

Nov. 20, 1951

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2,576,013

SHEET DELIVERY AND STACKING

Filed Oct. 15, 1949

4 Sheets-Sheet 1

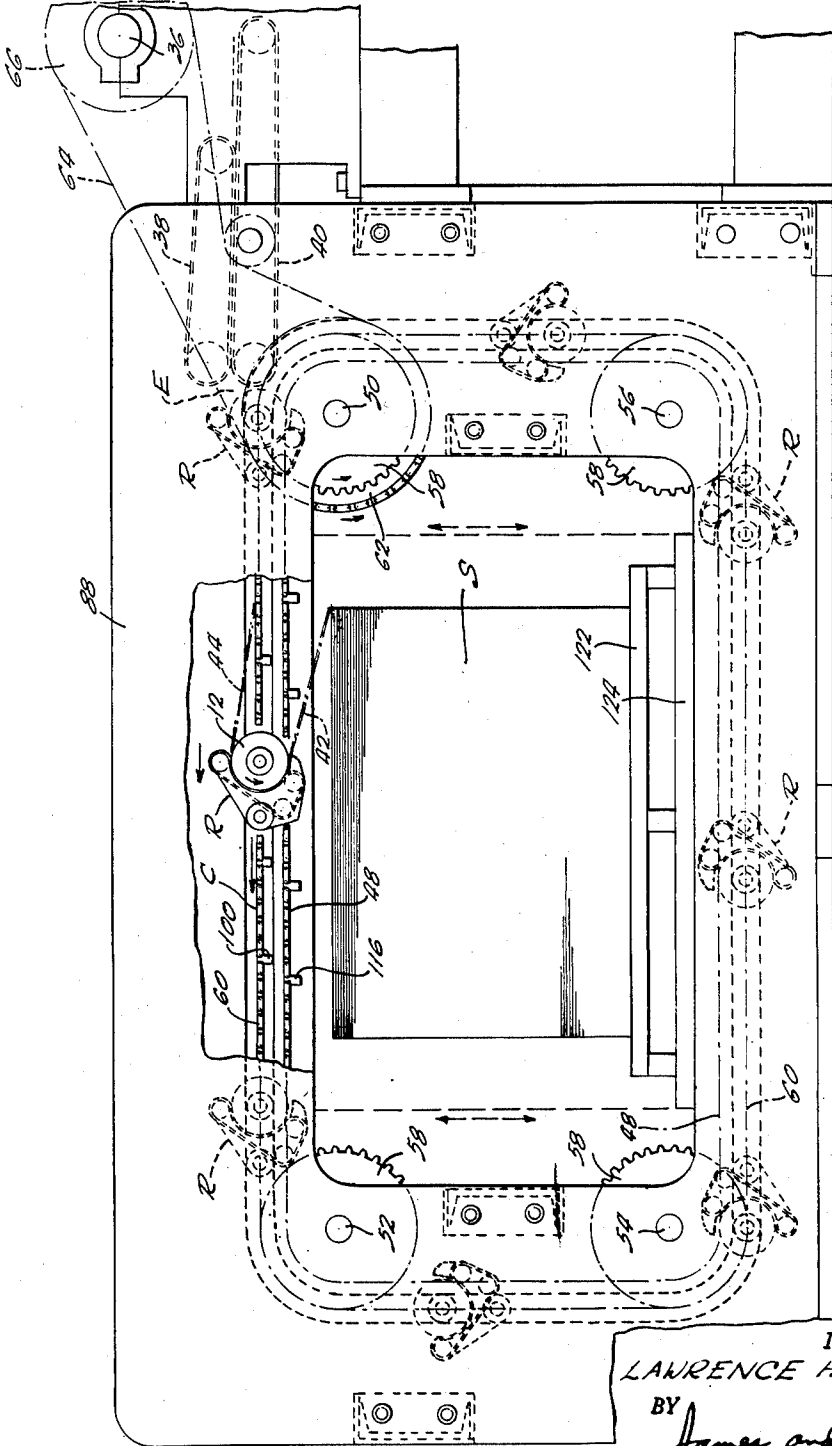


FIG. 1

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4 Sheets-Sheet 2

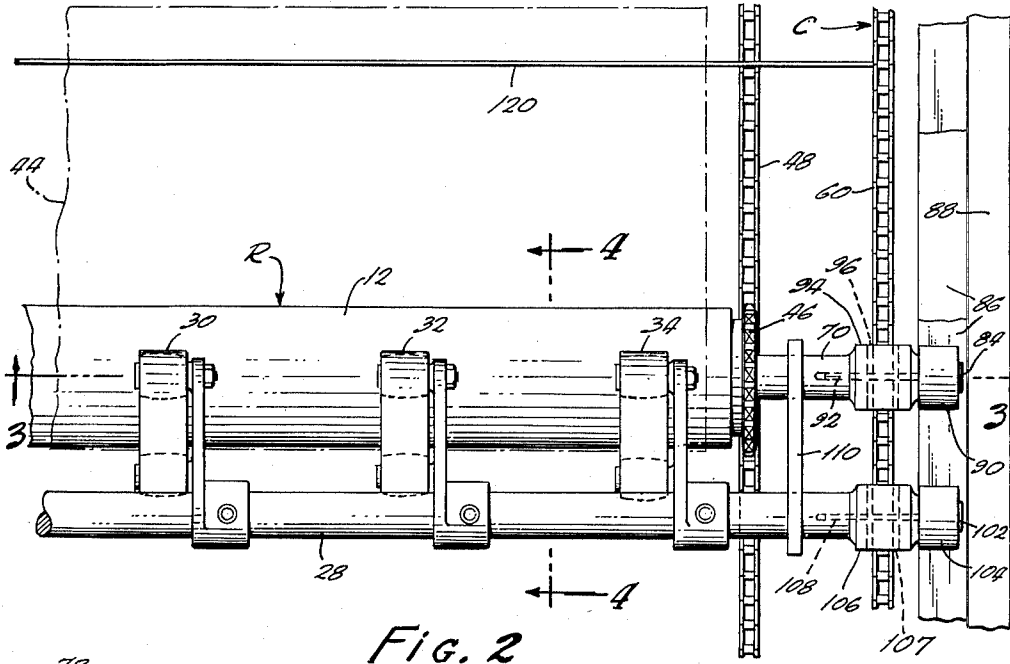


FIG. 2

