

May 22, 1956

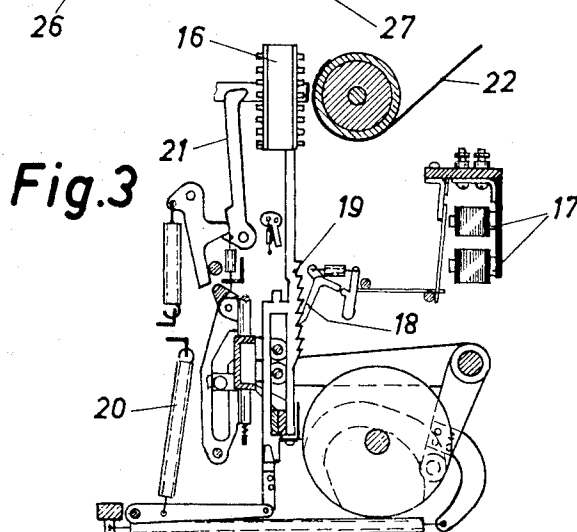
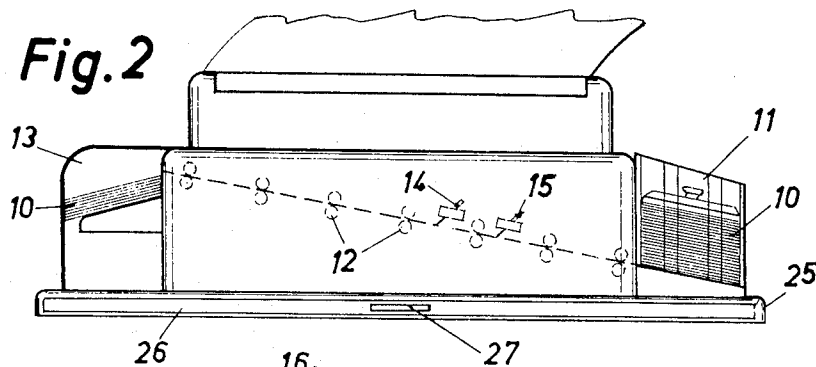
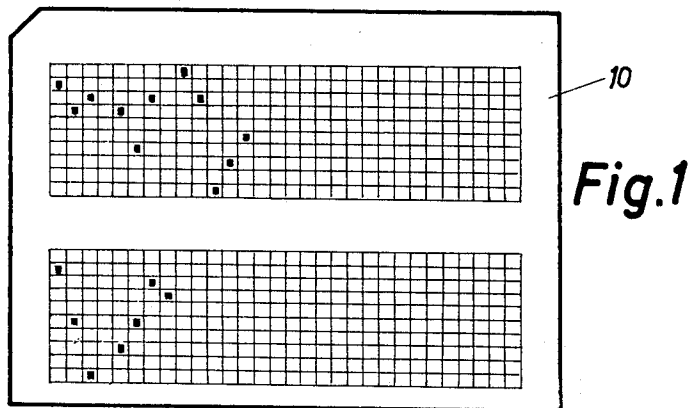
M. MAUL

