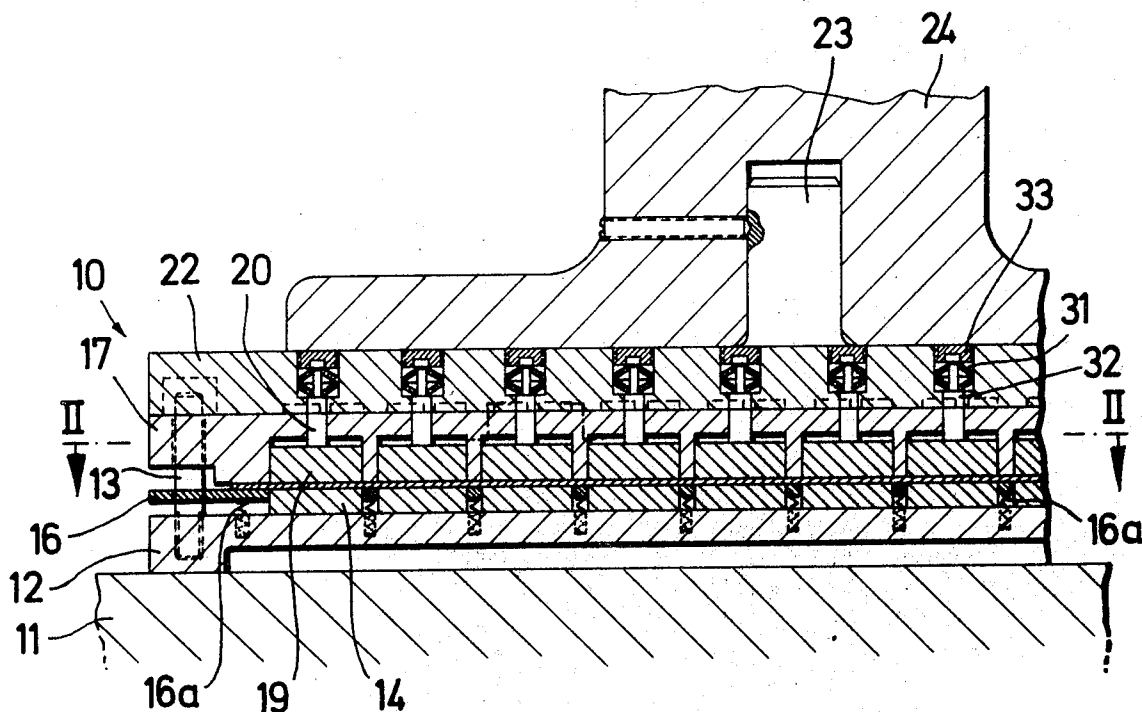


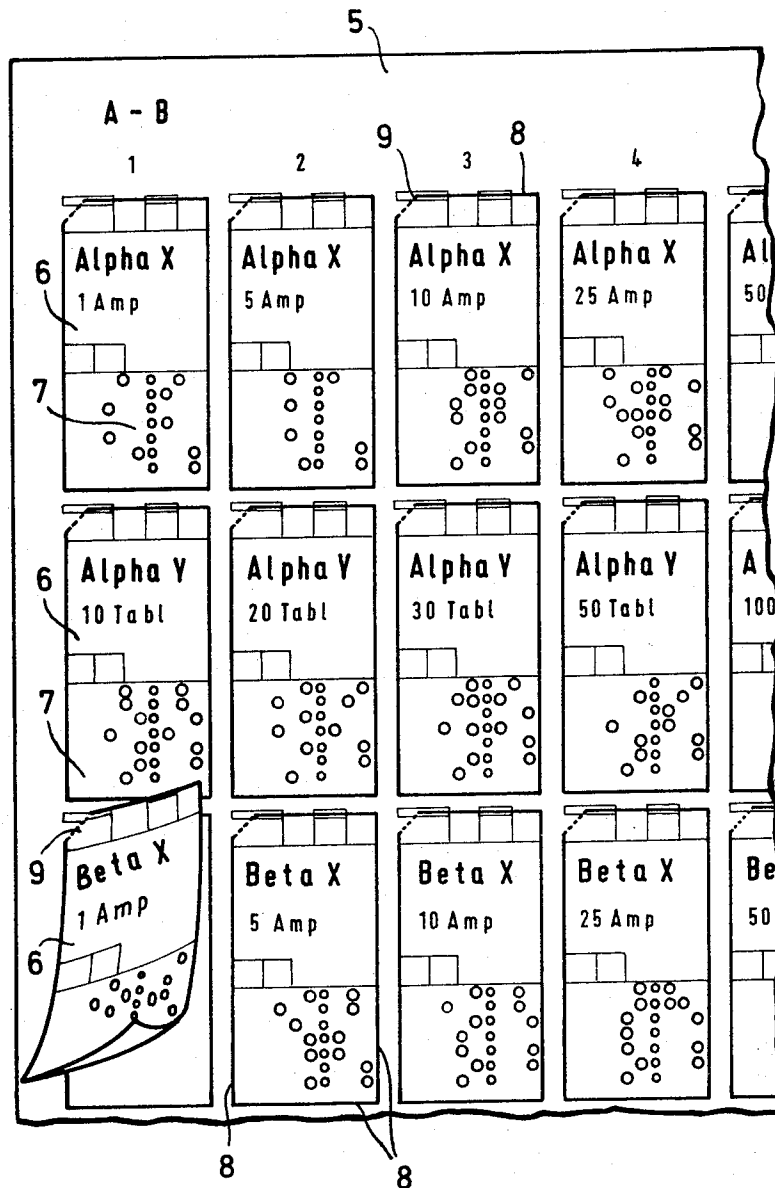
- | | | | |
|-----------|--------|----------------------|----------|
| 3,198,048 | 8/1965 | Finlayson et al..... | 83/691 X |
| 3,580,122 | 5/1971 | Powell | 83/695 X |

Punched and printed cards are produced in large groups by severing and simultaneous punching of printed plastic sheets in such a way that each card continues to adhere to but is readily separable from the remainder of the sheet. The apparatus for the punching and severing of sheets has two relatively movable sections one of which supports a sheet and the other of which can be moved against the sheet by the ram of a press. The sections have cooperating cutting edges which effect nearly complete separation of cards and one of the sections carries punches which can be forced through the sheet to form punch holes by motion transmitting pins or balls which are shifted in response to closing of the press. The pins or balls are inserted into the one section in accordance with a selected program, such as by copying the distribution of holes in a punched tape which is employed for precoding of the apparatus.