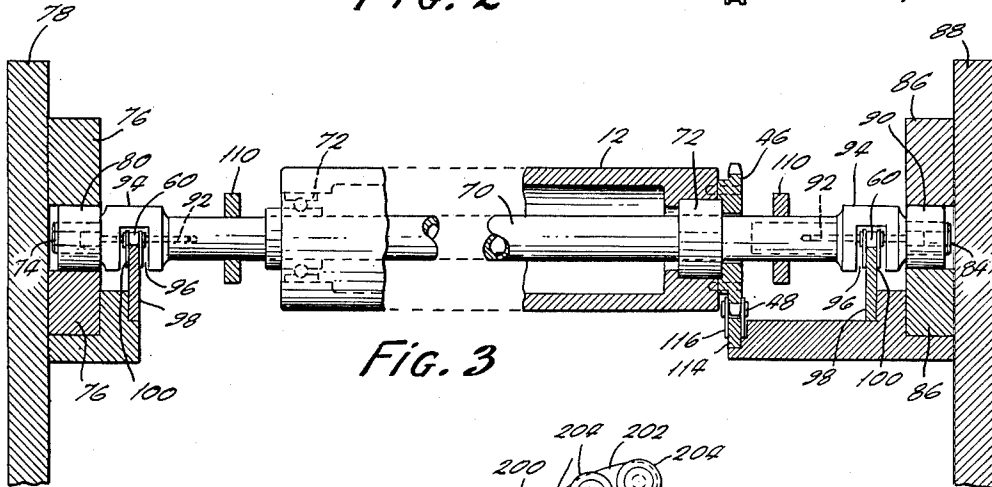


FIG. 3

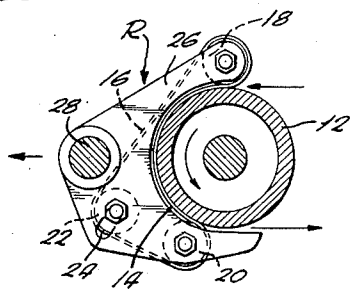


FIG. 4

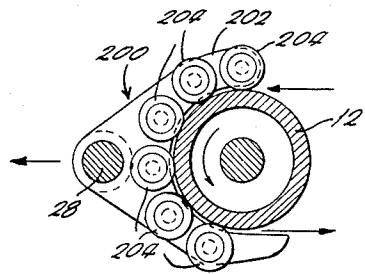


FIG. 5

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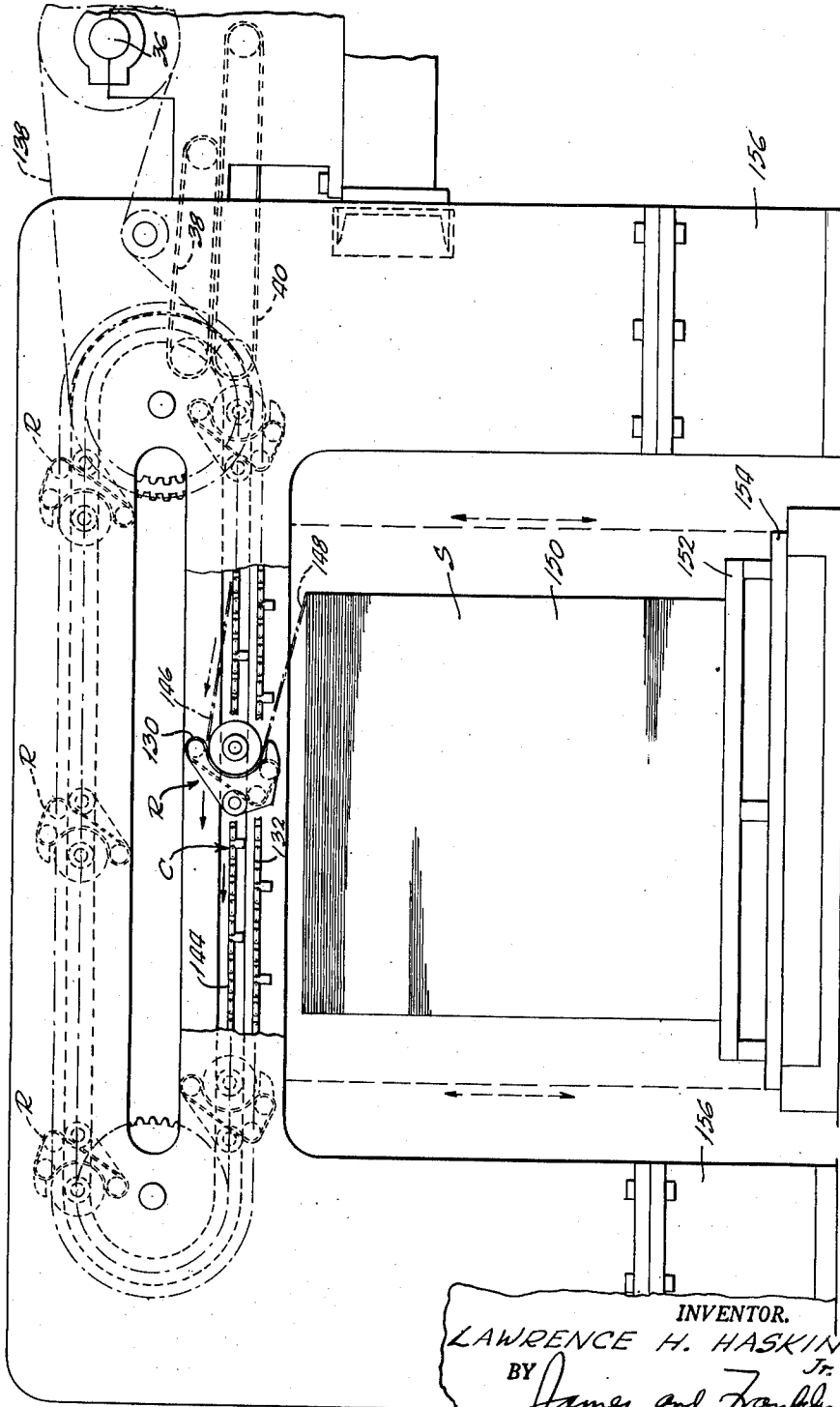
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4 Sheets-Sheet 3

