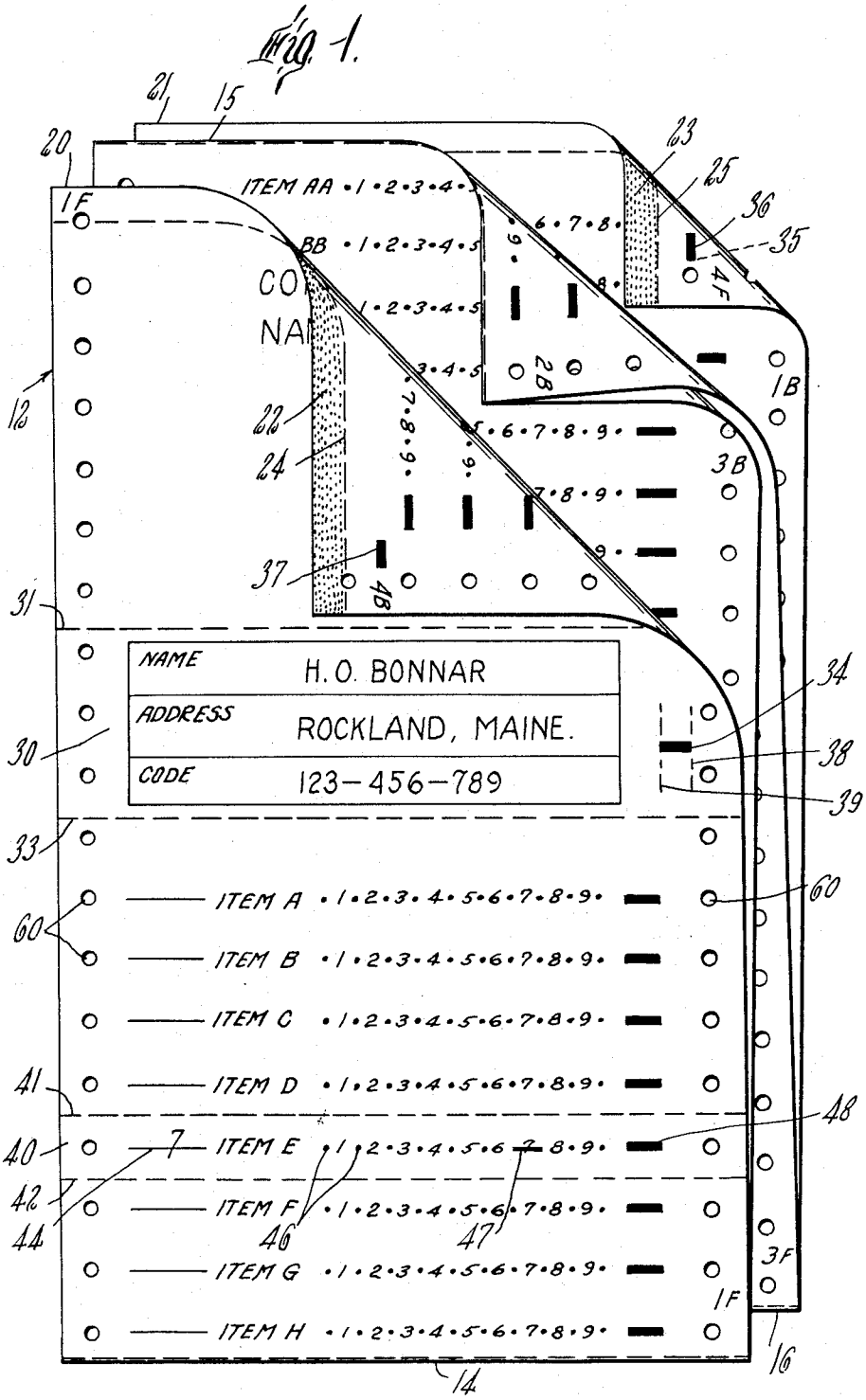
July 6, 1965 H. O. BONNAR 3,193,665

TABULATING FORM AND METHOD

Filed Sept. 28, 1959 3 Sheets-Sheet 1

Fig. 1.