2,746,680

RECORD CONTROLLED MACHINE WITH CROSS CONNECTING BOARD

Filed June 19, 1953

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4

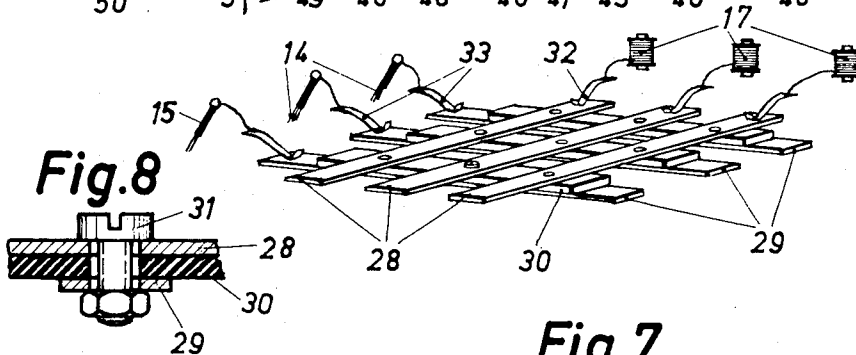
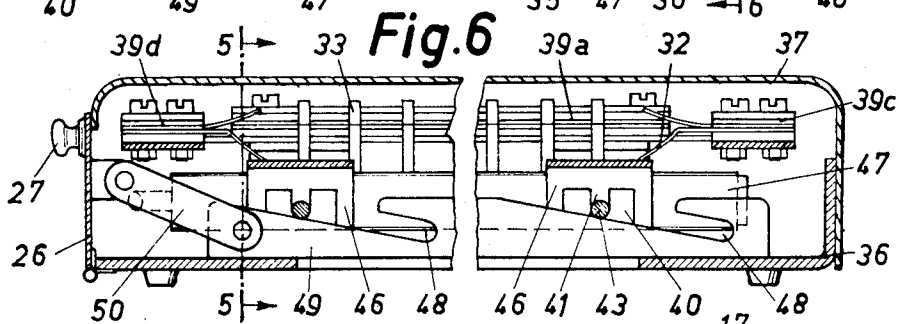
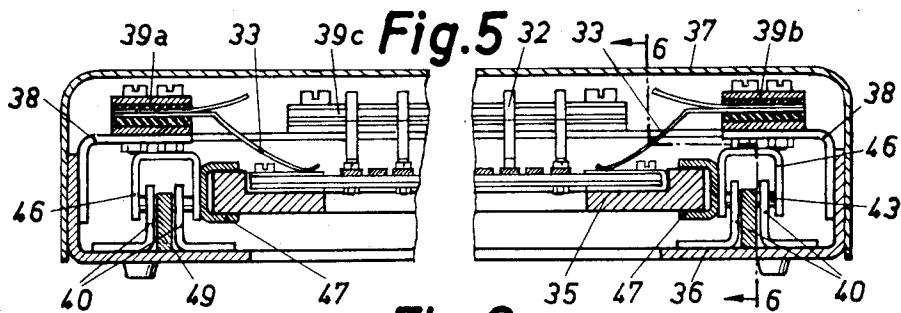
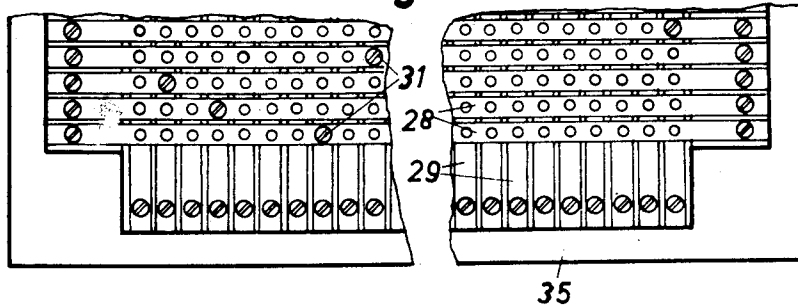


Fig. 7

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2,746,680

## RECORD CONTROLLED MACHINE WITH CROSS CONNECTING BOARD

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5 Claims. (Cl. 235—61.6)

In electrical record controlled machines, such as machines controlled by punched cards or graphical characters the record analyzing means controls receiving means for the analyzing impulses, such as for instance the clutch magnets in accumulator and printing mechanisms. In punched card machines to which reference is here particularly made as an example, the holes are electrically analyzed by analyzing brushes and the electrical impulses energize the controlling magnets of the machine.

In almost all machines of this type the need now arises to connect the analyzing brushes in any desired manner with the receiving means for the controlling impulses, depending on the card lay-out and the compilations desired. For a long time this need has been complied with in that stationary terminals leading on the one hand to the analyzing means and other stationary terminals leading to the receiving means were provided in the form of plug sockets which could be connected arbitrarily to one another by means of contact wires provided at both ends with contact pins. Since, however, when operating the tabulating machine it occurs, for instance, that the card lay-out to be operated on frequently changes, replugging on the plug board of the machine had to be repeated accordingly. This was not only troublesome and time consuming but involved also the possibility of frequent errors of connection since the connecting up of the machine was entirely left to the attention and machine experience of the operator.