FIG. 6



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4 Sheets-Sheet 4

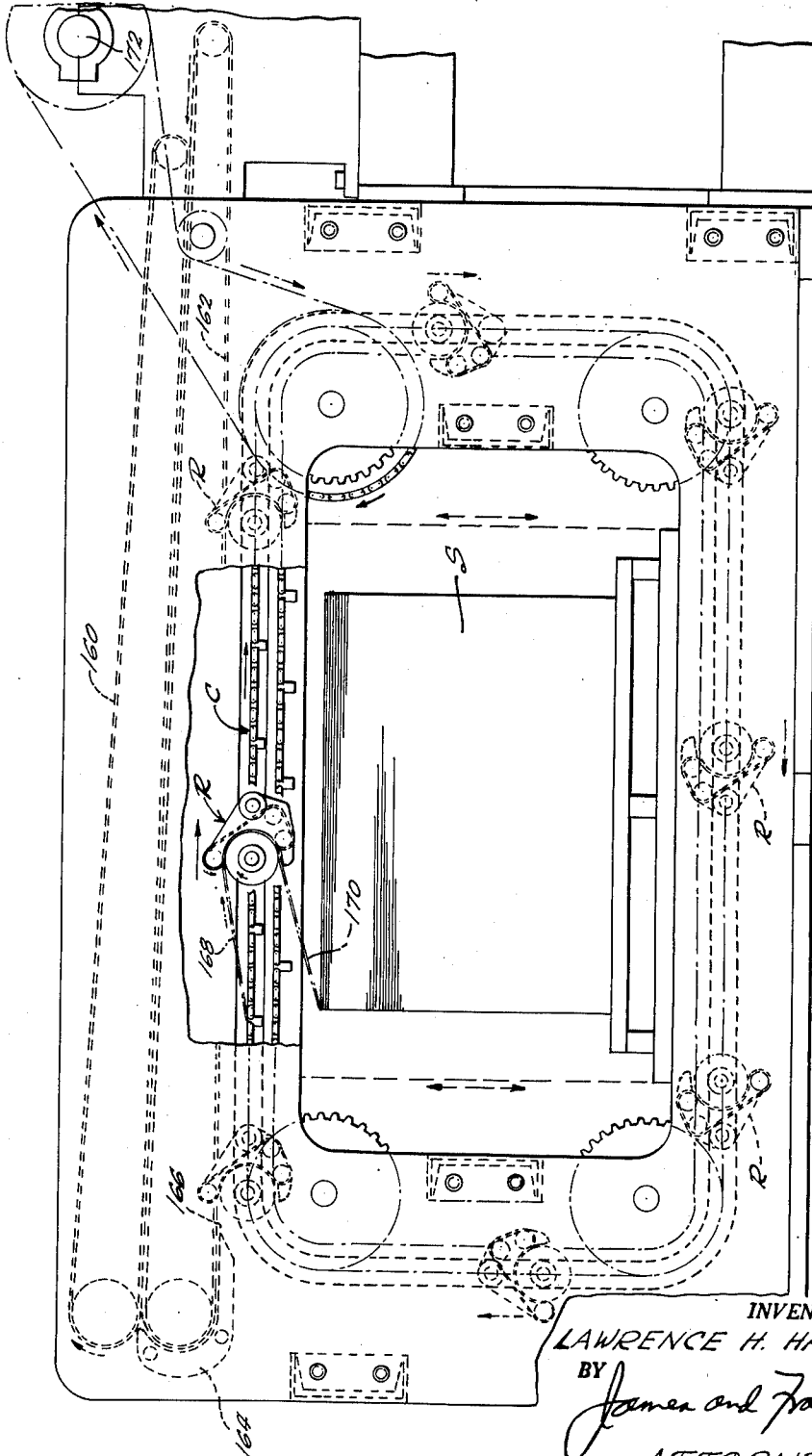


FIG. 7

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SHEET DELIVERY AND STACKING

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Application October 15, 1949, Serial No. 121,500

34 Claims. (Cl. 271—68)

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This invention relates to the delivery and stacking of sheets, particularly at high speed.

The primary object of the invention is to generally improve sheet stacking apparatus. Printing is usually performed on a continuous web of paper which is then severed by a rotary shear or other suitable cutting device, and the severed sheets are speeded up to provide a gap or space between the successive sheets. In ordinary stacking apparatus the moving sheets are brought against stationary stops which, of course, tend to crumple the leading edge of the sheet. The difficulty has become more pronounced at modern high speeds of printing.