July 6, 1965 H. O. BONNAR 3,193,665

TABULATING FORM AND METHOD

Filed Sept. 28, 1959 3 Sheets-Sheet 2

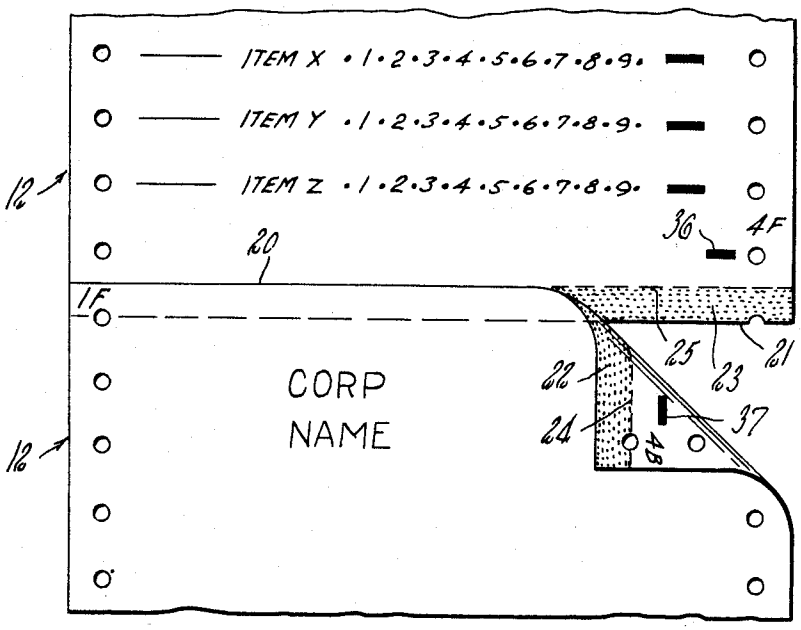


Fig. 2.

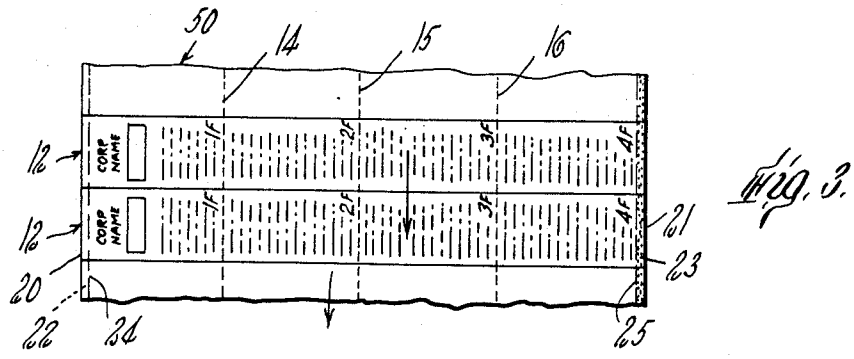


Fig. 3.

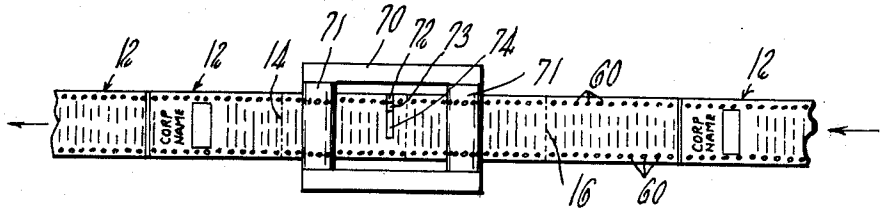


Fig. 4.

