Jan. 28, 1930. A. OLSON ET AL 1,745,311

PAPER HANDLING MACHINE

Filed April 13, 1927 3 Sheets-Sheet 1

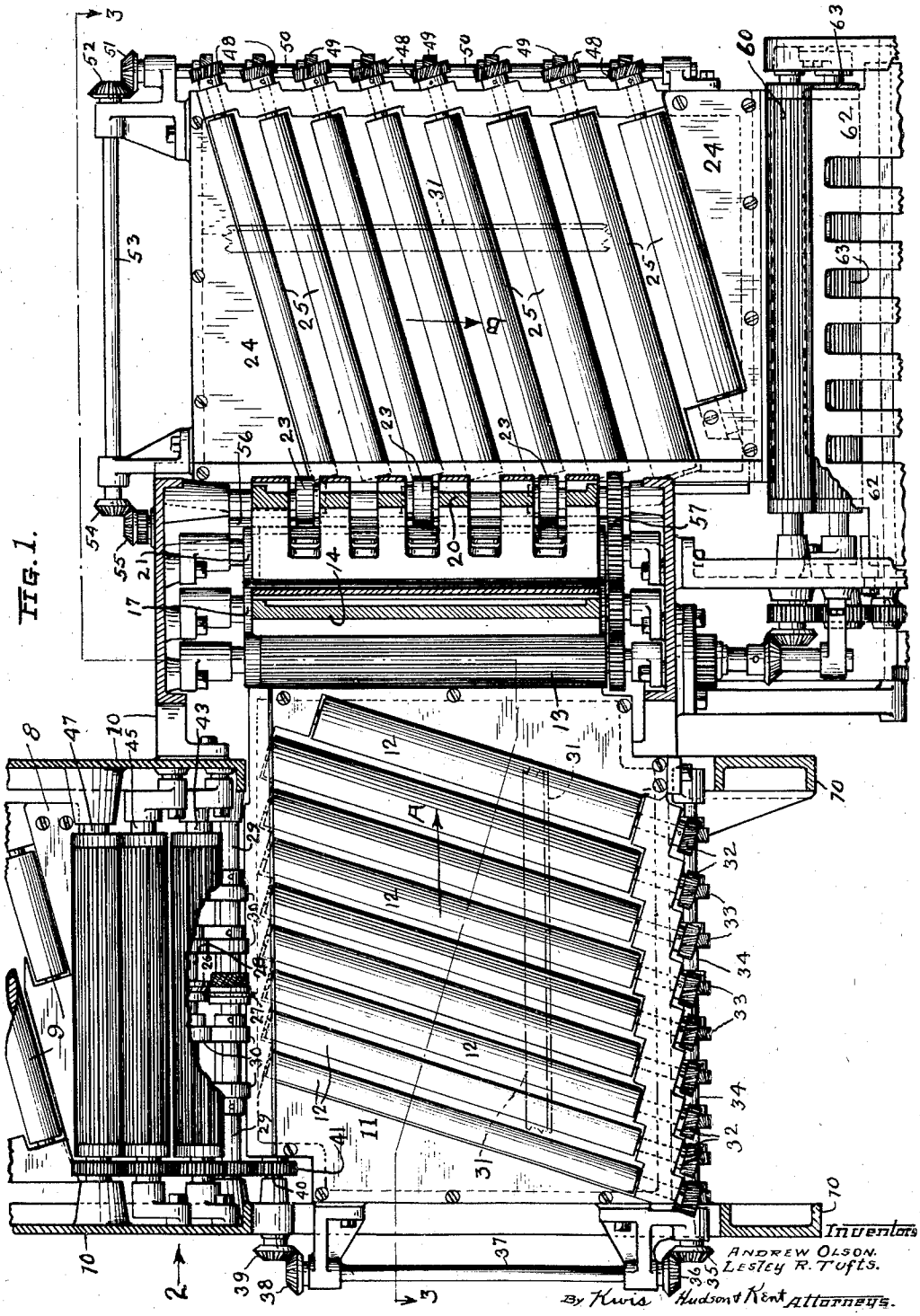


Fig. 1.