In accordance with the present invention, the velocity of the moving sheet is reduced to any desired small value, and preferably to zero velocity, so that the sheets may be laid down in stationary condition, instead of being delivered at high speed against a stop. For this purpose the stacking apparatus comprises a reverse means to receive and feed a moving sheet in reverse direction, and carrier means to bodily move the reverse means in the direction of the initially received moving sheet. In this way the absolute velocity of the leading edge of the sheet is reduced to the difference between the feed speed of the reverse means and the speed of the carrier means. By making these speeds equal the velocity of the sheet may be changed to zero. Moreover, the speed at which the sheet is fed to the reverse means may be made equal to the sum of the feed speed and the carrier speed, so that the sheet will be neither accelerated or decelerated when its forward edge hits the reverse means.

Another object of the invention is to provide improved and effective mechanical apparatus for effectuating the general object of the invention. Still another object is to provide variant forms of the apparatus for stacking sheets within the apparatus, or for stacking sheets beneath the apparatus, and for stacking the sheets either face downward or face upward.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the stacking elements, and their relation one to another as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings, in which:

Fig. 1 is a side elevation of a stacking apparatus embodying the features of my invention;

Fig. 2 is a fragmentary plan view of one of the reverse feed units employed in the apparatus of Fig. 1;

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Fig. 3 is a section taken in elevation approximately in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a transverse section taken approximately in the plane of the line 4—4 of Fig. 2;

Fig. 5 is a section similar to Fig. 4 but showing a modified guide means around the reverse feed roller;

Fig. 6 is a side elevation of a modified form of the apparatus in which the sheets are stacked below the apparatus; and

Fig. 7 is a side elevation of a modified form of the apparatus in which the sheets are stacked face upward.

Referring to the drawing, and more particularly to Fig. 1, the sheet stacking apparatus comprises reverse means R to receive and feed a moving sheet in reverse direction, and carrier means C to bodily move the reverse means R in the direction of motion of the received sheets, which, in the present case, is from right to left. Thus the velocity of the leading edge of the sheet is reduced to the difference between the feed speed of the reverse means R and the speed of the carrier C, and by making these speeds equal the sheet may be reduced to zero velocity, and thus deposited on a stationary stack S.

Referring now to Fig. 4 of the drawing, the reverse means R preferably comprises a roller 12 with a guide means 14 encompassing nearly half its circumference. The guide means is a small endless belt 16 extending around idlers 18 and 20, the part 14 of the belt being bent around and conforming to the roller 12. A tensioning idler 22 may be provided, said idler being adjustable in a slot 24 to permit the belt 16 to be tightened to desired tension. The idlers are carried on a suitable generally U-shaped support 26, which is itself carried on a support shaft 28 extending collaterally of the roller 12. Referring to Fig. 2, it will be seen that the complete guide means comprises a series of such small endless belt units 30, 32, 34, etc. (in this case six such units), spaced axially along the roller 12, the said units being carried on the support shaft 28 previously referred to.

Reverting now to Fig. 1, the sheets are presumed to come from a rotary shear, a main shaft of which is indicated at 36. The freshly severed sheets are delivered between suitable conventional upper and lower speed-up belts 38 and 40. These deliver the speeded-up sheets at a height corresponding to the entrant point of the reverse means, or, in other words, just before or at the point E. The speed of the carrier, and therefore the bodily movement of the reverse means, is preferably made about one-half that

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of the belts 38, 40 and the moving sheets. The peripheral speed of the roller 12 is preferably made equal to the carrier speed. Referring then to a sheet being deposited as indicated at 42, 44, it will be seen that the effective speed at which the top portion 44 of the sheet is traveling is equal to the sum of the roller and carrier speeds, and is therefore equal to the velocity of the sheet as delivered by the speed-up belts 38, 40. On the other hand, the effective or absolute speed of the lower part 42 of the sheet is equal to the difference between the roller speed and the carrier speed, which is zero, so that the sheet is laid down on the stack in a stationary condition.

The manner in which the rollers 12 are rotated at desired speed may be described with reference to Figs. 2 and 3 of the drawing. Each roller is provided at one end with a sprocket gear 46 for driving the roller. A stationary sprocket chain 48 is mounted on the apparatus and follows the path of travel of the rollers. Thus the travel of the roller and sprocket gear causes rotation of the sprocket gear. Moreover, the pitch diameter of the sprocket gear is preferably made exactly equal to the diameter of the roller, so that the peripheral speed of the roller is equal to the travel speed of the roller. Thus the arrangement is not only a rather simple and convenient way to produce the desired rotation of all of the rollers as they travel, but also insures that the desired equality of the peripheral and travel speeds will be maintained despite any accidental variation or intentional change in the travel speed.

The carrier means C preferably comprises a pair of endless chains spaced apart at the sides of the apparatus. Referring to Fig. 1, there are four shafts 50, 52, 54 and 56, which are preferably located at the corners of a rectangle. Each shaft carries two relatively large diameter sprocket gears, the nearer ones of which are indicated at 58. An endless sprocket chain 60 runs about the sprocket gears 58, and a similar sprocket chain runs about the remote sprocket gears at the opposite side of the apparatus. One of the shafts is driven, and in the present case it is the shaft 50 which is driven by a sprocket gear 62 and a drive chain 64 connected to a gear 66 on shaft 36 of the rotary shear previously referred to. Some form of positive drive is preferably provided in order to insure synchronism between the delivery of the sheets, and the presentation of the successive reversing means or rollers R for reception of the delivered sheets. It is assumed that shaft 36 rotates in the same direction as shaft 50, but if not, a pair of direction reversing spur gears may be interposed at any convenient point.