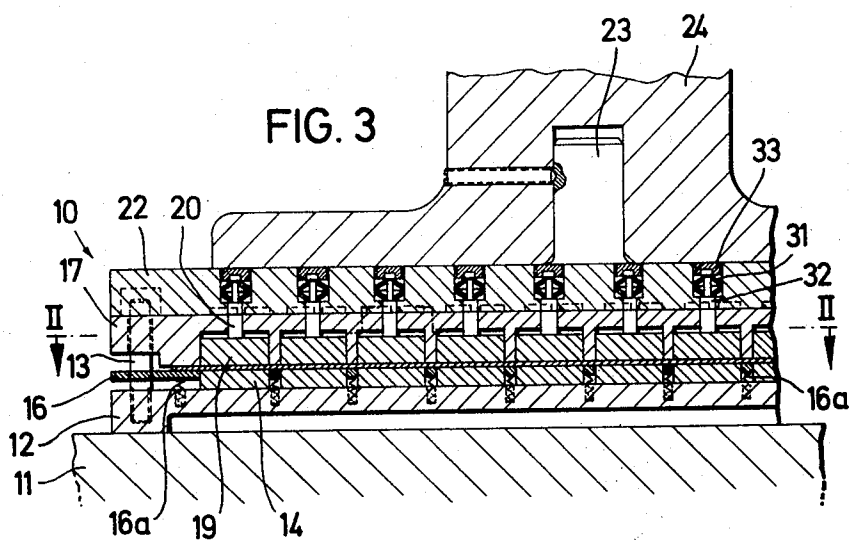
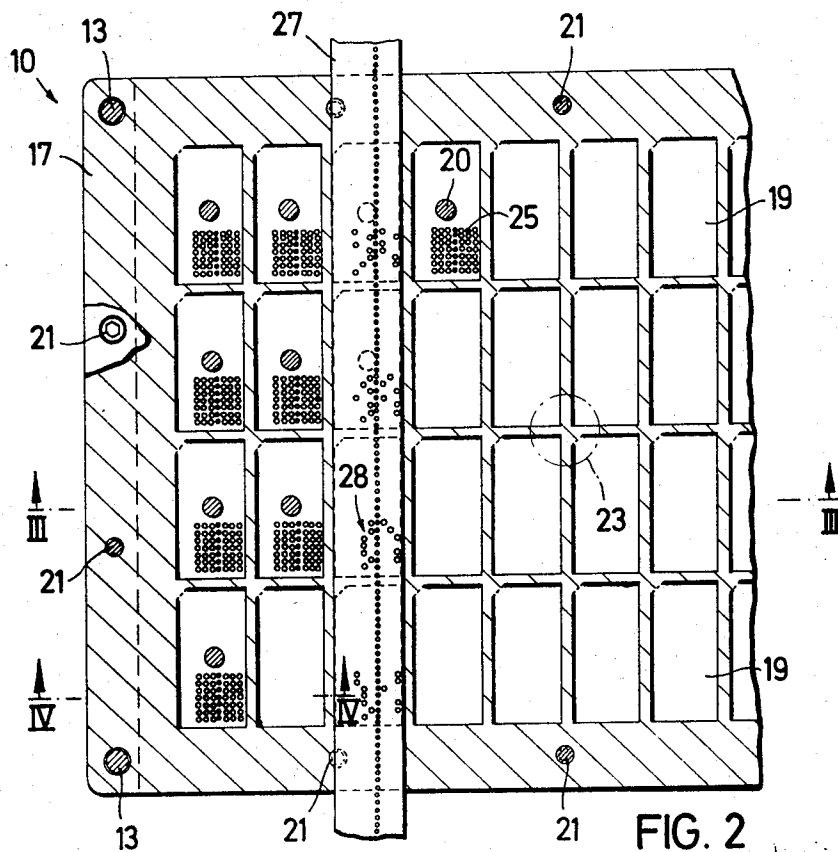
7 Claims, 6 Drawing Figures

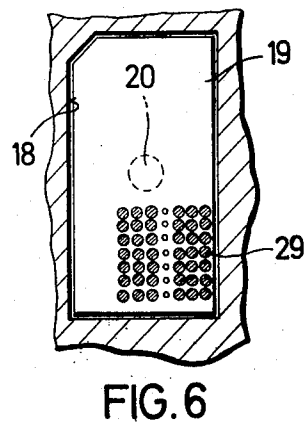
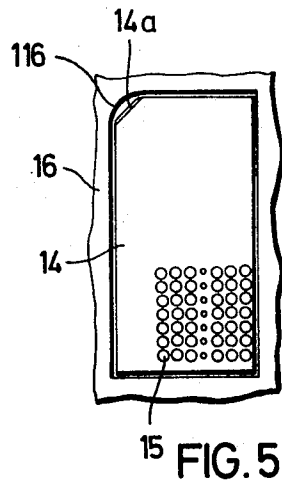
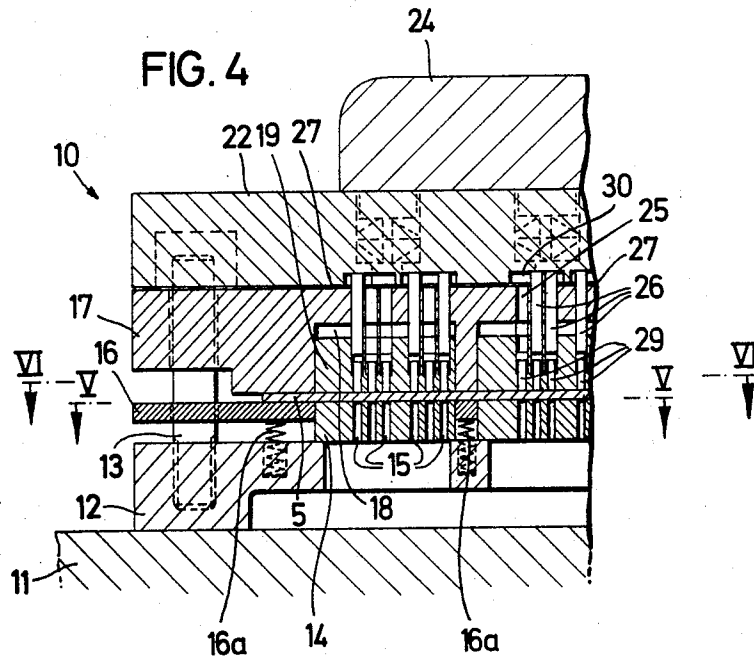