July 6, 1965 H. O. BONNAR 3,193,665

TABULATING FORM AND METHOD

Filed Sept. 28, 1959 3 Sheets-Sheet 3

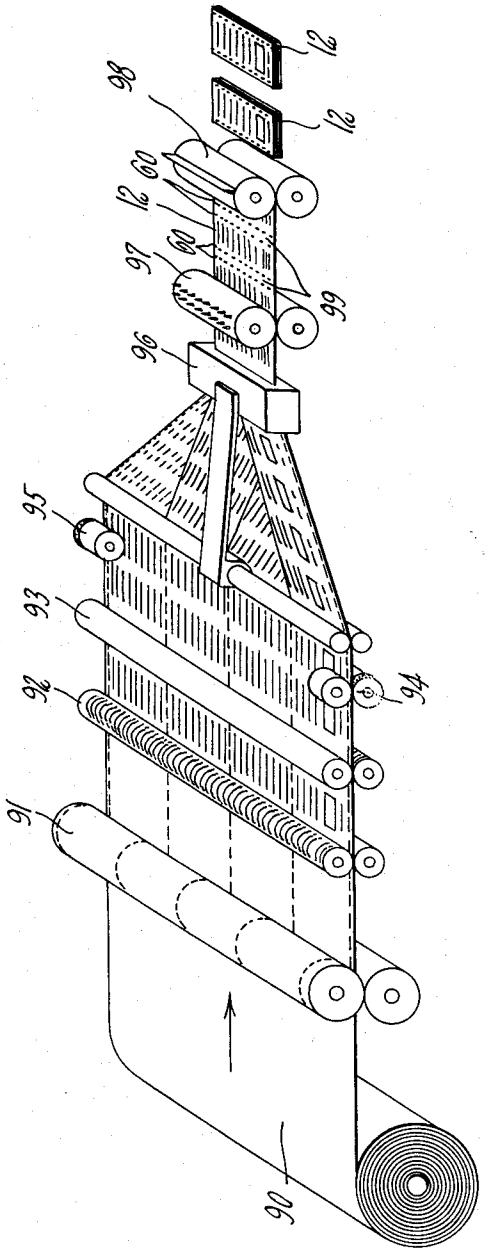


Fig. 5.

United States Patent Office 3,193,665 Patented July 6, 1965

3,193,665

TABULATING FORM AND METHOD

Henry O. Bonnar, Marblehead, Mass.
(% Bonnar-Vawter, Inc., Keene, N.H.)

Filed Sept. 28, 1959, Ser. No. 842,716
8 Claims. (Cl. 235—61.12)

This invention relates to business forms and more particularly to a novel machine readable tabulating form and novel methods of manufacturing and using it.

In recent years, automated business systems have been used in many industries, the well-known punched cards being widely used for such purpose. However, little attention has been paid to the use of automatic tabulation in a variety of situations, for example, with orders written in the field by salesmen and others, so that a great deal of hand work must still be carried out in transferring the handwritten information on the usual order forms onto punched cards and the like.

Accordingly, it is an object of the present invention to provide novel tabulating forms and methods of manufacturing and using them whereby salesmen and others in the field can directly enter information on machine readable forms which may thereafter be used directly to actuate automated reading and tabulating machinery for producing punched cards and the like.

More specifically, a major object of the present invention is to provide a "source document" which can be machine read to produce tabulating cards automatically, such a "source document" being that paper or form on which oral agreements are initially committed to a written form for transmittal, for example, of an order to the factory or the like. This has heretofore generally been done in handwritten form and then transcribed by a typist. By using a handwritten document for the entire sequence, however, the present invention eliminates such a typing operation which is expensive and time consuming as well as a source of potential error.

In modern office procedures, such a "source document" becomes the basic document which is used for the making up of tabulating cards which are vital to a computing and tabulating installation. In many cases, especially where the size of the individual order, dollar-wise, is small, the cost of the making of the necessary tabulating card is very significant. It is also time consuming. Thus, with a business situation having many small orders and a computing and tabulating installation with a high speed printer for handling them, it was necessary that there be many people punching cards just to keep up with the high rate at which the computing and tabulating machine used the cards.

With the heretofore known systems wherein the tabulating cards were manually prepared, first a card was manually punched using information from the "source document." That card was then put in a verifier and punched again. If the punching the second time was not identical with the first, the machine stopped and the source of the error was determined, whether it be first or second punching, and the card was corrected if necessary. According to the present invention, however, such manual punching is eliminated entirely and furthermore the tabulating is accomplished much faster and more accurately.