Referring now to Figs. 2 and 3 of the drawing, the roller 12 is rotatably carried on a stationary shaft 70. Anti-friction bearings may be employed between the roller and the shaft, as is indicated at 72. The ends of the shaft 70 are preferably positively guided between suitable guide rails. In the present case the end 74 is received between the stationary guide rails 76, which in turn are fixed on one of the side frame plates 78 of the apparatus. An anti-friction bearing 80 may be disposed between the shaft end 74 and the guide rails 76. A similar construction is employed at the opposite end, the shaft end 84 being received between stationary guide rails 86 fixedly mounted on side plate 88 of the machine, and an anti-friction bearing 90

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preferably being disposed between the shaft end and the rails 86.

The carrier chains 60 are preferably roller chains, and have pins 92 which replace some of the regular pins of the roller chains, the said pins being received in the shaft 70 at the centerline of the shaft. Thus the movement of the chain is applied at the axis, and does not tend to rotate the shaft. The shaft has enlarged portions 94 which are cut away at 96 to clear the chains 60. The chains may be additionally guided by stationary guide rails 98 on which the chains run. At intervals the links of the chains are provided with guide tabs 100, and these are disposed on opposite sides of the rails 98 and so hold the chains against sideward displacement.

Referring now to Fig. 2, the support shaft 28 for the guide belt units 30, 32 is similarly carried by the carrier chains 60. The end 102 of shaft 28 is guided between the rails 86 previously mentioned, and may similarly be provided with an anti-friction bearing 104. The shaft 28 is similarly enlarged at 106 and cut away at 107 to clear the chain, in order that the shaft may be connected to the chain by means of a connecting pin 108 located on the axis of the shaft, so that there is no tendency to turn the shaft as it is propelled by the chain. The other end of shaft 28 is similarly guided and carried.

The spacing between the shafts 28 and 70 may be determined not only by the chains, but additionally and more precisely by means of special spacing bars or links 110. Thus the complete sheet reversing mechanism constitutes a single unit, moved by the chains.

In Fig. 3 it will be noted that the support 112 for the stationary guide rail 98 is preferably projected inward and serves also to support a guide rail 114 on which the stationary chain 48 is carried. The chain 48 also is provided with side tabs 116. This is convenient in that it standardizes the chain employed, whether moving or stationary.

In Fig. 2 attention is directed to the slender cross wire 120. There are several, say three, such wires which are stretched at intervals between the chains 60 behind each of the rollers 12. The wires 120 are not essential, but they are convenient when handling long sheets, for they help support the long trailing end of the sheet as it is being fed about the roller.

In Fig. 1 it will be seen that the side plates of the machine are cut away within the chains to expose the stack S. The sheets may be stacked and jogged in any conventional manner. In the present case vertical guides and jogging means have been omitted in order not to complicate the drawing. In accordance with one common practice the sheets may be deposited on a suitable pallet 122 resting on a table 124. The table 124 may be an elevator table arranged for vertical movement, it being lowered gradually as the stack of sheets grows in height. When it reaches the lowermost position shown, the stack is removed, as by means of a fork lift truck, the fork of which is inserted beneath the pallet 122, following which a new pallet is placed on the table and the table is raised in order to begin the piling of a new stack of sheets.

In the arrangement shown in Fig. 1 the height of the stack is limited because the stack and stacking apparatus must fit between the upper and lower parts of the carrier mechanism. Of course, the height of the apparatus may be in-

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creased by raising the upper or working part of the carrier mechanism, but in such case the speed-up belts 38, 40 may have to be inclined upward and consequently lengthened, which in turn would increase the floor space needed. In Fig. 6 I show a modification of the apparatus in which the return path of the carrier chain is disposed above instead of below the work path of the carrier chains, so that the stack is disposed entirely beneath the apparatus. In most cases this has the advantage of substantially increasing the maximum height of stack, and in all cases has the advantage of making the height flexible, it depending solely on the legs or supports 156, which may be varied as needed. Moreover, the sides of the apparatus are cleared for handling the stack, whether manually or by means of a fork lift truck, etc.

Referring to Fig. 6 of the drawing, it will be seen that the apparatus is substantially the same as that previously described, except that the orientation of the guide belt units 130, and the location of the stationary chain 132 have been appropriately modified to feed the sheets in proper direction. As before, power is taken from the main shaft 36 of a rotary shear which severs the sheets and delivers the same to speed-up belts 38 and 40. The gearing between the shearing and stacking machines may include not only sprocket gears 134, 136 and sprocket chain 138, but also direction reversing gears, if needed to move the carrier chains 144 in desired direction. This depends on the direction of rotation of shaft 36. The stationary chain 132 extends parallel to the carrier chains 144, but in the present case is located outside of rather than within the carrier chains. It will be observed that a sheet 146, 148 being deposited on the stack 150 is treated the same as before, that is, the upper part 146 is moved at a velocity equal to the sum of the travel and peripheral speeds of the roller, while the lower portion 148 is deposited at a velocity equal to the difference between these speeds, which is preferably zero velocity. As before, vertical guides or/and joggling means for the stack have been omitted. As before, the stack is indicated to be deposited on a suitable pallet 152, which in turn may rest on an elevator table 154, here shown in lowermost position. It will be evident that with this arrangement any desired height of stack may be provided without changing the stacking apparatus itself, it being merely necessary to lengthen the support legs 156, or to rest the same on raised supports, in which case the height to which any one stack may be piled may be increased indefinitely.

It will be understood that in this form of the apparatus, compared to that shown in Fig. 1, the vertical legs of the generally rectangular carrier chains shown in Fig. 1 may be shortened, and in ultimate form only two shafts are needed as shown in Fig. 6, the guide sprockets for the chains having a radius sufficiently large to clear the reverse feed units as they travel with the carrier chains.

