR1 to the base of the normally energized transistor Q2 of FIG. 9. This positive pulse on the base of Q2 causes Q2 to turn off and fire Q10 through line 110 and C7. This first off status from Q2 is also effective through the driver CR6 and resistance R21 in parallel to the base of Q8 and thus Q8 remains on as long as Q2 remains off.

The first off status of Q2 also turns on the other side of the flip-flop Q3 through the time delay CR3 and R10 in parallel from line 110. Q3 turns on Q2 through the delay C2 and R9 in parallel and at the same time will pulse Q5 on and then off as this is a mono-stable multi-vibrator operated from the line 111.

Q5 in turn pulses Q6 through line 112 and the pulse driver CR5 and R17 in parallel and Q6 in turn turns on Q7 the follower current amplifier by draining the voltage through the emitter of Q6 for the time that the current travels through the resistance R18.

Q7 supplies an over energization to the clutch forward or reverse depending upon the position of this F/R relay. Q6 puts a short across R20 which drops the voltage holding Q7 off and Q7 is then pulsed to supply twenty-four volts on the inverse diode CR64. This supplies a full twenty-four volts to the forward contact that is shown connected in FIG. 9. If the forward or reverse relay F/R were energized the twenty-four volts line would be supplied to the reverse contact. As shown the forward contact of the F/R relay is connected to line 113, thence to the operating coil of the forward clutch assembly 54 and thence to ground.

When Q3 is turned on by the pulse generator resistance R10 and condensers C3 in parallel it will in turn turn on Q2 through line 111 and the nonstable circuit of the pulse generator C2 and resistance R9 in parallel will again pulse Q2 and Q2 again turns off Q3. This flip-flop circuit stops as it is mono-stable travelling through one cycle only. When Q2 is turned on the second time it again pulses Q8. This second pulse to Q8 provides a steady current below twenty-four volts to maintain the clutch closed. In this way the initial high voltage is used to turn on either the reverse or forward clutch and the second pulse to Q2 provides a steady current state to maintain the clutch closed until the printed circuit disc moves or rotates until the energized circuit of the Kc contacts of the K relay reaches the brake sector 98 to actuate the brake circuit. The character brush selected through the Kc contact thus closes the circuit through the brake sector 98 and a pulse of twenty-four volts from the brake segment through the character brush applies a positive pulse on the line 167 which passes through the resistance R4 to turn on the transistor Q1 which pulse puts an apparent negative potential on the diode CR1 through the line 109 which has the effect of turning off Q2 and de-energizes the selected clutch actuating coil 54 or 55.

In view of the fact that this flip-flop circuit of Q2-Q3 has a memory it is necessary to open the circuit by opening K48 to eradicate the memory of this flip-flop circuit.

By applying twenty-four volts to Q1 which turns off Q2, both Q1 and Q2 remain off.

Q2 when turned on by the pulse from Q3 also turns on Q10 which is pulsed through condenser C7 from line 110 and Q10 in turn turns on Q11 through the driver resistance R27 in parallel with the diode CR8. Q11 turns on Q12 to supply an overenergization voltage at the diode CR10 which overenergizing voltage is applied to the op-

erating coil of the brake 82 causing it to quickly actuate. Thus the brake 82 gets a high pulse over voltage at the same time that it receives a running voltage. This high voltage lasts until the current drains out of a resistance R28 connected with the collector of Q11 but Q13 is maintained on until a reset impulse is sent through by the opening of the relay K48. K48 resets the logic circuit whereas K47 resets the relay circuit.

The same pulse that turns on Q1 to de-energize the forward or reverse clutch 54 and 55 also turns off Q52 which is situated below Q1 through the pulse from line 107, the condenser C10, the diode CR12, the resistance R34 and R38 and the condenser C11 and the pulse driver CR69 in parallel with the resistance R166 to Q51. The same pulse that turns on Q51 also turns on Q52 through C42, CR68, C41 to the base of Q52. Q52 then pulses Q14 through the line 114 passing through C11 and CR13 to the base of Q14. Q14 and Q15 represent a multi-vibrator circuit which operates the same as Q2 and Q3.

The pulse or line 107 which turned on Q52 also passed through diode CR12 and condenser C10 to line 115, condensers C18 and C19 to turn on Q22.

The turning on of Q14 by Q52 provides a pulse through line 116, the pulse driver including the resistance R56 in parallel with the diode CR17 to the line 117, turns on Q20 and Q20 will remain on as long as Q14.