3 Sheets-Sheet 1



3 Sheets-Sheet 2





APPARATUS FOR THE MANUFACTURE OF PUNCHED CARDS

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a divisional application of the copending application Ser. No. 53,252 filed July 8, 1970.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for the manufacture of punched cards. More particularly, the invention relates to an apparatus for the production of punched cards with accurately configured and positioned punch holes, each such card having at least one of its corners removed for the convenience of handling and to facilitate discrimination between different types of cards.

Small punched cards are often employed by manufacturers of stationery for the storage and transmission of information. The information is stored in the form of punched holes. The cards can store information pertaining to programming of voluminous assortments for data transmission and can be used to facilitate economical transmission of data, for example, for transmission of orders between a main office and its subsidiaries, between a distributor and retailers as well as in many other instances where rapid transmission of orders, acceptances, repeat orders and like transactions is of interest. This eliminates the need for written orders, for the printing or writing of lists and/or other time-consuming procedures. Substantial savings in time are achieved by replacing conventional communicating methods with transmission of information which is stored on punched cards.

Proper functioning of data transmitting equipment depends on the accuracy with which the punched cards are manufactured and with which the punch holes are distributed and dimensioned. All dimensions of a punched card must conform to internationally accepted norms. For example, the distances between the punch holes as well as between the punch holes and the edges of punched cards should be selected with an accuracy which suffices to avoid tolerances beyond a small fraction of a millimeter. For example, the distance between the center of a punched hole which represents a bit of information and the center of the nearest synchronizing perforation (the so-called punch per inch distance) must equal exactly one inch or a whole multiple of an inch. The maximum permissible tolerance cannot exceed ± 0.05 millimeter.

A drawback of presently known methods of making punched cards is that they are not suited for the mass-production of accurately finished punched cards or that the number of rejects is extremely high. As a rule, each card is treated by several cutting or punching tools in a series of successive operations; this invariably creates problems if the cards are to be finished with a high degree of accuracy.

Another drawback of apparatus for the production of discrete punched cards in a series of successive steps is that the stacking and sorting of cards which store a wide variety of information consumes much time and necessitates the use of complicated and bulky equipment. For example, sorting of information pertaining to an assortment of up to and in excess of 10,000 discrete articles necessitates the manipulation of a very large number of punched cards which store different types of

information. The assembly of such a wide variety of punched cards in a manner which facilitates convenient access to and rapid processing of stored information presents a host of problems. Moreover, the storage and transport of a large number of discrete cards also contribute to the cost and complications of data transmission.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved apparatus for producing punched and printed cards with a degree of accuracy which cannot be matched by presently known methods.

Another object of the invention is to provide an apparatus for the production of punched cards which can be stored, transported and otherwise manipulated with greater facility than presently known cards and which can be resorted to in mass-production of cards bearing identical or different information.