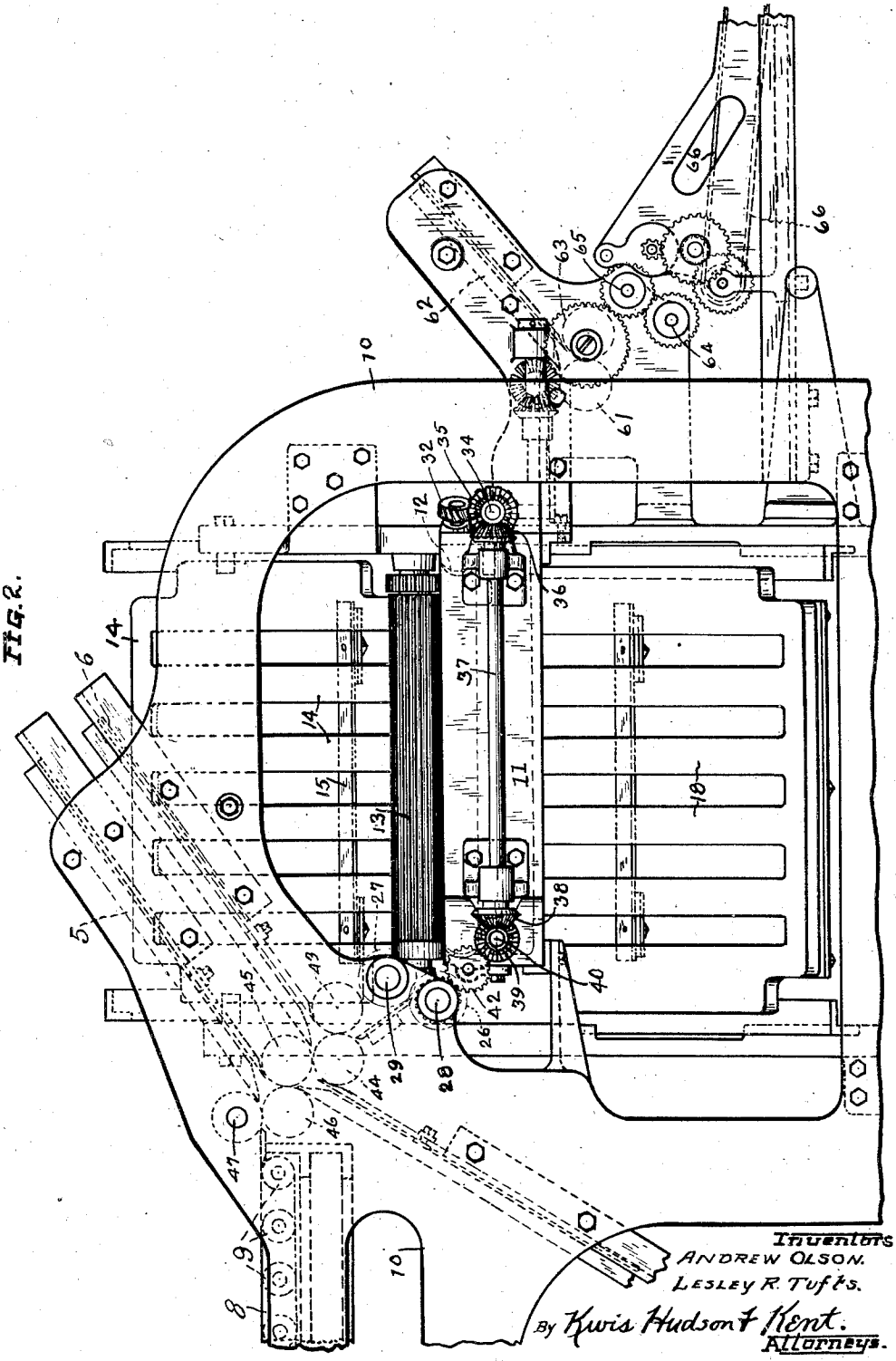
Inventors
Andrew Olson.
Lesley R. Tufts.
By Kwis Hudson & Kent Attorneys.

