L. INGERSOLL.
MULTIPLE FORM AND METHOD OF MAKING IT.
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1,368,729. Patented Feb. 15, 1921.
3 SHEETS—SHEET 2.

Inventor:

Said Ingersoll

By

Frank Marhley Ingersoll, his attorneys.
To all whom it may concern:

Be it known that I, LELAND INGERSOLL, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented new and useful Improvements in Multiple Forms and Methods of Making Them, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to what is generally referred to in the art as "multiple forms for continuous billing machines," and which consist of a multiplicity of strips of paper previously folded in superposed relation or separately rolled and subsequently caused to assume such superposed relation, and then fed into a billing machine in such relation, each strip in such fed position, having printed upon it certain successively repeated units of conventional matter called "forms." Such modifications of these "forms" may be made on the different respective strips that although any desired matter may be typewritten upon all of them simultaneously at one operation of the billing machine, they may, nevertheless, after being so simultaneously typewritten and filled out, be adaptable for use as records of different character or for whatever different purposes may be desired, all forms in one strip, however, being repeated impressions of the same.

The complete group of all the forms so printed on the different strips, with modifications, if necessary, constitutes and is known as a "set of forms," consisting of the same number of forms as the number of strips fed into the billing machine, all as is well understood and known to those skilled in this particular art.

The general requirements of this class of supplies, and of the method of feeding them into and using them upon the billing machines, in order to obtain the highest degree of economy are as follows:

First:—The printed matter on each of the superposed strips must register with similar printed matter on each and all of the other strips, and remain in registration with absolutely no readjustment so as to insure proper registry of the spaces left blank for typing or other writing.

Second:—There must be no waste of the material used.

Third:—The manipulation of the supply of forms during and after completion of the typewriting operation must be reduced to a 60 minimum.

Fourth:—The character of the supply of forms must be such that it can be used on any standard design of billing machine.

Fifth:—The arrangement of the supply of 85 form must be such as to permit a maximum of speed of operation.

Sixth:—The arrangement of the forms must also permit the installation, in connection with the billing machine, at one time 70 of a maximum quantity of supply so as to reduce to a minimum the operation of re-ewing such supply.

Seventh:—The arrangement must also be such as to eliminate the necessity of devising and using special attachments for holding and feeding the supply, and

Eighth:—The arrangement must also be such as to simplify the manipulation involved in starting the supply through the billing machine.

It is to the attainment, to the highest degree, of the above-mentioned objects, that my invention is directed.

Heretofore two different styles of supply 85 have been used, involving two different methods of feeding and which I shall now briefly describe.

In the one style which I shall hereinafter designate as the "roll style" of supply, single strips of paper, of a width suitable to accommodate transversely a single form, are first run through a printing machine and a given kind of form printed successively thereon, after which each strip is wound in one or more rolls, the diameter of which is limited by the weight per roll which can be efficiently handled, and by the space which can be economically allowed to each roll on any holder or feeding attachment. Other 100 required and different forms are similarly printed in a like manner either upon the same printing machine after the required number of any other form is completed, or upon different machines. The rolls of forms 105 so provided are then ready to be supplied to the billing machines for use. The required number of rolls, each roll in itself bearing homogeneous printed matter, but all or part of the rolls differing from each 110
other (unless exact duplicates of all forms be desired) are then mounted upon an especially designed and constructed holder arranged adjacently to or suitably attached to the billing machine or support thereof. This mounting of these rolls usually involves the placing of the different rolls in different horizontal planes so that the strips may be unwound from them without interference with each other. The free ends of the strips of the respective rolls are then gathered manually in their proper order and started through the billing machine in superposed relation, care being taken to effect the required registration of the first superposed group or set of forms. The successive groups or sets of forms are then fed through the machine in the usual manner and as the particular design of the machine upon which they are used may necessitate.

This style of supplying these forms, however, involves the following difficulties and objections.

The method of the preparation of the rolls, it will be noted, is such that the members of each group or set of forms consisting of superposed strip elements, are printed at different times and hence under different atmospheric and other physical conditions and even upon paper of different character. In consequence, the elements composing each group are often so widely variant in their required characteristics as to be incapable of proper registration. Again, the rolls being absolutely disconnected and independent of each other, it is extremely difficult to control or harmonize the feeding of the strips so rolled and even if originally of a character capable of the required registration, they unavoidably lose the registering relationship and necessitate adjustment. Furthermore, that portion of each roll near the center is wound to such a small diameter that the resulting curvature is so great that it renders such portion useless and it must be hence discarded as waste. The starting of the strips involves objectionable manipulation whose elimination is greatly to be desired; the ease and speed of operation are limited to a deleterious extent by reason of the force required to turn the rolls upon their axes; the size of the rolls used is necessarily limited, thus limiting the quantity of the supply; and a special arrangement or construction is necessary to accommodate these rolls, thus adding a material expense to the equipment and necessitating the additional manipulation in the installation of the rolls.