Q14 pulses Q15 through the pulse generator including the resistance R45 in parallel with the condenser C13 which in effect is a time delay after which Q15 turns off Q14 through the line 118 and the pulse generator producing a time delay by the resistance R44 in multiple with the condenser C12. Q15 in turn pulses Q17 through the line 118 and the condenser C15. Q17 in turn pulses Q18 through the pulse driver of resistance R55 in parallel with the diode CR16. When Q18 is turned on it literally short circuits the twenty-four volt line through Q18 which turns on Q19 for the time that is required for the current to travel through R57 of the collector Q18. Q19 supplied overenergization to the press clutch 27 on line 120. Q18 being a short across R59 drops the high voltage holding Q19 off. Q19 is then pulsed to give twenty-four volts on resistance R155 and CR66 inversely. At the same time the pulse from Q14 operating through line 116 and line 117 the pulse drive supplies normal operating voltage on the press clutch 27. Thus the press clutch 27 is provided with an excessive voltage to close the same and a holding voltage to maintain the same closed for a period of time necessary to operate the function which in this instance is the embossing of the selected indicia.

Q14 which started a pulse to turn Q15 on through the pulse generator time delay of the resistance R45 and C13 in parallel then causes Q15 to be turned on which in turn turns off Q14 through the time delay pulse generator of resistance R44 in parallel with the condenser C12. As previously noted this type of multi-vibrator circuit is mono-stable and a pulse to Q14 will again turn off Q15 and stop the vibrator circuit at the end of one cycle.

Q14 turning on Q20 through line 117 provides a stable current below twenty-four volts to maintain the press clutch 27 on for the allotted time required to perform the function.

The pulse of Q52 through the line 114 operating through the pulse driver of the resistance 166 in parallel with the diode CR69 turns on Q51 which in turn shuts off Q52.

At the same time that the pulse from line 107 turns on Q52 this pulse travels through line 115 to turn on Q22 which in turn sends a pulse through line 121 and condenser C20, diode CR20 to line 122 and condenser C21 to turn on Q24. Q24 has its collector connected to line 123 which supplies twenty-four volts to the operating coil of the reset relay K48 which is shown in its de-energized position for the purpose of connecting line 102 to the twenty-four volt line 108 that is connected to a positive supply of twenty-four volts of direct current. Thus

while the K48 relay is de-energized the line 102 will supply twenty-four volts to the K series relays from K1 to K44 through the line 102 as shown in FIG. 8.

When Q24 is turned on line 123 also produces a pulse through the pulse driver resistance R72 in parallel with the diode CR21 to the base of Q23 which turns on Q23 and thereafter turns off Q24 through line 122, thus dropping the relay K48 to the position as shown in FIG. 9. If the automatic control of the readout mechanism 2 is to be operated by a card as indicated at 3 in FIG. 1, the reset relay K48 connects the power line 108 to 125 to supply a direct current power thereto and the return line 126 which is connected to the ground line 127 through the resistance R157.

Line 114 which supplies a pulse from Q52 is connected through the resistance R46 and the diode CR11 to the line 128. The line 109 which is connected to the base of Q2 is also connected through the diode CR2 to the line 128. Line 128 is in turn connected directly to the front contact K47a of relay K47 the heel of which is connected to ground. Relay K47 has one side of its operating coil connected to ground and the other side connected to resistance R161 and thence directly to a twenty-four volt D.C. source. The resistance R161 has connected in parallel therewith the diode CR67 inversely directed to the twenty-four volt D.C. supply. A condenser C40 is also connected between ground and the connection between the operating coil of K47 and the resistance R161. This circuit with these diodes CR2 and CR11 prevents the multivibrator circuit from floating and if for any reason the KR47 relay is energized it opens the same to ground which circuit is again returned when the main switch is employed to supply power to the whole of the circuit.

In view of the fact that the readout drive function actuated by a punched tape or perforated card as indicated at 3 involves an ordinary circuit which must be matched with particular results to be lodged by the readout drive function circuit and which will change almost on every installation, the specific design of such a circuit is not believed to be important insofar as this invention is concerned. However, it is important that such a combination may be made to control the logic circuit and operate the machine through a tape or perforated card 3 without the use of the manual push button keyboard 10. Although the readout drive function with the card 3 is illustrated as being on this machine, it, of course, may be in a central location remote of the machine 1 and may be represented by only a portion of the card readout circuit that is employed to control the operation of one or more other functions simultaneously. Even though this logic circuit is illustrated for use on an embossing machine such an illustration is merely demonstrative of one use of this invention as it merely illustrates the energization instituted for one specific function in determining the direction of rotation of the logic circuit and upon the completion of such rotation to arrest the same by applying a brake and permit another function to be carried further which in the present illustration would be the act of embossing.