Jan. 28, 1930. A. OLSON ET AL 1,745,311

PAPER HANDLING MACHINE

Filed April 13, 1927 3 Sheets-Sheet 2

FIG. 2.



Jan. 28, 1930. A. OLSON ET AL 1,745,311

PAPER HANDLING MACHINE

Filed April 13, 1927 3 Sheets-Sheet 3

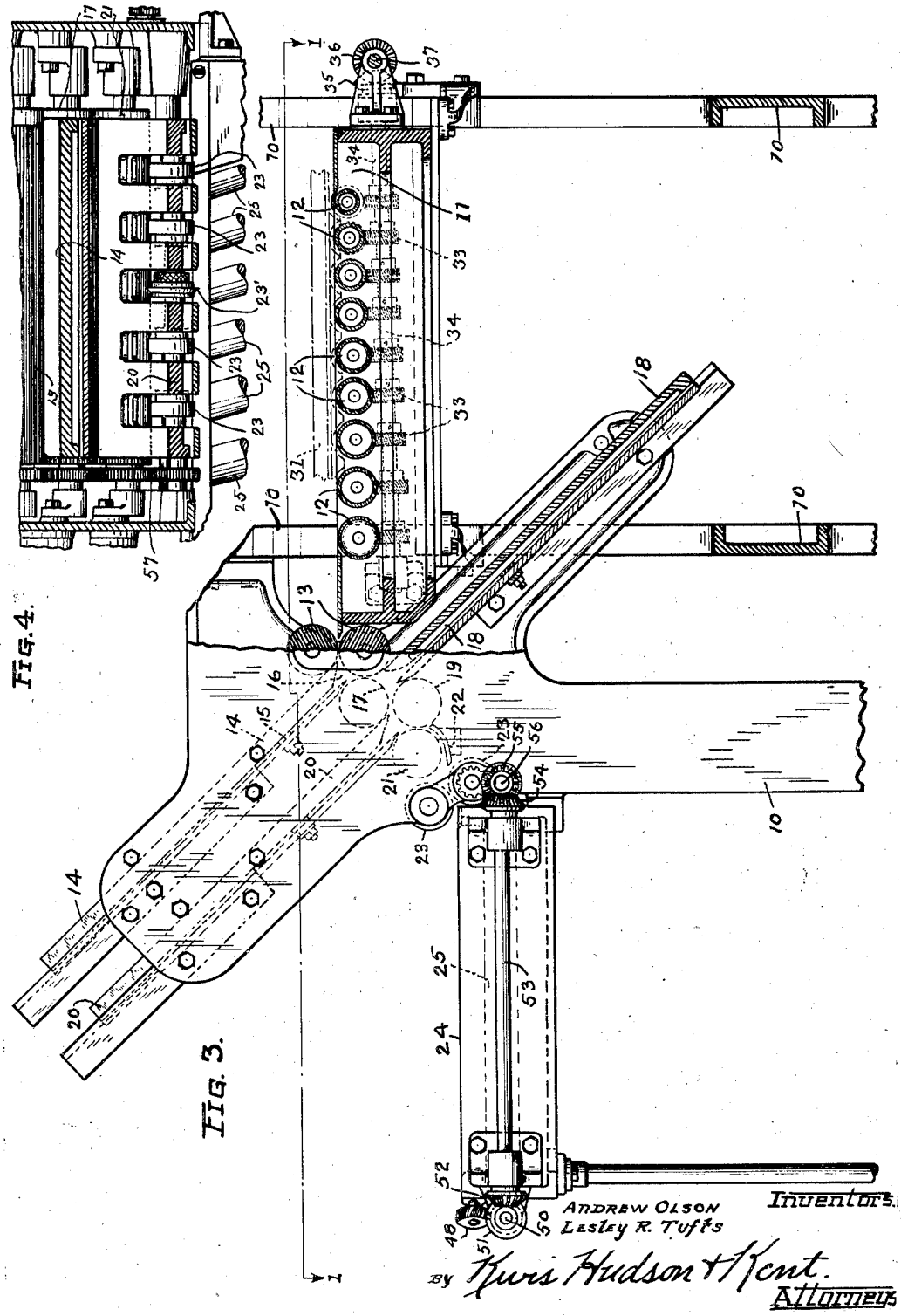


FIG. 4.

FIG. 3.

Inventors.
ANDREW OLSON
LESLEY R. TUFTS
By Kuris Hudson & Kent.
Attorneys

Patented Jan. 28, 1930 1,745,311

# UNITED STATES PATENT OFFICE

ANDREW OLSON, OF CLEVELAND, AND LESLEY R. TUFTS, OF EAST CLEVELAND, OHIO, ASSIGNORS TO THE CLEVELAND FOLDING MACHINE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

## PAPER-HANDLING MACHINE

Application filed April 13, 1927. Serial No. 183,399.

This invention relates to paper handling machinery for transferring sheets of paper to different mechanisms which operate thereon.

While the invention is applicable to paper handling machines in general, it is especially applicable to paper folding machines and will be illustrated and described in that connection.

It is one of the objects of the invention to provide a simple and efficient means for spacing or separating sheets on a feed table so that they will follow into the mechanism which operates on them in proper sequence to avoid interference between successive sheets.

A further object of the invention is the provision of means which shall be inherent in the rollers that form the feed table, for spacing or separating the sheets thereon.

Other objects of the invention and the features of novelty will be apparent from the following description taken in connection with the accompanying drawings of which:

Fig. 1 is a plan view of a portion of a paper folding machine embodying our invention, some of the parts being shown in section substantially upon the line 1—1 of Fig. 3.

Fig. 2 is an end elevation of the machine looking in the direction of the arrow 2 of Fig. 1.

Fig. 3 is an elevational view partly in section on the line 3—3 of Fig. 1.