The other style of supply is generally known to the trade as the "fanfold form." The preparation of this style of form includes the initial passing through a printing machine of a continuous sheet of paper of sufficient width to print simultaneously and transversely, the desired number of different forms to constitute a "set." These forms or sets are afterward passed through the billing machine in superposed relation, as will be hereinafter further described. The product resulting from this printing operation is a wide continuous sheet having longitudinal columns of forms, forms of any one column being identical in printed matter, but the forms of different columns differing from each other (unless duplicates are desired). This continuous sheet is then provided with longitudinally alined perforations between each column of forms and may be provided with transversely extending parallel lines of perforations between the transversely alined groups of different forms, either by a special operation or by means forming a structural and coordinating part of the printing machine. This sheet is then folded upon the longitudinal perforations and in alternate directions, to assume a zigzag form, such folding operation being designated in the art, as "gathering." The longitudinally folded or gathered continuous sheet is then "fanned" or folded transversely zigzag-wise upon or independently of transverse perforations or other lines of weakness, as some may or may not have been provided, this transverse folding being at such intervals as is convenient for packing in convenient receptacles or placing on suitable holders, and the continuous sheet by transverse cutting is divided into sections of such length as may be convenient for packing, or to suit the particular requirements of the different styles of standard billing machines, the length of each section being limited only by the size of the container determined upon in any instance.

There results a pile of superposed sets or groups of forms all connected at their sides and ends, which pile is then placed in a proper receptacle, such as a box, and this box or supply of forms is then placed adjacent to the billing machine and fed through the same as required, this feeding operation resulting in lifting the successive groups of forms up into position and then being passed through the machine.

It will be noted that this type of supply consists of one integral sheet of forms all connected with each other at their adjacent sides and ends. This fanfold form eliminates very many of the difficulties and objections to the rolled style of supply, inasmuch as all the forms register with each other and remain in registration without readjustment; there is no waste of material such as is involved and previously mentioned in connection with the roll style; the supply may be used on standard types or designs of billing machines; the supply may be manipulated at greater speed than...
when in the form of rolls, and the limitation as to amount of supply is eliminated; no special attachment or device is necessary for holding the supply during the feeding operation, and the operation of starting the supply through the machine is simplified.

The only objection to this fanfold type of supply lies in the fact that as a result of the connection at the adjacent sides of all the forms, the latter must be separated after the typewriting operation and such separation introduces an objectionable element of manipulation and sometimes involves waste and destruction of certain of the forms, and this is also true where machines have been supplied with cutting devices for slitting the sides of the strips and thus separating the connection between the adjacent side edges of the forms.

My invention, therefore, contemplates the elimination of all of the objectionable features of the above two described ways of producing the forms and the methods of feeding same.

My said invention, therefore, consists of an article and a method of producing same hereinafter fully described and particularly set forth in the claims.

I aim to produce a set of forms in perfect registry laterally as well as longitudinally. In order to effect this I must have complete uniformity of material and conditions, particularly as relating to each transverse section of the web, and this similarity of material must start with the paper. I produce the strips all at once from the same pulp in a single web of paper, and I print the forms all at the same time in the same press; and I subject all the forms of a set all the way through to the same conditions at the same time.

The annexed drawings and the following description set forth in detail certain means embodying my invention, the disclosed means, however, constituting but one of the various mechanical forms in which the principle of the invention may be employed.

In said annexed drawings:

Figure 1 represent a top plan of a portion of a sheet having printed thereon groups of five different forms, three of which forms are printed upon the obverse side.

Fig. 2 represents a plan of the reverse side of such sheet showing the other two forms.

Fig. 3 represents a perspective view of a portion of such sheet in a partially folded condition.

Fig. 4 represents a perspective view of a portion of a supply shown in a folded and partially "fanned" condition.

Fig. 5 represents a perspective view of a billing machine showing the supply in connection therewith and its relation thereto during the feeding operation.