Therefore, in more modern machines one turned to mechanisation of the wiring of the machine for the respective job. The machine has been provided with a wiring device having a so called "removable plug board". In the wiring device provided on the machine stationary terminals such as those formerly in use lead on the one hand to the analyzing means and other stationary terminals to the said receiving means. The desired electrical connections between both have, however, been provided in the special so called removable plug board which may be handled separately and which may be inserted into the wiring device. By hand lever pressure for instance the electrical contact connection between the analyzing means and the receiving means may be established through the removable plug board which includes the desired connections preset between its terminals. Of course, the removable plug board can also include other electrical connections which are essential for the operation of the machine. If then for each card lay-out a prepared removable plug board is available the operator only needs to exchange the removable plug board on change of job. The new setting of the machine can, therefore, be rapidly effected and above all, with freedom from errors, and the connections on the removable plug board have to be established but once for each of the same job while formerly the same plugging had to be repeated for each like job.

The electrical connections within the removable plug board may be made fixed for instance by soldering of

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the connecting wires to the individual contact terminals of the removable plug board. Then, however, for each card lay-out a special movable plug board is necessary. It is, however, also possible to connect the contact terminals of the removable plug board to one another by plugging by means of contact wires. It is then possible to do with a limited number of removable plug boards for all jobs, and in case one of the jobs no longer arises the same removable plug board may be used for another job by replugging. Due to the pluggable construction of the removable plug boards the latter become however comparatively large and require much space in the wiring device due to the many plug wires with which it is burdened.

Heretofore wiring devices of the above mentioned type have been attached to the side walls of the machine where they require not only a considerable space due to the comparatively large construction of the removable and pluggable plug boards, but also adversely affect the appearance of the machine.

In order to solve the wiring problem involved, it has also been suggested to employ a matrix having parallel conductors in two layers, the conductors in the two layers being arranged at right angles to each other, and means to selectively connect the intersection points of the conductors in the two layers in accordance with the desired wiring. The conductors of the one layer are permanently connected to the analyzing means and the conductors of the other layer are permanently connected to the index mark controlled receiving means. Of course, such a matrix may also be constructed to be removably mounted in or on the machine. It is now the object of the invention to provide a removable plug board in a hollow base plate of a record controlled machine and to use as a removable plug board a matrix of the above mentioned type having parallel conductors in two layers, said conductors being arranged in the two layers at a predetermined angle. By this combination a number of advantages are obtained over the solutions of the wiring problem known so far. The arrangement within the base plate affords the advantage that here on the one hand there is the largest possible plane available within which the wiring connections may be accommodated. Moreover the shape of the machine is not affected disadvantageously. Therefore, the arrangement is particularly suitable for small type machines in which at the side and at the top there are no large wiring planes available and particularly for desk machines in which the interchanging can be made easily in the base plate. The possibility of providing the matrix as a flat frame contributes greatly to an easy accommodation thereof in the base plate, and the base plate can be kept reasonably shallow. Ample accommodation for the contact terminals on the side walls is afforded since the length of the side walls affords sufficient space and since all four sides may be made use of, which again is due to the construction of the removable plug board as a matrix of the type referred to, since also the ends of the bars of the matrix are distributed on four sides. The two sets of bars of the matrix can be selectively electrically connected by connector screws at the intersection points of the bars in accordance with the wiring diagram so that by replugging, the matrix can be used repeatedly at any time. Consequently there is the same advantage which is obtained with inserts provided with plug wires, the latter however not being necessary. Therefore, the whole wiring device requires less space and thus can be accommodated easily in the base plate.

Further preferred features of the invention consist in that, after insertion into the base plate, the matrix may be brought into operative positional electrical relationship with the analyzing means and the receiving means by a

slight vertical displacement of said matrix. Preferably this vertical displacement is effected automatically by the closing of a door in the base plate, the door serving to open and close an opening in the base plate through which the matrix is moved. The operative connection is so constructed that, with the door open, the matrix may be inserted and removed from the base plate without being hindered by the stationary contact terminals with which it cooperates. Upon closure of the door the matrix is however raised whereby the connection of the contact bars of the matrix to the analyzing and receiving means is established. The vertical movement of the matrix can be obtained by bars each having an inclined upper edge upon which abutments carried by a holder for the matrix can slide in such a manner that the prescribed vertical movement of the movable matrix will be obtained upon opening and closing of the door.