Fig. 4 is a fragment of Fig. 1 showing a modification whereby the sheets may be cut in two between the first and second cross-carriers.

Referring to the drawings, the portions of the frame of the machine are indicated at 10. A horizontally arranged feed table or cross-carrier 11 is comprised of rollers 12 with their upper surfaces all in the same plane for feeding the sheets of paper. The table 11 may be the delivery table of a feeding mechanism for separating sheets from a pile and forwarding them to the folding or other mechanism which operates on the sheets. In the present illustration of my invention the sheets are delivered by the table 11 to a pair of feed rolls 13 which forward the sheets to the fold plate 14, which is one of the characteristic elements of the well known type of folding machines in which the folding operations are performed by causing the sheet to be buckled. In this type of machine the forward edge of the sheet strikes a stop 15 which is positioned across the slot in the fold plate 14 thereby causing a buckle to form in the sheet in the space 16, this buckle producing a fold which enters between the lower roll 13 and the roll 17, these rolls serving to form the crease in the sheet and to feed it into a second fold plate 18 from which the sheet is carried by roll 17 and the roll 19 into a third fold plate 20. From the latter fold plate the sheet is carried by the roll 19 and the roll 21 which co-operates therewith against a deflecting plate 22 which directs the sheet between the pairs of rolls 23 by which it is delivered onto another table or cross-carrier 24 made up of rollers 25.

It will be understood that in accordance with the usual practice in connection with this type of folding machine any one or more of the fold plates 14, 18 and 20 may be rendered inoperative at will and in accordance with the requirement as to the number and character of the folds that are to be made in the sheets.