The apparatus for producing accurately punched cards comprises two basic sections one of which serves as a support for sheets and is provided with cutting edges for severing of the sheets along the major edges of the cards. The other section is provided with complementary cutting edges which cooperate with the cutting edges of the one section when at least one of the sections moves toward the other section. The section with complementary cutting edges carries punches which can be displaced by the aforementioned motion transmitting elements to form in a sheet between the two sections holes simultaneously with severing of the same sheet along the major edges of the resulting cards.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood from the perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary plan view of a sheet of simultaneously produced punched cards, showing the manner in which the cards can be detached from the remainder of the sheet;

FIG. 2 is a fragmentary horizontal sectional view of an apparatus which can be utilized for the production of cards shown in FIG. 1, the section being taken along the line II—II of FIG. 3, as seen in the direction of the arrows;

FIG. 3 is a vertical sectional view substantially as seen in the direction of arrows from the line III—III of FIG. 2;

FIG. 5 is a fragmentary sectional view as seen in the direction of arrows from the line IV—IV of FIG. 2;

FIG. 5 is a fragmentary sectional view as seen in the direction of arrows from the line V—V of FIG. 4; and
FIG. 6 is a sectional view as seen in the direction of arrows from the line VI—VI of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, there is shown a novel sheet 5 which contains, for example, 30, 40 or 50 punched cards. The information which is stored on such cards in

the form of punch holes 7 can represent discrete numbers of articles, goods, other commodities and/or materials. Such information can be stored for the purpose of facilitating ordering, accounting, recording and/or other operations. The number of cards 6 in a sheet 5 depends on the nature of such operation. The cards 6 can form several rows (numbered 1, 2, 3, 4 . . .) which can extend horizontally and/or vertically. The blanks which are to be converted into sheets 5 preferably consist of a rather stiff synthetic plastic material and are provided with printed information as shown in FIG. 1. Each such blank is thereupon placed into register with a suitable cutting device which can form two or more sheets 5 in a single operation. The cutting device may be provided with a large number of dies which separate from a blank a corresponding number of sheets 5.

Each sheet 5 is thereupon treated in an apparatus 10 of the type shown in FIGS. 2 - 6. The apparatus can form in the sheets 5 any desired combinations or groups of punch holes 7 which are applied in such a way that they are located at an optimum distance from the edges 8 of cards 6 which are formed simultaneously with the punching of holes 7. However, it is preferred to form the cards 6 in such a way that each thereof continues to adhere to the remainder of the sheet 5 but is readily separable from the sheet when necessary and without necessitating the use of any tools. Those of the punches 29 which do not participate in the formation of holes 7 are loosely mounted in the apparatus 10 so that they cannot remove material from or make cuts in the sheet 5. The arrangement is such that the apparatus 10 can sever a sheet 5 along each of the four major edges 8 of each card 6 but leaves a weakened connection along the inclined edge 9 of each card so that the cards continue to adhere to the remainder of the sheet. When a user wishes to completely detach a card 6, the weakened connection along the inclined edge 9 is destroyed in a manner as shown in the lower lefthand corner of FIG. 1. For example, the connection along the edge 9 can be weakened by a row of perforations. It is preferred to cut completely through the sheet 5 along each of the longer or major edges 8; this insures that the edges 8 are less likely to be damaged or defaced during complete separation of the respective card 6 as well as that the edges 8 are formed by clean cuts all the way through the material of the sheet 5.

The details of the apparatus 10 are shown in FIGS. 2 to 6. This apparatus comprises a first section having a plate-like base 12 which can be placed onto the stationary portion or bedplate 11 of a press. The four corners of the base 12 carry vertical guide posts 13 which insure controlled up-and-down movements of various components of a second section with reference to the base 12. The first section further comprises a set of plate-like back supports or anvils 14 which are secured to the upper surface of the base 12 and one of which is shown in detail in FIG. 5. The contours of the anvils 14 correspond to those of the punched cards 6. Each of these anvils is formed with a large number of apertures or bores 15 which permit penetration of punches 29 serving to cut in the sheet 5 punch holes 7 shown in FIG. 1.