Too, in many situations the "source document" should be continuous to gain the most benefit from the automatic card punching operation. The problem, however, is that such document may be used singly at two points—first, when the salesman makes it up, a situation in which it would be unwieldy to use a continuous form and—secondly, the form may be used for picking the items to fill the order at the warehouse and may even become the packing slip and thus eventually end up back at the

source. Because the form may be so used singly as well as in continuous fashion, it is an important feature of the invention to provide a form that makes this possible.

The machine readable tabulating form of the invention, then, comprises a flexible paper strip folded in the manner of a fan, i.e. fan folded, along perforated fold lines, to provide a conveniently small assembly for use in the field, yet one capable of listing a great number of individual inventory items or other qualities thereon. In addition to a form identification section, preferably at the head end of the form, in which may be entered a salesman's name, address, code number and the like, the form includes a multiplicity of individual quality or item tabulation sections which extend entirely across the width of the form and are longitudinally spaced from one another for sequential reading upon advance of the form through a reading and tabulating machine. The folded assembly of the strip form of the invention is unique in enabling the listing of a large number of individual items or other qualities in its section for machine reading, yet in a convenient assembly for field use. For example, as many as fifty items may be listed on each side of each page of such a form, so that a four page form printed on both sides may readily list several hundred items with adequate room for headings and other desirable identification. To make possible the use of the form both by human readers and machine readers and tabulators, each item or quality tabulation section includes printed indicia symbolically identifying each section for human recognition as well as space for entry of the quality, such as the quantity of the item or other quality to be tabulated therein. It also includes machine initiating indicia for machine recognition of each section and preferably punched holes for mechanically feeding the form, as well as machine tabulating indicia defining a numerical code for tabulating such quality, for example, the quantity of the item entered in each section. This code is preferably one which is readily usable by persons in the field, such as by drawing pencil lines in specified positions dependent upon a numerical quantity, so that the transposition of the entered quality to a coded machine readable quality does not require additional services, although such could be so done if desired for any reason.

To aid in the machine reading of the form of the invention, the terminating pages thereof are provided with glue lines preferably of co-adhesive glue so that a number of forms may be attached in head to tail relationship to provide a continuous strip thereof of indeterminate length for machine reading. Machine total form sensing indicia are provided so that individual forms may be sensed. Also, machine readers may be employed for reading a code number on each form for entry onto tabulating cards or otherwise.

The methods of the invention comprise the manufacture of the above described form by methods related to form manufacturing processes employing folding a continuous sheet of paper in the manner of a Japanese fan, i.e. fan folding, followed by the assembly and reading of the forms, after completion by a salesman or other person, by automated machinery.

There are a number of reasons why it is desirable to produce the form of the invention by fan folding processes. One is because variations in humidity make paper expand and contract. Such dimensional instability is greater across the paper sheet than in the longitudinal direction thereof. Because a typical form reading machine is activated by the machine initiating indicia on the form and not by some mechanical device which measures distance, the spacing from one such indicia to the next is of little importance. However, once such indicia activates the form reading mechanism, the relationship of the punched holes and the initiating and tabulating indicia

becomes vital, in order to avoid reading the wrong quantity because of misspacing. According to the invention, then, the establishment of this relationship is such as to make it much less affected by variations in paper length caused by variations of humidity.

Another reason to manufacture the form of the invention by the novel methods thereof is because the manner in which the forms will be used will vary with different companies. For example, the number of items will vary considerably, and even within a company the number of items may vary seasonally, say from almost 700 during the Christmas season to 500 normally. If the form were to be printed at right angles to the manner of the preferred method of the invention paper would be wasted when fewer items exist than are needed to fill out the whole form or, alternatively, there would have to be a variety of different diameter cylinders, the latter in particular having substantial economic disadvantages. More specifically, the methods of the invention comprise continuously operating upon an extended sheet of paper of indeterminate length and of width equal to that of the length of the form to print, perforate and apply glue lines before fan folding, punching and finally cutting into individual forms. The printing is carried out simultaneously across the width of the sheet to provide symbolic and other indicia defining a series of forms, each extending across the entire width of the sheet and being in side by side abutting relationship with one another. The individual quality or item tabulation sections thus extend across the width of the form in the long dimension of the sheet, as do the fold defining perforation lines. The glue lines are applied to the edges of the sheet, with one of the glue lines on the opposite face of the sheet from the other.