It is frequently desirable to cut the sheet in two or more sections either before it has been folded or after it has received the desired number of folds and for this purpose I have shown a pair of cutting disks 26 and 27 on shafts 28 and 29, respectively. During the cutting operation the sheets are held in alignment and fed by rubber wheels or rollers 30 also mounted on the shafts 28 and 29. After the sheet has passed the cutting disks 26 and 27 there are then a plurality of sheets that move forwardly side by side onto the feed table 11, the feed rollers 12 of which are arranged at an angle to the longitudinal axis of the table in accordance with the usual practice.

In order to properly direct and guide the sheets on the feed table, as well as stop their movement transversely of the table as they are fed thereon at right angles to the length of the table, there is provided a stop or guide

bar 31 which may be mounted in any suitable manner to take a direction parallel to the length of the table and which bar is preferably adjustable crosswise. Various means for mounting these stop bars or guides are known in the art, and for the sake of clearness in the drawing I have omitted any illustration of such means herein. The diagonal arrangement of the rollers serves to hold the advancing sheets against the guide.

The means which I employ for separating two or more sheets as they are fed side by side onto one of the feed tables is inherent in the rollers themselves and their movement of rotation. This means consists in imparting to the rollers 12 a surface speed which increases progressively as the delivery or forward end of the table is approached. Although this result is attainable in another manner, as by making all of the rollers of the same diameter and rotating them with varying degrees of speed, I prefer to make the rollers of gradually increasing diameter toward the delivery end of the table and to rotate them at the same speed. To this end the shaft of each roller is extended at one end beyond its bearing and carries on its extremity a spiral gear 32 which meshes with a spiral gear 33 fixed on a shaft 34 arranged at a slight angle to the horizontal, as illustrated in Fig. 3. The gears 32 are all of one size as are also the gears 33, and the centers of the gears 32 are in a line parallel with the axis of the shaft 34. This shaft may be driven in any suitable manner, and herein is shown provided with bevel gear 35 meshing with a bevel gear 36 on a shaft 37 which in turn is driven through a pair of bevel gears 38 and 39, the latter being mounted on a short shaft 40 which carries at its opposite end a spur gear 41 meshing with a spur gear 42, which is one of a train of gears on the shafts 28 and 29 carrying the cutting disks. Any convenient means may be employed for applying power to this train of gears.

In the upper left-hand corner of Fig. 2 we have indicated by dotted lines a series of fold plates and feeding and folding rolls, the rolls being marked 43, 44, 45, 46 and 47 while the fold plates are marked 5, 6 and 7. Paper may be fed into the folding mechanism just described and thence into the machine upon a horizontally arranged feed table 8 comprising feed rolls 9.

The rollers 25 of the feed table 24 are formed similarly to the rollers 12, that is they increase regularly in size from one end of the table to the other, as shown in Fig. 1, and are driven by spiral gears 48 and 49 from a shaft 50, the latter being driven by bevel gears 51, 52 from a shaft 53 and this shaft in turn being driven through bevel gears 54 and 55. Gear 55 is fixed to a shaft 56 which extends through the machine and carries at its opposite end one of a train of gears 57 to which power may be applied in any convenient manner.

From the foregoing, it will be understood that the sheets which have been delivered onto the table 11 in side by side arrangement will be moved longitudinally of the table in single file arrangement in the direction indicated by the arrow A of Fig. 1, being guided in that movement by the stop bar 31, and on account of the higher surface speed of the rollers under the forward sheet the motion of that sheet will be accelerated more than the motion of the sheet or sheets in the rear. Consequently, the sheets will be separated sufficiently to permit each sheet to be acted upon by the folding rolls and plates at the forward end of the table wthout interference from the next succeeding sheet. In this way is avoided the objectionable folding of one sheet into another. The folded sheets are delivered upon the table 24 and then have imparted to them motion in the direction of arrow B in precisely the same manner as previously described in connection with table 11. From table 24 the sheets may enter a further folding mechanism including rolls 60 and 61, fold plate 62 and folding rolls 61, 63, and may then be guided downwardly between rolls 64 and 65 and out onto an endless belt carrier 66, or the folding mechanism at this point may be omitted or the fold plates moved out of the way so that the sheets can be delivered directly onto the carrier 66.