The anvils 14 are surrounded and separated from each other by an apertured confining plate 16 which consists of brass and is biased upwardly by helical springs 16a reacting against the base 12. The four corners of the confining plate 16 are formed with bores for

the guide posts 13. The parts 14 and 16 are overlapped by a so-called encoding plate 17 which is also formed with bores for the posts 13. The underside of the encoding plate 17 is formed with recesses 18 which receive plate-like inserts 19 each having a configuration corresponding to that of a card 6. Each insert 19 has a tight fit in the respective recess 18 but is movable up and down therein. The median portion of each insert 19 is provided with an upwardly extending stem or shaft 20 which passes through a registering bore of the encoding plate 17. The top faces of the stems 20 are flush with the upper side of the plate 17. When the apparatus 10 is ready for use, the encoding plate 17 is fixedly secured to a plate-like cover 22 by several screws, bolts or analogous fasteners 21 (see FIG. 2). The cover 22 has a centrally located upwardly extending clamping pin 23 which is connected to the movable second portion or ram 24 of the press, namely, of the press which includes the bed 11.

The encoding plate 17 is formed with a large number of vertical apertures or bores 25 (FIG. 4) each of which registers with an aperture or a bore 15 of one of the anvils 14. Similar apertures or bores are provided in the inserts 19. The bores 25 can receive vertically movable motion transmitting pins 26.

When the upper section (including the parts 17, 19, 22) is remote from the lower section (including the parts 12, 14, 16), the sheet-supporting upper surface of the confining plate 16 is coplanar with the sheet supporting upper surfaces of the anvils 14.

The precoding of the apparatus 10 is carried out by resorting to punched paper tapes 27 one of which is shown in FIG. 2. The tapes 27 are formed with perforations or holes 28 which are applied in a suitable paper tape punch. The tapes 27 are placed on top of the encoding plate 17 so each of them overlies a selected row of anvils 14 whereby each perforation 28 registers with one of the apertures or bores 25. Such bores 25 then receive motion transmitting pins 26 which descend therein to abut against the enlarged heads of small chip removing punches 29 which are received in stepped apertures or bores of the respective inserts 19 so that they are held against accidental ejection. The distance between the head and the lower end of each punch 29 is selected in such a way that the punches can be propelled through the material of a sheet 5 when the upper section is moved toward the lower section. The upper end portions of those pins 26 which abut against the punches 29 extend slightly above the upper side of the encoding plate 17 and into cutouts or compartments 30 provided in the underside of the cover 22. The combined length of a punch 29 and motion transmitting pin 26 is such that the lower end of the punch 29 is flush with the underside of the encoding plate 17 when the latter is properly fastened to the cover 22.

As mentioned before, the inserts 19 are movable upwardly in the respective recesses 18 of the encoding plate 17, namely, against the opposition of dished springs 31 which are located above plungers 32 and surround the respective stems 20. The parts 31, 32 are received in tapped bores of the cover plate 22, and the upper ends of such bores receive threaded plugs 33.

Once the precoding of the apparatus 10 is completed, i.e., once the motion transmitting pins 26 are inserted into a requisite number of apertures or bores 25 above each anvil 14, the cover 22 is secured to the encoding plate 17 by means of the fasteners 21 and the resulting