The sheet illustrated by Figs. 1 and 2 is prepared as above described, the dotted lines 2 and 3 respectively indicating the position of the longitudinal slits and transverse lines of weakness here shown as perforations. After the sheet has been printed and the longitudinal perforations supplied, it is fanfolded as indicated in Fig. 3. This folded strip is then passed through a machine which provides the transverse perforations, where such transverse perforations are required. The sheet so gathered is then passed through a suitable machine which slits the sides, that is, separates the connected side adjacent edges of the individual strips. After being so slit, the superposed strips are then folded upon the transverse perforations or "fanned" so as to assume the form illustrated by Fig. 4. After being so "fanned" the supply is then placed in suitable receptacles or boxes, as shown in Fig. 5, whereupon they are ready for application in the machine. The above method of operation may be varied as follows: It may not be necessary always to have any or all the longitudinal rows of perforations.

The sheet is first printed as above described and then by any suitable means forming a coordinating part of the printing device, cut longitudinally and then transversely perforated. The strips so cut are then subjected to the operation of a suitable device which will gather them in superposed relation and with the printed matter facing the same direction, after which the superposed strips are "fanned" or folded upon the transverse perforations in opposite directions. The word "perforations" and other words from the same root, here used are to be understood as having a generic meaning, so as to include such treatment of the paper as a creasing, grooving, scratching, making lines of wet or otherwise weakening the fiber along a line transverse to the web.

There are various other features that I wish to have understood as mutual equivalents. Thus the sequence in certain claims of the acts of gathering and of slitting is not always important, and it may be varied.

Under some circumstances, the method first outlined may afford rather better results. When the sheet is accurately gathered before being slit the pile is stiffer and the strips are controlled by their union to each other so as to be put exactly proper position before they are cut apart. The effect of any small local irregularity of the paper is also more apt to be distributed upon parts immediately superposed, so that the effect of such irregularity is the same as corresponding and substantially similar spots upon two or more strips. Thus, if there should be a thin spot, Fig. 2, between strips 2 and 3, it would extend to the same rela-
tive part of each form and the right hand ends of the two forms would be affected alike, as is obvious. So too, it is better to have any transverse punching done after the sheet is gathered, as the act of punching forces the sheets into close contact, and the punch carries particles of each into the perforations of the next below. They are thus, in some measure, held united. The close connection makes the fan-folding easier too. The pile is then boxed as before.

As a result of the above method of operation, the structural form of the supply is such as to eliminate all of the previously mentioned objections resulting from the first two-described methods.

The method of packaging or folding here termed "fan-folding" enables me to preserve the forms in proper registry because alternate faces at short-intervals are subjected to bending or folding stresses and thus that portion of a sheet which at one end is on the inside of a fold, at the other end is on the outside and the misplacement due to the cumulative "creeping" on roll, is corrected.

The object of my invention is to make a set of superposed form strips free longitudinally and in exact registry, and I effect this by subjecting the sheet to transverse simultaneity of action all the way through treatment whereby the transverse portions of the sheet are all affected the same way.

What I claim is:

1. Folded, superposed, printed, registering detached strips of forms forming sets having registering spaces for filling in for continuous billing machines, made from side-by-side components of the same sheet of paper, every set of printed forms having been created, produced, cut apart and fan folded from identical material by operations performed in simultaneity as to the strips so as to obtain uniformity of product and assured registry of said printed forms.

2. As a new article of manufacture, a pile of paper bearing a multiplicity of forms, each form being a member of a set, each set consisting of superposed forms, each element of each group bearing printed matter impressed on all at the same time and under identical paper affecting conditions, the bodies of all the elements being made of paper having the same physical characteristics; both the side edges of each such form being entirely free, each of the elements of all of the said sets having its ends attached respectively to adjacent ends of elements of the two sets lying upon opposite side faces thereof.

3. The process of preparing from a continuous, long sheet a supply of blank multiple forms for any continuous billing machine, which consists in printing all at one time upon a sheet of paper a set of differing forms running across the sheet and repeating the printing lengthwise the sheet, gathering the sheet as printed so as to make a strip having all the members facing the same way, in superposed relation with the members of each set in blank space registry, slitting apart lengthwise the parts of the strip, and fanfolding the slitte strips, the sequence of the acts of gathering and slitting being reversible.

4. The process of preparing from a continuous, long sheet a continuous connected supply of multiple forms having exactly registering blank spaces, which process consists in performing in variant sequence the following acts in printing upon and transversely across a sheet of paper, sets of forms, gathering the sheet so printed as to effect registry of blank spaces on the forms, slitting the folded sheet on lines of length, and folding the superposed strips by forces directed across the strip against alternate faces, whereby cumulative creeping of the strips upon each other is avoided, all the actions across the strip being performed in transverse simultaneity.

Signed by me this 9th day of Sept. 1919.

LELAND INGERSOLL.