An embodiment of the invention is illustrated in the accompanying drawings, wherein,

Figure 1 shows a punched card,

Figure 2 shows a machine provided merely as a tabulation column printer which is controlled by cards according to Figure 1,

Figure 3 shows to a larger scale a section through the printing mechanism portion of the tabulation column printer, this printing mechanism being known in Hollerith tabulation machines,

Figure 4 is a broken detail face or plan view of the matrix.

Figure 5 is a broken section on the line 5—5 of Figure 6 which is taken in a plane parallel with the door or front of the base plate,

Figure 6 shows a broken sectional view on the line 6—6 of Figure 5,

Figure 7 shows diagrammatically the matrix with the connections to the analyzing and receiving means,

Figure 8 shows a section through an intersection point of two conductor bars of the matrix electrically connected to each other at the intersection by means of a connector screw.

Referring to the drawings, in Figure 1 a punched card has been assumed having two perforation decks. Each deck is punched in a known manner according to the so called "single hole" system. For reasons of simplicity the holes are, however, indicated in a few columns only.

The tabulation column printer shown only diagrammatically in Figure 2 analyzes the punched cards running through the machine and prints the data indicated in the card in perforations on a list in type printing by means of a printing mechanism. Frequently such machines are also equipped with accumulator mechanisms and are then designated as tabulating machines. The illustration of the respective device has, however, been avoided herein since it is not essential for the understanding of the invention.

In the tabulation column printer shown in Figure 2 the cards 10 are fed from the magazine 11 of transparent material along a card feeding path through feeding rollers 12 to the receiving pocket 13. In the feeding path the cards run past the analyzing brushes 14, 15 which are arranged in accordance with the spacing of the superpositioned perforation decks so that the two perforation decks are analyzed simultaneously. For each perforation deck there is provided in a known manner a number of analyzing brushes in one row, the number of analyzing brushes corresponding to the number of columns of the perforation deck. Therefore, in the example assumed, all columns of the two decks are analyzed simultaneously, but the various positions of each column are analyzed one by one in a known manner.

Synchronously with the passage of the hole positions under the associated analyzing brushes the type bars 16 (see Figure 3) of the printing mechanism are raised by a cam and an associated lifting mechanism. Each perforation column has in a known manner a type bar 16

associated therewith. If there is a hole in the appropriate position, the associated analyzing brush emits a controlling impulse through the printing mechanism electro-magnet 17 connected thereto, said electro-magnet raising, by attraction of its armature, a locking pawl 18 normally held in latched position and which will then engage the teeth 19 of the type bar. Since the latter follows the lifting mechanism under the tension of the spring 20 it is arrested after locking by the pawl 18 in a position corresponding to the perforation, in which position the type corresponding to the perforation is in the printing position. At the end of the raising movement of all type bars, or after their locking by the pawl 18 respectively, striking of the selected type against the record sheet 22 fed around the printing roller is effected by the printing hammer 21.

The wiring device is located in the base plate 25 of the tabulation column printer provided as a desk machine, and the matrix may be inserted or removed after the opening of a door 26 (by means of handle 27) provided on the front side. The construction in principle of the removable matrix may best be seen from Figure 7. It consists of an upper layer of conductor bars 28 being in parallel with one another and of a layer of parallel conductor bars 29 below and extending in directions intersecting and normal to the first mentioned bars. Between the bars 28 and 29 there are insulating strips 30 so that, apart from electrical connections which are made selectively across the bars of the two sets of bars, the two sets of bars are insulated from each other.