The apparatus as so far described inverts the sheets, that is, they are deposited face-downward compared to the position in which they are initially received. In some cases it may be important to deposit the sheets face-upward. This desired result is readily accomplished by so feeding the sheets to the apparatus as to preliminarily invert the same, that is, the sheets are fed to the apparatus face-downward, and the apparatus deposits the sheets face-upward.

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An apparatus for this purpose is shown in Fig. 7. The arrangement is similar to that shown in Fig. 1, except that the conveyor belts 160 and 162 extend over the top of the stacking apparatus, and transfer the sheets to its far end. There a guide 164 is provided which turns the sheets downwardly and feeds the same reversely into the stacking apparatus at the point 166. A sheet in the process of being stacked is illustrated at 168, 170, the part 168 being received at full velocity, and the part 170 being deposited at zero velocity. It will be evident without further explanation that the sheets on the stack S are face-upward relative to the sheets as initially delivered from any preceding apparatus, such as the rotary shear 172. Here again the drive from shaft 172 should include direction reversing gears where necessary.

It will be understood that the features shown in Figs. 6 and 7 may, if desired, be combined. More specifically, a pair of transfer belts like the belts 160 and 162 shown in Fig. 7 may be disposed to overlie the apparatus shown in Fig. 6. The reverse feed means 164 shown in Fig. 7 is modified by using the upper belt and an inside guide to feed the sheet downwardly and inwardly around the end of the carrier chain apparatus shown in Fig. 6. The sheet is then fed into the carrier chain apparatus at the left with the sheets face-downward. The sheets will be deposited face-upward, as was described in connection with Fig. 7. The stack may in such case be of indefinite height, depending on the height to which the belts and stacking machine are elevated.

It will be understood that the reversing units are spaced about the carrier chain an amount which depends on the maximum length of sheet to be accommodated. If the maximum length sheet is provided for, shorter sheets may also be handled. However, the physical spacing between reversing units need not be as great as the maximum length of sheet. It may be substantially less, for each sheet is being fed around the reverse unit as the next unit comes into position to receive the next sheet. In strict theory the spacing between reverse units might be made as little as one-half the maximum length of sheet, but in practice it is better to provide a somewhat greater spacing. Short or long sheets assume the speed of the speed-up belts when the sheet has been cut off from the web.

The fundamental thing of importance in respect to the speed of movement of the carrier chains is that one roller unit should be presented at the intake end of the stacking apparatus for each sheet fed to the stacking apparatus. For simplicity the carrier chains are preferably moved continuously at a uniform speed. The spacing between rollers may be equal to the length of a medium length sheet, for as mentioned the maximum length sheet may theoretically be twice the spacing between rollers, due to the cumulative feed action of the roller and the carrier chains.

The spacing between the nearer edge of the stack and the inlet point of the stacking apparatus, corresponds to the circumference of the roller, and is independent of the length of the sheet. It is also independent of the spacing between successive rollers on the carrier chains.

It is believed that the construction and operation, as well as the advantages, of my improved stacking apparatus will be apparent from the foregoing detailed description thereof. The sheets are received at full velocity yet are de-

posited at zero velocity. This abrupt change in velocity is obtained without physically arresting the sheets or in any way abusing or damaging the same. The conversion from full velocity to zero velocity may be obtained regardless of how high the initial velocity of the sheet may be. The apparatus is therefore well adapted for high speed stacking.

The guide means for guiding the sheet about the roller may be modified to employ a series of small idlers instead of a belt. This is illustrated in Fig. 5, referring to which it will be seen that the roller 12 has nearly half its circumference encompassed by guide units 200 mounted in spaced relation on the support shaft 28. Each unit includes a generally U-shaped support 202 carrying a series of small rollers 204. These are located sufficiently closely together to successfully guide the sheet around the roller 12, thereby dispensing with the need for the belt. It will be understood that the roller unit shown in Fig. 5 may be employed in any of the forms of the invention shown in Figs. 1, 6 and 7.

In Fig. 1 the sprocket gear 46 at the end of each roller is maintained in mesh with the stationary chain 48 throughout the travel of the roller. The same applies to Figs. 6 and 7. However, the stationary chain is essential only along the delivery path, which in Figs. 1 and 7 is the upper part of the endless carrier, and in Fig. 6 is the lower part. It is preferred to maintain the stationary chain entirely around the apparatus in order to eliminate wear which might take place when the sprocket gears engage the stationary chain if only a limited section of stationary chain were employed, and to avoid any difficulty from inertia or the need to speed up the roller and belts after letting them slow down if a continuous stationary chain were not employed.

It will therefore be apparent that while I have shown and described my invention in several preferred forms, changes may be made in the structures shown, without departing from the spirit of the invention as sought to be defined in the following claims.

I claim:

1. Sheet stacking apparatus comprising reverse means to receive and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said reverse means at a uniform speed to cause said reverse means to travel in the direction of the initially received moving sheet, whereby the velocity of the sheet is reduced to the difference between the feed speed of the reverse means and the speed of the carrier means.

2. Sheet stacking apparatus comprising reverse means to receive and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said reverse means at a uniform speed to cause said reverse means to travel in the direction of the initially received moving sheet, whereby the velocity of the sheet is reduced to the difference between the feed speed of the reverse means and the speed of the carrier means, said speeds being made equal to one another, whereby the sheet is reduced to zero velocity.

3. Sheet stacking apparatus comprising reverse means to receive and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said reverse means at a uniform speed to cause said reverse means to travel in the direction of the initially received moving sheet,

whereby the velocity of the sheet is reduced to the difference between the feed speed of the reverse means and the speed of the carrier means, said speeds each being made equal to one another and approximately one-half the initial velocity of the received sheet, whereby the velocity of the sheet is changed from initial velocity to zero.