After fan folding the continuously moving sheet, it is punched to provide the apertures on superposed pages in registry with one another, and the sheet is then cut transversely to separate the individual forms from one another. It should be especially noted that during the above operations, the sheet is advanced from one step to the next in a direction perpendicular to the long dimension of the form. This makes possible the simultaneous printing and punching of an entire form of a length of several feet as is required to accommodate a large number of individual sections, the simultaneous printing and punching making possible the accurate registry and alignment of machine indicia and feeding apertures on a flexible distortable sheet of paper.

After an individual form has been used by entering the desired information, both writtten and coded as is described above, a series of forms are attached together in head to tail relationship to provide a strip of indeterminate length and the strip is then machine read, as for the direct production of punched cards, by advancing it in a direction along its length for successive reading of the indicia of each section. This makes possible the use of relatively simple reading apparatus, since such apparatus need read but one section at a time with this arrangement. The reading and tabulating apparatus is much simplified as a result, to the extent that for the first time it becomes economically feasible for many industries to establish automatic inventory or other control, for example.

For the purpose of explaining further objects and features of the invention reference is now made to the following detailed description of preferred embodiments thereof, together with the accompanying drawing, wherein

FIG. 1 is an isometric view of the form of the invention;

FIG. 2 is an isometric view of two forms of the invention partially attached in head to tail relationship;

FIG. 3 is a diagrammatic view of an extended sheet of paper having a plurality of forms printed thereon in accordance with the invention;

FIG. 4 is a diagrammatic view of a strip of forms attached in head to tail relationship for advance through a reading machine in accordance with the invention; and

FIG. 5 is a diagrammatic view showing apparatus useful in the invention.

Referring to FIG. 1, the form of the invention consists of a fan folded flexible paper strip **12** of substantially greater length than width, herein shown as having four pages printed on both front and back, the front pages being numbered 1F, 2F, 3F, 4F, in sequence and the back pages being numbered 1B, 2B, 3B, and 4B in sequence. More pages can be used if desired. The pages are of substantially equal length with their fold lines defined by lines of perforations, perforations **14** between pages 1F and 2F, perforations **15** between pages 2F and 3F and perforations **16** between pages 3F and 4F. The terminating pages each have free edges, the head page having a free edge **20** and the rear page having a free edge **21**. Glue lines are provided along said free edges on opposite faces of the form for attaching together a series of forms in head to tail relationship as is illustrated in FIG. 2, the glue line **22** adjacent edge **20** on the head page being on the back face of the form and the glue line **23** adjacent edge **21** being on the front face of the form. The glue used is preferably of the co-adhesive variety which sticks only to itself. To aid in separating forms after they have been attached as in FIG. 2, a line of perforations is placed along each glue line, perforations **24** on the head sheet and perforations **25** on the tail sheet.

Preferably, one of the terminating pages, here the tail page 4F, is shorter than the other pages by an amount at least as great as the width of the glue line, as may be seen in FIG. 1. This aids in providing uniform stacking of the forms by reducing their thickness along the end at which both glue lines are present.

At least one page of the form, preferably the head page 1F, has a space at one end thereof in which the company name is printed as shown and may include any other printed information that may be desired, usually information of a type which need not be read by a reading and tabulating machine. The head page also includes a total form identification section **30** which extends across the entire width of the form between the dotted lines **31, 33** which are herein added for clarity in defining the longitudinal extent of said section. This total form identification section includes printed indicia symbolically identifying a particular form for human recognition and identification and entry of total form information therein, such as name, address, etc., and preferably a code number which can be read by suitable reading machinery, all as is shown in FIG. 1 in said section **30**. The total form identification section also includes machine total form sensing indicia appearing as a printed line **34**, and other such indicia may be printed at the end of the form on page 4F at **36**, and on the other face of the form on page 1B at **35** on page 4B at **37**. These indicia are suitable for recognition by known photocell sensing means and are positioned on the form in such a manner that upon advance of the form in its longitudinal direction relative to a total form indicia sensing means no other indicia is present for sensing by said means. This is accomplished by reserving a longitudinal column, defined between dotted lines **38, 39** for illustration in FIG. 1, which extends for the entire length of the form. Of course, other types of indicia and sensing means therefor may be utilized, for example, electromagnetic or electric sensing may be used.