The selective electrical connection across the appropriate bars of the two sets is made possible by providing holes at the opposed intersecting parts of the bars and insulation, the holes at each intersection being in alignment, the electrical connections at the selected points being effected by means of screws 31 inserted in the holes and fixed in position by nuts as shown in Figures 4 and 8. Since these connector screws can be removed individually easily, each movable plug board can always be used anew if a setting for a particular job is no longer required. Normally for each of the regularly occurring jobs a special removable matrix is, of course, ready, the bars of which are electrically connected to one another in accordance with the predetermined job by means of the screws 31.

When the matrix is inserted in the base plate the upper bars 28 are pressed against permanently located leaf spring contacts 32 in the base plate, these leaf spring contacts in turn being connected to the printing mechanism electro-magnets 17, whilst, in a similar manner, the bars 29 are pressed against leaf spring contacts 33 which are also provided in the base plate and are connected to the analyzing brushes 14, 15. It will be seen from Figure 7 that by means of the connecting screws 31 any desired brush may be connected to any desired printing magnet. The arrangement of the printing columns on the list can, therefore, be changed at will with respect to the arrangement of the perforation columns on the card as required upon the application of different card divisions in different jobs.

The actual construction of the matrix and its location on the base plate of the machine may be seen from Figures 4 to 6. The bars 28, 29 are inserted in a frame 35 consisting of insulating material and are fastened to the frame by means of screws. Therefore, the matrix itself consists only of a very shallow flat frame. This is also advantageous for keeping a stock of several removable plug boards as they will require little space in the stocking frame.

The door 26 provided on the front side of the machine may be swung downwards about hinges at its lower edge and is operatively connected with the lifting device for the matrix, in a manner still to be described.

The base plate consists of a lower supporting plate 36 and an upper cover plate 37. On the two side walls angle brackets 38 are provided on which are fastened

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bars 39a, 39b carrying the spring contacts 32 insulated from the brackets. Contrarily to Figure 7 the leaf spring contacts 33 are here distributed on two sides. In a similar manner the leaf spring contacts 32 are fastened to bars 39c and 39d arranged at the rear and front respectively.

On each side of the supporting plate 36 two pairs of angles 40 are provided each having a slot 41 in the middle of its upwardly extending limb. In each slot there is guided the appropriate one of a number of pins 43 of a holding frame still to be described, said pins coacting with inclined upper edges of longitudinally displaceable actuating bars 49 which will be described later on. The pins 43 are fastened to stirrups 46, and the two stirrups along each side are connected to each other by a channelled or U-section bar 47 for guiding the matrix, these two U-section bars having their channels opposed so that the wiring frame 35 may be slid therein. With the door opened the bars 47 are in the lowered position and in this position the spring contacts 32 and 33 do not interfere with the insertion of the wiring frame.

The longitudinally displaceable actuating bars 49 are arranged each between the limbs of the associated stirrup 46, and each lifting bar 49 is in operative connection at its front end with the door 26 by means of a linkage 50 as shown in Figure 6. The bars 49 are formed with inclined upper edge parts engaged by the pins 43 and if the door is opened the bars 49 are drawn forwardly. Due to their weight, the U-bars 47 and the stirrups 46 connected thereto tend to move downwards, the pins 43 riding on the inclined upper edges of the sliding lifting bars 49. The U-bars 47 are secured in the lower position against upward and downward movement by the pins 43 entering slotted rear terminal parts 48 of the bars 49.

If a change of job is to be effected the matrix is removed after opening the door 26 and is replaced by another matrix. When the door is closed the actuating bars 49 are moved rearwardly (to the right in Figure 6) and the inclined upper edges of the bars lift the pins 43 and also the U-bars 47 which carry with them the matrix so that the ends of the bars 28, 29 are pressed against the spring contacts 32, 33. It is, therefore, obvious that between the matrix and the spring contacts only a relative vertical movement can occur and again this can only take place if the matrix has already been inserted in the machine. The matrix is moved to the rear into the base plate until it engages a stop at the rear end of the U-section bars 47. In this position a detent spring, which is not illustrated, engages the front end of the U-bars 47 and thereby ensures the exact positioning of the matrix.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

I claim:

1. In an electrical record card controlled machine having analyzing means for searching index marks provided in said cards, index mark controlled receiving means under the supervision of said analyzing means, a removable matrix having parallel conductor bars in each of two layers and arranged in the two layers at a predetermined angle in crossing relationship, means for selectively connecting the intersection points of the conductors in the two layers, a hollow base plate in said record card controlled machine having internally, along at least one side, terminal leads to said analyzing means and along at least one further side, at an angle corresponding to the angle between the conductors in the two layers, terminal leads to said index marks controlled

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receiving means and locating means in said base plate cooperating with said matrix when inserted in the base plate to position said matrix with one of said groups of terminal leads in electroconductive contact with the conductors of one of said layers and the other of said groups of terminal leads in electroconductive contact with the conductors of the other of said layers.

2. In an electrical record controlled machine having analyzing means for searching index marks provided in said records, index mark controlled receiving means under the supervision of said analyzing means, a removable matrix having parallel conductors in two layers and arranged in the two layers at a predetermined angle in crossing relationship, means for selectively connecting the intersection points of the conductors in the two layers, a hollow base plate in said record card controlled machine having internally along at least one side terminal leads to said analyzing means and along at least one further side at an angle corresponding to the angle between the conductors in the two layers terminal leads to said index marks controlled receiving means, said base plate having an opening for inserting the matrix within the base plate, and guiding means within the base plate for positively guiding the matrix during insertion without engaging said terminal leads, and means for pressing the conductors of said matrix into engagement with said terminal leads of the two layers when the matrix is in proper position with respect to said terminal leads.

3. In an electrical record controlled machine having analyzing means for searching index marks provided in said records, index mark controlled receiving means under the supervision of said analyzing means, a removable matrix having parallel conductors in two layers and arranged in the two layers at a predetermined angle in crossing relationship, means for selectively connecting the intersection points of the conductors in the two layers, a hollow base plate in said record card controlled machine having an opening in said base plate for inserting the matrix within the base plate, and guiding means within the base plate for positively guiding the matrix during insertion without engaging said terminal leads, a door to said opening, actuating means for moving said guiding means, together with the matrix, when inserted therein, towards said terminal leads, an operative connection between said door and said actuating means, said connection serving to bring about movement of the guiding means towards the terminal leads during closure of said door and movement of said guiding means away from said terminal leads during opening of said door, whereby when the door is closed the conductors of said matrix are pressed against said terminal leads and when the door is open said conductors are disengaged from said terminal leads.

4. A machine as specified in claim 3, wherein the terminal leads consist of contact springs against which the conductors in said matrix are pressed when the conductors of the matrix are in engaging position with said terminal leads.

5. In an electrical record controlled machine having analyzing means for searching index marks provided in said records, index mark controlled receiving means under the supervision of said analyzing means, a removable matrix having parallel conductors in two layers, the conductors in the two layers being arranged at a right angle to each other, means for selectively connecting the intersection points of the conductors in the two layers, a hollow rectangular base plate in said record controlled machine having internally along at least one side terminal leads to said analyzing means, and along at least one further side, at a right angle to said first side, terminal leads to said index mark controlled receiving means, said base plate also having an opening at one side thereof for inserting the matrix within the base plate, guide bars for said matrix, said guide bars being arranged on opposite sides within said base plate, an actuating bar associated with

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and parallel to each guide bar and mounted for longitudinal movement, an inclined sliding connection between said actuating bars and said guide bars said connection serving to lift the guide bars during movement of the actuating bars in one direction and to lower the guide bars during movement of the actuating bars in the opposite direction, a door to said opening and a linkage between said door and the actuating bars, said linkage serving to move the actuating bars in the direction to effect lifting of the guide bars during closure of said door and to move the actuating bars in the direction to effect

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lowering of the guide bars during opening of said door, whereby when the door is closed the conductors of a matrix carried by said guide bars are pressed against said terminal leads and when the door is open said conductors are disengaged from said terminal leads.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |          |               |
|-----------|----------|---------------|
| 1,972,289 | Chauveau | Sept. 4, 1934 |
| 2,240,667 | Paris    | May 6, 1941   |
| 2,613,287 | Geiger   | Oct. 7, 1952  |