4. Sheet stacking apparatus comprising a roller with guide means encompassing about half the circumference of the roller in order to receive, bend and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said roller and associated guide means at a uniform speed in the direction of movement of the received sheet, whereby the sheet speed is reduced to the difference between the peripheral speed of the roller and the travel speed of the roller.

5. Sheet stacking apparatus comprising a roller with guide means encompassing about half the circumference of the roller in order to receive, bend and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said roller and associated guide means at a uniform speed in the direction of movement of the received sheet, whereby the sheet speed is reduced to the difference between the peripheral speed of the roller and the travel speed of the roller, said speeds being equal so that the sheet is reduced to zero velocity.

6. Sheet stacking apparatus comprising a roller with guide means encompassing about half the circumference of the roller in order to receive, bend and feed a moving sheet in reverse direction relative to the initial direction of motion of the sheet, and endless carrier means to bodily move said roller and associated guide means at a uniform speed in the direction of movement of the received sheet, whereby the sheet speed is reduced to the difference between the peripheral speed of the roller and the travel speed of the roller, said speeds being equal so that the sheet is reduced to zero velocity, and said speeds being approximately one half the initial velocity of the received sheet.

7. Apparatus as defined in claim 4, in which the associated guide means encompassing about half the circumference of the roller comprises a series of small endless belt units spaced axially along the roller, each of said units consisting of a plurality of idlers, and an endless belt extending around said idlers, with a part of the belt bent around the roller.

8. Apparatus as defined in claim 5, in which the associated guide means encompassing about half the circumference of the roller comprises a series of small endless belt units spaced axially along the roller, each of said units consisting of a top idler, a bottom idler, a tensioning idler, and an endless belt extending in generally triangular formation around said idlers with one side of the triangle bent around the roller.

9. Apparatus as defined in claim 4, in which the cooperating guide means encompassing about half the circumference of the roller comprises a series of idler units spaced axially along the roller, each of said units, including a generally U-shaped support carrying a series of small idler rollers bearing against the roller.

10. Sheet stacking apparatus for stacking moving sheets, said apparatus comprising an endless carrier for a spaced series of reverse feed units, each unit having roller means to

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feed a sheet forward and downward and rearward relative to the initial direction of motion of the sheet, means to move said carrier to cause travel of said reverse feed units in the direction of movement of the received sheets, each of said reverse feed units including a sprocket gear disposed at the end of the unit for driving the unit, and a stationary sprocket chain following the path of travel of the carrier and rollers and engaging said gears and rotating the same as they travel.

11. Sheet stacking apparatus for stacking moving sheets, said apparatus comprising an endless carrier for a spaced series of reverse feed units, means to move said carrier to cause travel of said reverse feed units in the direction of movement of the received sheets, each of said reverse feed units comprising a roller and guide means encompassing about half the circumference of the roller, thereby adapting said unit to receive, bend and feed a sheet in reverse direction relative to the initial direction of motion of the sheet, a sprocket gear disposed at the end of each roller for rotating the roller, and a stationary sprocket chain following the path of travel of the carrier and rollers and engaging said gears and rotating the same as they travel.

12. Sheet stacking apparatus for stacking moving sheets, said apparatus comprising an endless carrier for a spaced series of reverse feed units, means to move said carrier to cause travel of said reverse feed units in the direction of movement of the received sheets, each of said reverse feed units comprising a roller and guide means encompassing about half the circumference of the roller, thereby adapting said unit to receive, bend and feed a sheet in reverse direction relative to the initial direction of motion of the sheet, a sprocket gear disposed at the end of each roller for rotating the roller, and a stationary sprocket chain following the path of travel of the carrier and rollers and engaging said gears and rotating the same as they travel, said gears having a pitch diameter equal to the diameter of the rollers, whereby the reverse feed of the rollers equals the travel of the rollers, thereby reducing the velocity of the sheet to zero.

13. Sheet stacking apparatus for stacking moving sheets, said apparatus comprising an endless carrier for a spaced series of reverse feed units, said carrier causing travel of said reverse feed units in the direction of movement of the received sheets, each of said reverse feed units comprising a roller and guide means encompassing about half the circumference of the roller, thereby adapting said unit to receive, bend and feed a sheet in reverse direction relative to the initial direction of motion of the sheet, a sprocket gear disposed at the end of each roller for rotating the roller, and a stationary sprocket chain following the path of travel of the carrier and rollers and engaging said gears for rotating the same as they travel, said gears having a pitch diameter equal to the diameter of the rollers, whereby the reverse feed of the rollers equals the travel of the rollers, thereby reducing the velocity of the sheet to zero, and means to drive the carrier at a speed approximately one half the initial velocity of the sheets being received by the stacking apparatus.

14. Stacking apparatus comprising a plurality of shafts, two spaced sprocket gears of substantial diameter on each of said shafts, two

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endless sprocket chains carried about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, and means for driving one of the shafts in order to move the carrier chains.

15. Stacking apparatus comprising a plurality of shafts, two spaced sprocket gears of substantial diameter on each of said shafts, two endless sprocket chains carried about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, a third sprocket chain arranged parallel to the aforesaid chains but fixed against movement, a sprocket gear at the end of each roller for rotating the same, said gears meshing with the stationary chain in order to rotate the rollers as they travel with the moving carrier chains, and means for driving one of the shafts in order to move the carrier chains.

16. Stacking apparatus comprising a plurality of shafts, two spaced sprocket gears of substantial diameter on each of said shafts, two endless sprocket chains carried about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, a third sprocket chain arranged parallel to the aforesaid chains but fixed against movement, a sprocket gear at the end of each roller for rotating the same, said gears meshing with the stationary chain in order to rotate the rollers as they travel with the moving carrier chains, said sprocket gear having a pitch diameter equal to the roller diameter, whereby a sheet leaving the roller has zero velocity, and means for driving one of the shafts in order to move the carrier chains.