section is placed on top of the confining plate 16 so that its corner bores receive the guide posts 13. The lower section of the apparatus 10 is thereupon placed onto the bedplate 11 of the press (which can be a mechanical or a hydraulic press) and the pin 23 of the cover 22 is secured to the ram 24. The stroke of the ram 24 is selected in such a way that, when the ram is lifted, a plastic sheet 5 can be readily introduced into the space between the upper and lower sections of the apparatus 10. As a rule, the thickness of each sheet 5 is about 0.4 millimeter. FIG. 4 shows that an inserted sheet 5 is located between the confining plate 16 and the underside of the encoding plate 17. In the course of the punching operation, the ram 24 moves the encoding plate 17 downwardly whereby the motion transmitting pins 26 (whose upper ends abut against the cover 22 in the respective cutouts 30) move downwardly with the associated punches 29. The surface surrounding the recesses 18 in the underside of the encoding plate 17 are formed with sharp cutting edges which cooperate with the cutting edges of the anvils 14 to sever the sheet 5 along the major edges 8 and to weaken the sheet along the edges 9. As the encoding plate 17 descends with the cover 22 and ram 24, the spring-biased confining plate 16 yields so that the cutting edges of the plate 17 are free to cooperate with the cutting edges of the anvils 14 to sever the sheet 5 along the edges 8. The inclined edges 9 are weakened but continue to connect the cards to the remainder of the sheet 5. This is achieved by providing the registering portions of the confining plate 16 with correspondingly rounded corner zones 116 (see FIG. 5). The vertical surfaces of each anvil 14 have sharp cutting edges which cooperate with the major portions of cutting edges around the respective recesses 18.

The formation of punch holes 7 takes place simultaneously with the cutting of the sheet 5 along the major edges 8 of the cards 6. During each working stroke of the ram 24, the inserts 19 can move upwardly with reference to the descending encoding plate 17 whereby the springs 31 store energy. The extent of such upward movement of the inserts 10 depends on the length of the working stroke. The chips which are removed by the punches 29 enter the aligned apertures 15 in the anvils 14.

The motion transmitting pins 26 can be replaced with balls or other types of motion transmitting elements. When the punching of a desired number of sheets 5 is completed, the pins 26 (or balls) are withdrawn from the respective bores 25, for example, by means of magnets or other suitable withdrawing means. The apparatus is thereupon precoded for the next series of punching operations by resorting to different paper tapes 27, i.e., the positions of pins 26 inserted into the apertures 25 of the encoding member 17 are copied from the tapes.

An important advantage of the improved apparatus is that it can produce a large number of cards 6 in a single operation and that the simultaneously produced cards continue to adhere to the remainder of the respective sheet 5. This facilitates the transport and storage of cards since a stack of, for example, 250 sheets each having for example 40 cards connected thereto along the inclined edges 9, can be manipulated with greater facility than one or more stacks containing a total of 10,000 different cards. Also, the cards on a given sheet can be arranged in alphabetical or other

order (see FIG. 1). The sheets can be identified by numerals, letters or other symbols to facilitate stacking in a desired sequence. Verifying of the individual cards 6 is not necessary; all that is needed is to insure that the sheets 5 are grouped together in a desired sequence.

Another advantage of my method and apparatus is that several punched cards, each with a different number and/or distribution of punch holes therein, can be produced in a simultaneous operation. This further reduces the likelihood of excessive tolerances. Moreover, such mass-manufacturing of cards eliminates the sorting operations which are necessary if the cards are produced individually and do not adhere to each other. Moreover, the precoding of the apparatus in a manner as shown in FIG. 2 consumes much less time than the precoding of conventional apparatus which produce one card at a time. It is much simpler to maintain desirable tolerances when an apparatus is employed to produce a substantial number of cards in a single operation. Moreover, the accuracy is enhanced due to the fact that the punching of holes takes place simultaneously with the cutting of cards; this insures that the positions of holes 7 with reference to the edges 8 are the same in each of a series of successively treated sheets 5. The accuracy of the distribution of holes 7 and of the dimensioning of cards 6 depends only on the precision finish of the components in the apparatus 10. Such precision finish can be more readily achieved in an apparatus for simultaneous formation and punching of a large number of cards than in apparatus which produce one card at a time and wherein the cutting of cards, and the punching of holes are performed in separate steps.

Since the motion transmitting elements 26 preferably consist of magnetizable material, they can be readily withdrawn from the bores 25 of the encoding plate 17 so that the apparatus is immediately ready for the next precoding operation. This reduces the periods of idleness and thus contributes to a greater output.