Following the total form identification section **30** are a multiplicity of individual item tabulation sections such as section **40** defined as between lines **41** and **42**. These individual item tabulation sections extend across the entire width of the form and are longitudinally spaced from one another as may be seen in FIG. 1 for sequential reading of said sections upon advance of the form in its longitudinal direction through a reading and tabu-

lating machine therefor. The entire remainder of the front face of the form on pages 1F, 2F, 3F, 4F and the entire rear face of the form on pages 1B, 2B, 3B, 4B are printed with sequential individual item tabulation sections so that a very great number of separate items may be entered and tabulated on a single form—furthermore, the sections may be much closer together than as shown in FIG. 1 for clarity, so that at least three or four times as many sections may readily be included on a form no larger than that shown in FIG. 1.

Each of the time tabulation sections 40 includes printed indicia symbolically identifying each of the sections, such as "ITEM A, ITEM B, . . . ITEM E, . . ." as shown in FIG. 1, and a space defined by a line 44 preceding such item identification for entry of the quantity of the item to be tabulated therein, such as the quantity "7" entered at line 44 in section 40 before "ITEM E." Machine tabulating indicia based on a numerical code are also provided in each said section for coding the quantity of the item tabulated therein for machine reading. Although a variety of coding systems may be used, it is important that it be a simple and easily understandable one readily usable in the field.

Accordingly, the coding system used comprises a series of dots 46 extending across the width of the form, said dots defining a number between any two adjacent dots. As shown in FIG. 1 as a simplified illustration, ten dots are used to define the numbers 1, 2 . . . 9, which are also printed on the form between the dots to facilitate the coding of entered information. The quantity information is entered in the line of coded dots simply by drawing a pencil line between adjacent dots defining the quantity to be entered, for example, as shown in section 40 in FIG. 1, a line 47 has been drawn between the dots defining seven. Thus any quantity of an item less than ten may be directly tabulated on the form illustrated and higher numbers may be tabulated by utilizing a reading machine capable of addition. By using additional dots to define two digit and three digit numbers, for example, much larger quantities may be tabulated in the same manner. The so coded information is read by a machine having sensing means for measuring the electrical conduction of at least a portion of the space between any two adjacent dots, as by two brushes in contact therewith connected to suitable electrical conduction measuring apparatus, thus, when a pair of brushes for a given number come in contact with the electrically conducting pencil line between two dots, a characteristic signal will be produced. The dots defining a given number are all arranged in longitudinal columnar form for sequential sensing of a given number defined by two of said dots in successive sections.

In order to initiate machine operation as to each item tabulation section, machine initiating indicia are provided therefor, such indicia consisting of a printed line 48 for each section with all of said lines arranged in longitudinal columnar form. Photoelectric reading thereof may be employed as above described.

The longitudinal position of the dots 46 and section indication lines 48 are generally in a line across the width of the form for generally simultaneous reading, and are related to preceding and succeeding sections in longitudinal columnar form sufficiently spaced from those of said succeeding and preceding sections for completion of the reading of a preceding section before beginning reading of a succeeding section. This unique arrangement of the form of the invention makes possible the utilization of simple reading apparatus since exactly the same reading cycle is carried out successively as to each section by a single reading unit including means for sensing the coded indicia 47, the section lines 48 and the form lines 34, 35, 36, 37 all of these being laterally spaced from one another across the width of the form being read. The form lines 34, 35, 36, 37 are generally on the ends of the form beyond the longitudinally spaced series of section lines 48 so that the item sensing elements of the reading machine will be turned on and off thereby and so only be energized when a form is actually being read.