17. Stacking apparatus comprising four shafts arranged at the corners of a rectangle, two spaced sprocket gears of substantial diameter on each of said shafts, two endless sprocket chains carried in generally rectangular formation about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, and means for driving one of the shafts in order to move the carrier chains.

18. Stacking apparatus comprising four shafts arranged at the corners of a rectangle, two spaced sprocket gears of substantial diameter on each of said shafts, two endless sprocket chains carried in generally rectangular formation about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said

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units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, a third sprocket chain arranged in generally rectangular shape parallel to the aforesaid chains but fixed against movement, a sprocket gear at the end of each roller for rotating the same, said gears meshing with the stationary chain in order to rotate the rollers as they travel with the moving carrier chains, said sprocket gear having a pitch diameter equal to the roller diameter whereby a sheet leaving the roller has zero velocity, and means for driving one of the shafts in order to move the carrier chains.

19. Stacking apparatus comprising four shafts arranged at the corners of a rectangle, two spaced sprocket gears of substantial diameter on each of said shafts, two endless sprocket chains carried in generally rectangular formation about said sprocket gears, said spaced chains acting as travelling carriers for a plurality of sheet reversing units spaced therebetween, each of said units consisting of a roller rotatably carried between the chains, guide means also carried between said chains and encompassing about half the circumference of the roller for reversing the direction of a sheet fed to the roller, a third sprocket chain arranged in generally rectangular shape parallel to the aforesaid chains but fixed against movement, a sprocket gear at the end of each roller for rotating the same, said gears meshing with the stationary chain in order to rotate the rollers as they travel with the moving carrier chains, said sprocket gear having a pitch diameter equal to the roller diameter, whereby a sheet leaving the roller has zero velocity, and means for driving one of the shafts in order to move the carrier chains at a speed approximately one half the velocity of the sheets being received by the stacking apparatus.

20. A stacking apparatus as defined in claim 14, in which the roller is carried on the carrier chains by pins located on the centerline of the roller.

21. A stacking apparatus as defined in claim 14, in which the roller is carried on the carrier chains by pins located on the centerline of the roller, said chain having guide tabs, and said apparatus including stationary guide rails on which the chains run with the tabs disposed at opposite sides of the guide rails.

22. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller.

23. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller, said shafts being cut away within said rails to receive the moving chain, and a pin connecting the moving chain to the shaft on the centerline of the shaft.

24. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller, said shafts being cut away within said rails to receive the moving chain, and

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a pin connecting the moving chain to the shaft on the centerline of the shaft, said chain having guide tabs, and said apparatus including an additional stationary guide rail on which the chains run with the tabs disposed at opposite sides of the guide rails.

25. A stacking apparatus as defined in claim 14, in which the guide means is carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the shaft.

26. A stacking apparatus as defined in claim 14, in which the guide means is carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the shaft, said shaft being cut away within said rails to receive the moving chain, a pin connecting the moving chain to the shaft on the centerline of the shaft.

27. A stacking apparatus as defined in claim 14, in which the guide means is carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the shaft, said shaft being cut away within said rails to receive the moving chain, a pin connecting the moving chain to the shaft on the centerline of the shaft, said chain having guide tabs, and said apparatus including an additional stationary guide rail on which the chains run with the tabs disposed at opposite sides of the guide rails.

28. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller, and in which the guide means are mounted on a generally similar guide support shaft spaced from the roller support shaft and similarly carried and guided, said support shafts being spaced from one another by appropriate rigid spacer links.

29. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller, said shafts being cut away within said rails to receive the moving chain, a pin connecting the moving chain to the shaft on the centerline of the shaft, and in which the guide means are mounted on a generally similar guide support shaft spaced from the roller support shaft and similarly carried and guided, said support shafts being spaced from one another by appropriate rigid spacer links.

30. A stacking apparatus as defined in claim 14, in which the roller is rotatably carried on a non-rotatable supporting shaft of substantial diameter, the ends of said shaft being received in fixed guide rails to accurately guide the travel path of the roller, said shafts being cut away within said rails to receive the moving chain, a pin connecting the moving chain to the shaft on the centerline of the shaft, said chain having guide tabs, and said apparatus including an additional stationary guide rail on which the chains run with the tabs disposed at opposite sides of the guide rails, and in which the guide means are mounted on a generally similar guide support shaft spaced from the roller support shaft and similarly carried and guided, said support shafts

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being spaced from one another by appropriate rigid spacer links.

31. A stacking apparatus as defined in claim 1, in which the travel means is disposed at about the height of the received sheets, and the described apparatus is located wholly above the stack deposited by the apparatus. 5

32. A stacking apparatus as defined in claim 14, in which the working side of the carrier chains is disposed at about the height of the received sheets, and the return side of the carrier chains is located thereabove and above the stack deposited by the apparatus. 10

33. A stacking apparatus as defined in claim 1, in which the sheets are stacked face uppermost, said apparatus comprising means disposed over the stacking apparatus for first transferring the sheets to the far end of the stacking apparatus, means for bending the sheets downward and feeding the same reversely at a uniform speed into the stacking apparatus face downward, said stacking apparatus serving to again reverse the sheets and to stack the same face upward. 15

34. A stacking apparatus as defined in claim 5, in which the sheets are stacked face uppermost, 20 25

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said apparatus comprising a pair of delivery belts disposed over the stacking apparatus for first transferring the sheets to the far end of the stacking apparatus, additional means for bending the sheets downward and feeding the same reversely at a uniform speed into the stacking apparatus face downward, said stacking apparatus serving to reverse the sheets and to stack the same face upward.

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