It is clear that, even though FIG. 2 shows a paper tape 27 with different groups of perforations 28 for each overlapped anvil 14, the apparatus can be precoded to produce a desired number of cards of which is provided with the same number of holes 7 and in each of which the distribution of holes 7 is the same. Moreover, the tape 27 can be used for the precoding of horizontal rows of inserts 19 and the anvils 14 and the confining plate 16 can be designed to provide each card 6 with several inclined edges along which the cards continue to adhere to the remainder of the respective sheet.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. In an apparatus for the production of punched cards from sheets, particularly for the production of cards for use in data transmission, a combination comprising a sheet-supporting first section having a plurality of coplanar apertured anvils each provided with first

cutting edges distributed in conformance with the outline of a card and a base fixedly supporting said anvils; a second section arranged to overlap a sheet which is supported by said first section and including an encoding member provided with second cutting edges complementary to said first cutting edges; and means for moving one of said sections toward the other section so that said first and second cutting edges cooperate to sever the sheet between said sections and to thus form in the sheet a plurality of cards, said first and second cutting edges having major portions which cooperate to cut through a sheet between said sections and minor portions which cooperate to weaken the portions of a sheet therebetween so that each of the simultaneously formed cards continues to adhere to the remainder of the sheet, said major portions of said cutting edges on each of said anvils forming rectangles and said minor portions of said first cutting edges extending obliquely at the corners of the respective rectangle.

2. A combination as defined in claim 1, wherein said encoding member has a plurality of recesses each in register with one of said anvils and said second cutting edges surround the respective recesses.

3. A combination as defined in claim 2, wherein said second section further comprises apertured inserts movably received in the recesses of said encoding member, punches movably received in the apertures of said inserts, motion transmitting elements received in selected ones of apertures provided in said encoding member in alignment with the apertures of said inserts, and means for propelling the punches through the material of a sheet between said sections by way of said motion transmitting elements in response to movement of said one section toward said other section whereby the thus propelled punches cut holes into the corresponding cards.

4. A combination as defined in claim 3, wherein the means for propelling the punches comprises a cover member separably secured to said encoding member.

5. In an apparatus for the production of punched cards from sheets, particularly for the production of cards for use in data transmission, a combination comprising a sheet supporting first section having a plurality of coplanar apertured anvils each provided with first cutting edges distributed in conformance with the outline of a card; a second section arranged to overlap a sheet which is supported by said first section and in-

cluding an encoding member provided with second cutting edges complementary to said first cutting edges; means for moving one of said sections toward the other section so that said first and second cutting edges cooperate to sever the sheet between said sections and to thus form in the sheet a plurality of cards, said first and second cutting edges having major portions which cooperate to cut through a sheet between said sections and minor portions which cooperate to weaken the portions of a sheet therebetween so that each of the simultaneously formed cards continues to adhere to the remainder of the sheet; and a spring biased confining member surrounding said anvils and arranged to yield to said encoding member in response to movement of said one section towards said other section, said confining member having a sheet supporting surface and said anvils having sheet supporting surfaces coplanar with the surface of said confining member prior to movement of said one section toward said other section.

6. In an apparatus for the production of punched cards from sheets, particularly for the production of cards for use in data transmission, a combination comprising a sheet supporting first section having a plurality of coplanar apertured anvils each provided with first cutting edges distributed in conformance with the outline of a card; a second section arranged to overlap a sheet which is supported by said first section and including an encoding member provided with second cutting edges complementary to said first cutting edges; and means for moving one of said sections towards the other section so that said first and second cutting edges cooperate to sever the sheet between said sections and to thus form in the sheet a plurality of cards, said means for moving said one section comprising a press having a first portion supporting said other section and a movable second portion connected to said one section, said first and second cutting edges having major portions which cooperate to cut through a sheet between said sections and minor portions which cooperate to weaken the portions of a sheet therebetween so that each of the simultaneously formed cards continues to adhere to the remainder of the sheet.

7. A combination as defined in claim 6, further comprising guide means for guiding said one section along a predetermined path during movement with reference to said other section.

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