We claim:

1. An imprinting machine having an annular series of selective indicia on a wheel means, a contact means on a logic disc, said wheel means and said logic disc connected relative to each other and mounted for selective directional rotation to position a specific indicia at an imprinting station, a stationary circular series of brush means mounted to engage said contact means and each brush means representing a specific selective indicia of said series, the shortest directional movement of the selected indicia to the imprinting station determined by the actual location of said contact means on said logic disc relative to a representative selected brush means, and circuit means to energize the selected brush means to rotate the corresponding selected indicia in the shortest distance,

characterized in that said contact means is the only arcuate contact substantially semicircular in length on said logic disc and in said circuit means and if in engagement with the selected energized brush means said circuit means rotates said indicia wheel means in one direction and if said single arcuate contact is not in engagement with the selected energized brush means said circuit means rotates said indicia wheel means in the opposite direction.

2. An imprinting machine having a frame, an indicia and logic disc means mounted on said frame for selective directional rotation by independently operated directional circuit means to position indicia for imprinting, and which consists of a logic circuit means having an arcuate contact on said disc means substantially semicircular in length and an insulating portion, an annular series of brush means supported from said frame to engage in the rotary path of and to engage said arcuate contact and said insulated portion as said disc means rotates, each of said brush means representing a specific selective indicia circuit including said circuit connection with said arcuate contact, circuit means to energize a specific brush means to rotate said disc means in one direction when its respective energized brush means is in engagement with said arcuate contact, and in the opposite direction when said energized specific brush means is not in engagement with said semicircular contact and thereby determine the shortest distance for said selected indicia to travel for imprinting, and which also includes in said logic circuit means a second contact substantially less in arcuate length than said semicircular contact and mounted on said disc means to be engaged by said respective energized specific brush means at the position of imprinting, a brake means mounted on said frame to engage and stop said disc means when energized, said respective energized specific brush means engaging said second contact on said disc means to close a circuit and energize said brake means to stop said disc means.

3. An imprinting machine including an indicia and logic disc mounted on said machine for rotating in either direction to a position for imprinting an arcuate contact section on said disc extending substantially through a semicircle, a reference contact section of less arcuate length than said arcuate contact at one end of said substantially semicircular contact, a circular series of brush means, one for each indicia, mounted on said machine to engage the circular path including both of said contact sections, and selected direction circuit means initiated through a selected of said brush means to complete a logic circuit and rotate said disc in the selected direction till said brush engages the reference contact section, and an operating circuit completed through said selected brush and said reference contact section to perform an imprinting operation on the indicia represented by the selected brush.

4. An imprinting machine having a rotary mounted shaft to support and turn a logic circuit disc in either direction and an indicia disc means to be selectively positioned for reproducing the indicia therefrom, said logic disc having an arcuate contact section extending through substantially one half circle, a reference contact section of less arcuate length than said arcuate contact at one end of said arcuate contact, a circular series of brushes mounted on said machine, one for each indicia mounted to engage the circular path including said contact sections, a brake to stop said shaft and discs at the one selected indicia position, circuit means to selectively energize a brush which through its position relative to said arcuate contact section rotates said discs in the direction and shortest distance to present the selected indicia for use by presenting its corresponding brush to said reference contact, circuit means initiated through the selected brush and said reference contact to set the brake, and a second circuit means to initiate through the selected brush and reference contact to perform the function by imprinting the selected indicia.

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5. The imprinting machine of claim 4 which also includes a relay for each indicia energized by a corresponding push button to set up a circuit through one of its front contacts to said corresponding brush, a stick contact on said relay for maintaining it energized, an interlocking back contact on said relay in series with corresponding back contacts of the other relays to prevent the other relays from being energized, and a clearing circuit to open the stick circuit of the energized relay upon the energization of the function circuit in operating the imprinting machine.

6. An imprinting machine having a rotary mounted shaft, a constantly driven motor driven fly wheel in alignment with said shaft, a clutch to connect said shaft and fly wheel to rotate the former through a single revolution and a brake to stop said shaft as it completes its

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single revolution, a crank on said shaft, a ram operated by said crank to impress indicia when imprinting, said shaft being stopped when said crank is withdrawn from the imprinting.

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ROBERT E. PULFREY, *Primary Examiner.*

E. S. BURR, *Assistant Examiner.*