In order to control the advance of the form while it is being machine read, a series of uniformly spaced apertures 60 is provided along each edge thereof in registry with the machine indicia such as dots 46 and section lines 48, although a pair of apertures need not be provided for each section as shown—rather any even integral relation will serve, such as two, three or four times as many sections as pairs of apertures 60. Also, the apertures 60 of each page are in registry with those of superposed pages for feeding and holding of folded forms in automatic form handling machines. It should be noted that hole spacing is preserved after adhesively securing two forms together in head to tail relationship, as may be seen in FIG. 2, by accurately mating the glue lines 22 and 23 by means of their edges 20 and 21 and perforations 24 and 25. By so doing a strip of forms of indeterminate length can be prepared in which the perforations 60 are uniformly spaced even at form junctions as is required for accurate machine feeding to preserve registry with the machine indicia.

The method of manufacturing the above described form, as has been heretofore explained, features the preparation of forms by simultaneously printing throughout the length of the form and applying glue lines 22 and 23 and lines of perforations 14, 15, 16, 24, 25 before folding, perforating, and cutting. The sheet 50 so manufactured is shown in FIG. 3 after the completion of the printing, perforating, and gluing, the arrow indicating its direction of advance as perpendicular to the length of the forms 12 printed thereon during its manufacture.

The method of reading as is diagrammatically shown in FIG. 4 may be seen to be carried out at right angles to the direction of sheet movement during manufacture, that is, along the length of a form 12 or strip thereof. The reading means 70 diagrammatically shown therein may include suitable driving rolls 71 engaging the apertures 60 of the forms 12, as well as a total form sensing photocell device 72, an individual item sensing photocell device 73, and a numerical code sensing device 74. Such devices being generally well known and in themselves forming no part of the present invention will not herein be further described. Devices or machines of types useful for the purposes indicated may be found for example in U.S. patents as follows:

For photo electric sensing devices—Pat. No. 2,402,222—Willis; Pat. No. 2,258,204—Gould; Pat. No. 2,320,338—Bryce.

For other sensing devices; Pat. No. 2,303,081—Weitmann and Pat. No. 2,171,556—Higginbottom et al.

Other known arrangements like these and similar equipment, modified in obvious fashion as desired for obtaining operation as needed, may be used for carrying out the method of this invention.

In FIG. 5 is shown in diagrammatic form a complete method of manufacture of the form of the invention. Thus, a sheet 90 of paper of indeterminate length and of width equal to the length of the form is perforated by perforations 91, printed on both faces of printing rolls 92 and 93 and glued by edge glue application 94 and 95 to produce the sheet 50 of FIG. 3. This sheet is then continuously fan folded by folder 96 to produce a continuous fan folded sheet which is then punched by punching rollers 97 to provide a fan folded sheet having spaced transversely extending lines of apertures 60, the form 12 being positioned between the wide spaced lines and the form edges being positioned midway between the narrow spaced lines at 99. The sheet is then cut at 99 to produce the individual forms 12 of the invention.

Thus, it will be seen that the invention provides a novel form as well as novel methods for using and manu-

facturing it. Various modifications of the invention will be apparent to those skilled in the art.

I claim:

1. A machine readable tabulating form comprising a fan folded flexible paper strip of substantially greater length than width and having a plurality of folded pages of substantially equal length defined by lines of perforations extending throughout the width of the strip, said pages including beginning and end terminating pages, said terminating pages each having a co-adhesive glue line adjacent its terminating edge, with said glue lines on opposite faces of said strip for attaching a plurality of strips to one another in sequence to provide a form of indeterminate length for machine reading, said strip having a series of uniformly spaced apertures along both edges for controlling the advance of said strip through a reading and tabulating machine therefor, a multiplicity of individual item tabulation sections in transverse registry with said apertures and extending across the width of said strip and longitudinally spaced from one another for sequential reading of said sections upon longitudinal advance of said strip through a reading and tabulating machine therefor, said item tabulation sections each including printed indicia symbolically identifying each of said item tabulation sections for human recognition and identification and entry of the quantity of the item to be tabulated therein, machine initiating indicia for machine recognition of each individual item tabulation section and machine tabulating indicia defining a numerical based code for tabulating the quantity of the item entered in each item tabulation section, said tabulating indicia extending across the width of said strip for simultaneous presentation to a reading machine of a plurality of coded indicia together defining said quantity and a total form identification section extending across the width of said strip and longitudinally spaced from said item tabulation sections for identification of each form upon advance of said strip through a reading and tabulating machine therefor, said form identification section including printed indicia symbolically identifying said form identification section for human recognition and identification and entry of total form information therein, and machine total form sensing indicia on said strip at both of the ends thereof beyond the longitudinally spaced series of said machine initiating indicia.