Referring to Fig. 4, it will be seen that a pair of cooperating cutter disks 23′ are arranged on the shafts which carry the rolls 23 so that the folded sheet may be cut into sections as it is delivered onto cross-carrier 24. The disks 23′ cut the sheet in a direction at right angles to the cut made by the disks 26, 27 and may be used in conjunction with the latter when so desired, or independently. The rolls 25 insure the separation of the sheets on the table 24 so that they will not interfere with one another in the subsequent folding operations which are performed after leaving the table 24.

While the employment of the invention described herein is particularly desirable where two or more sheets are fed onto the table in side by side relation, as for instance, in the case of table 11 to which the sheets are fed after being cut into sections by the cutter disks 26 and 27, still it has advantage also where sheets are fed onto a table singly because it helps to get a sheet out of the way quickly and before the next one is fed down on top of the first, and even if two sheets do overlap for a brief instant the more rapid acceleration of the one in the lead separates them.

It is, of course, desirable to operate these machines at their maximum capacity and, heretofore, it has been necessary to increase the speed of each cross-carrier about fifty

per cent over that of the next preceding cross-carrier in order to avoid interference between sheets in the fold plates but, there are practical limits to the velocity of the sheets through the fold plates as well as to the speed at which rolls of the cross-carriers may be successfully operated and, hence, it has heretofore been found impracticable to successfully fold the sheets in the third folding section of the machine represented by the fold plate 62, when a plurality of sheets were simultaneously delivered onto the table 11 and the latter was run at its maximum speed, because of interference between the sheets on the table 24. However, our invention, through the separation of the sheets on the table 11, as above described, has made it possible to employ said third folding section and still operate the table 11 at its maximum speed because, having separated the sheets on table 11, the speed of the table 24 does not have to be greater than that of the table 11 and we have found that it may be even less than that of table 11 due to the reduction of the size of the paper sections by the operation of the second folding section of the machine. The use of our invention in the table 24 permits the use of the cutters 23′ by virtue of the fact that the sheets will then be separated on the table 24 and the cut sections of the sheet will then not interfere in said third folding section of the machine.

By means of our invention it is, therefore, now possible to utilize three successive right angularly arranged folding sections and to cut the sheet between the first and second folding sections and/or between the second and third folding sections and to have all of the parts or sections of the original sheet folded by the same folding mechanisms and still operate the first folding section or mechanism at its maximum speed.

We claim as our invention:

1. In a paper handling machine, the combination with a feed table comprising sheet moving means, means for feeding a plurality of sheets simultaneously onto said table transversely of the direction of movement given to the sheets by said sheet moving means, a stop for interrupting such transverse movement of the sheets, said sheet moving means comprising a series of rollers, the rollers at one end of the table having greater diameters than those at the the other end thereof, whereby the acceleration of one of said sheets upon said table is more rapid than that of the other sheet.

2. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table to which said sheets are delivered by said means, feeding means for moving said sheets longitudinally of said table in single file arrangement comprising a series of rollers the rollers at one end of the table having greater diameters than those at the other end thereof, whereby the acceleration of one of said sheets upon said table is more rapid than that of the other.

3. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feeding table to which said sheets are delivered by said means, a feeding means for moving said sheets longitudinally on said table comprising a series of rollers, means for driving said rollers all in the same direction, the surface speed of the rollers at one end of the table being greater than that of the rollers at the other end thereof, whereby the acceleration of one of said sheets upon said table is more rapid than that of the other.

4. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table to which said sheets are delivered by said means comprising a plurality of rollers for moving the sheets on said table at right angles to the direction in which the sheets move in being delivered to said table, a stop for the sheets arranged longitudinally of said table adapted to guide the sheets in their movement longitudinally thereof, means for driving said rollers all in one direction, the surface speed of the said rollers increasing from one end of the table towards the other to give to the leading sheet on the table an initial movement that will separate the leading sheet from the sheet following it.

5. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table arranged transversely to the direction of movement of sheets on said feeding means, said table comprising a series of rollers with their upper surfaces in a common plane, means for rotating said rollers, the surface speeds of the rollers increasing toward the delivery end of the table, whereby the sheets fed upon the table are separated due to the difference in their accelerations.

6. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table arranged transversely to the direction of movement of the sheets on said feeding means, said table comprising a series of rollers with their upper surfaces in a common plane, said rollers at the delivery end of the table being of greater diameter than those at the receiving end thereof, whereby the sheets fed upon the table are separated due to the difference in their accelerations.

7. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table arranged transversely to the direction of movement of the sheets on said feeding means, said table comprising a series of rollers diagonally arranged with their upper sur-

faces in a common plane, and means for rotating said rollers, the surface speeds of the rollers increasing toward the delivery end of the table, whereby the sheets fed upon the table are separated due to the difference in their accelerations.

8. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table arranged transversely to the direction of movement of the sheets on said feeding means, said table comprising a series of rotating rollers with their upper surfaces in a common plane, and means inherent in the rollers themselves and their rotation for spacing said sheets so that they will be separated as they leave the delivery end of the table.

9. In a paper handling machine, the combination with means for feeding a plurality of sheets in side by side arrangement, a feed table arranged transversely to the direction of movement of the sheets on said feeding means, said table comprising a series of rollers with their upper surfaces in a common plane, a stop for the sheets arranged longitudinally of said table for guiding the sheets in their movement longitudinally thereof, said rollers being arranged diagonally with respect to said stop whereby the sheets are held against the stop and guided thereby, and means inherent in the rollers themselves and their rotation for spacing said sheets so that they will be separated as they leave the delivery end of the table.

10. In a paper handling machine, a feed table, means for delivering sheets onto said table from a position to one side thereof, said table comprising a series of rotating rollers with their upper surfaces in a common plane, and means inherent in the rollers themselves and their rotation for imparting greater acceleration to a sheet near the delivery end of the table than to one near the receiving end thereof.

11. In a paper handling machine, a feed table, means for delivering sheets onto said table from a position to one side thereof, said table comprising a series of rotating rollers with their upper surfaces in a common plane, and means for rotating said rollers, the surface speeds thereof being greater towards the delivery end of the table, whereby greater acceleration is imparted to a sheet near the delivery end of the table than to one near the receiving end thereof.

12. In paper handling machines, the combination of a feed table, means for delivering a plurality of sheets onto said table simultaneously, and means for starting the movement of said sheets longitudinally of said table at different rates of acceleration.

13. In a paper handling machine, the combination of a first and a second cross-carrier, said first cross-carrier being adapted to deliver sheets to a sheet feeding and slitting mechanism, said second carrier being adapted to receive the sections of said sheets from said feeding and slitting mechanism, said second cross carrier being adapted to effect the separation of said sections as they move longitudinally thereupon.

14. In a paper handling machine, the combination of a first and a second cross-carrier, said first cross-carrier being adapted to receive sheets from a sheet feeding and slitting mechanism and to deliver said sheets single file to a second sheet feeding and slitting mechanism, said second carrier being adapted to receive the sections of said sheets from said second sheet feeding and slitting mechanism, both of said cross-carriers being adapted to effect the separation of the sheets or sections as they move longitudinally thereupon.

15. In a paper handling machine embodying feed rolls and means for cutting a sheet into sections as it passes through said feed rolls, the combination of a table onto which said sections are fed in side by side relation, and means for starting the movement of said sheets longitudinally of the table at different rates of acceleration.

In testimony whereof, we hereunto affix our signatures.

ANDREW OLSON.
LESLEY R. TUFTS.