2. A machine readable tabulating form comprising a paper strip of substantially greater length than width having a multiplicity of individual quality tabulation sections extending across the width of said strip and longitudinally spaced from one another for sequential reading of said sections upon longitudinal advance of said strip through a reading and tabulating machine therefor, said quality tabulation sections each including in a single line, transversely arranged and aligned, printed indicia symbolically identifying each of said quality tabulation sections for human recognition, machine initiating indicia for machine recognition of each individual quality tabulation section and machine tabulating indicia defining a code for tabulating a quality entered in each quality tabulation section, and a series of uniformly spaced apertures along at least one long side of said strip for controlling the longitudinal advance of said strip through a reading and tabulating machine therefor, each of said apertures being in transverse registry with a said individual quality tabulation section.

3. A machine readable tabulating form as claimed in claim 2 further including a co-adhesive glue line on each

of the opposite short sides of said strip, and with said glue lines on opposite faces of said strip for attaching a plurality of strips to one another in sequence to provide a form of indeterminate length for machine reading.

4. A machine readable tabulating form as claimed in claim 2 further including machine total form sensing indicia on said strip at one of the sides thereof beyond the longitudinally spaced series of machine initiating indicia.

5. A machine readable tabulating form comprising a paper strip of substantially greater length than width and having a plurality of foldable pages defined by lines of perforations extending throughout the width of the strip, said pages including beginning and end terminating pages, said strip having a multiplicity of individual item tabulation sections extending across the width of said strip and longitudinally spaced from one another for sequential reading of said sections upon longitudinal advance of said strip through a reading and tabulating machine therefor, said item tabulation sections each including in a single line, transversely arranged and aligned, printed indicia symbolically identifying each of said item tabulation sections for human recognition, machine initiating indicia for machine recognition of each individual item tabulation section and machine tabulating indicia defining a numerical based code for tabulating the quality entered in each item tabulation section, a series of uniformly spaced apertures along at least one long side of said strip for controlling the longitudinal advance of said strip through a reading and tabulating machine therefor, each of said apertures being in transverse registry with a said individual item tabulation section and a total form identification section extending across the width of said strip and longitudinally spaced from said item tabulation sections for identification of each form.

6. A machine readable tabulating form as claimed in claim 5 wherein said apertures in each page are positioned in registry with like apertures in all other pages when said pages are folded.

7. A machine readable tabulating form as claimed in claim 5 wherein said terminating pages each have a co-adhesive glue line adjacent its terminating edge, with said glue lines being on opposite faces of said strip for attaching a plurality of strips to one another in sequence to provide a form of indeterminate length for machine reading.

8. A machine readable tabulating form as claimed in claim 7 wherein one of said terminating pages is reduced in length to an extent at least as great as the width of said glue lines.

References Cited by the Examiner

UNITED STATES PATENTS

1,081,314	12/13	Legg	235—50 XR
1,385,569	7/21	Mayer et al.	
1,508,095	9/24	Fuller	235—61.12
2,171,556	9/39	Higginbottom et al.	235—61.12
2,258,204	10/41	Gould	235—61.11 XR
2,288,360	6/42	Jensen.	
2,302,081	11/42	Weitmann	235—61.11 XR
2,402,222	6/46	Willis	235—61.11 XR
2,547,838	4/51	Russel	235—61.12

MALCOLM A. MORRISON, *Primary Examiner.*

LEO SMILOW, *Examiner.*