Feb. 12, 1935. B. D. STEVENS 1,991,003

METHOD OF AND MEANS FOR FEEDING SHEETS

Filed Feb. 6, 1931 2 Sheets-Sheet 1

Fig. 1.

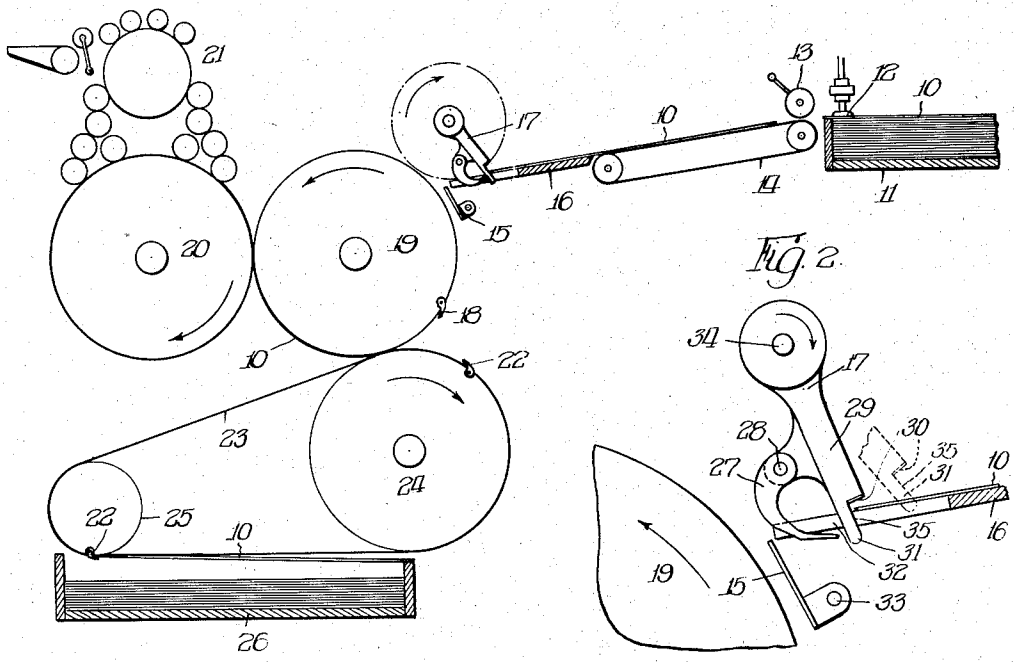


Fig. 2.

Fig. 3

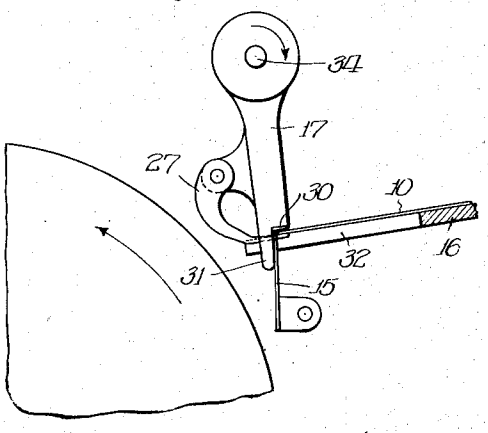
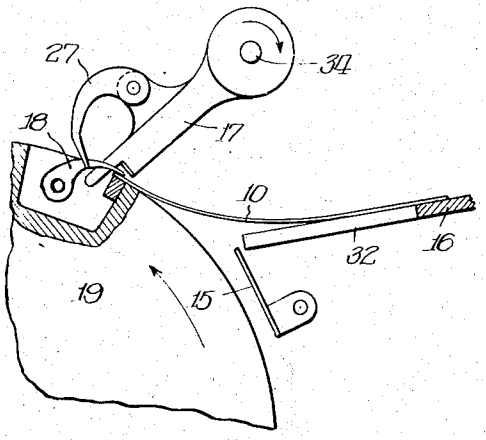


Fig. 4



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METHOD OF AND MEANS FOR FEEDING SHEETS

Filed Feb. 6, 1931 2 Sheets-Sheet 2

Fig. 6

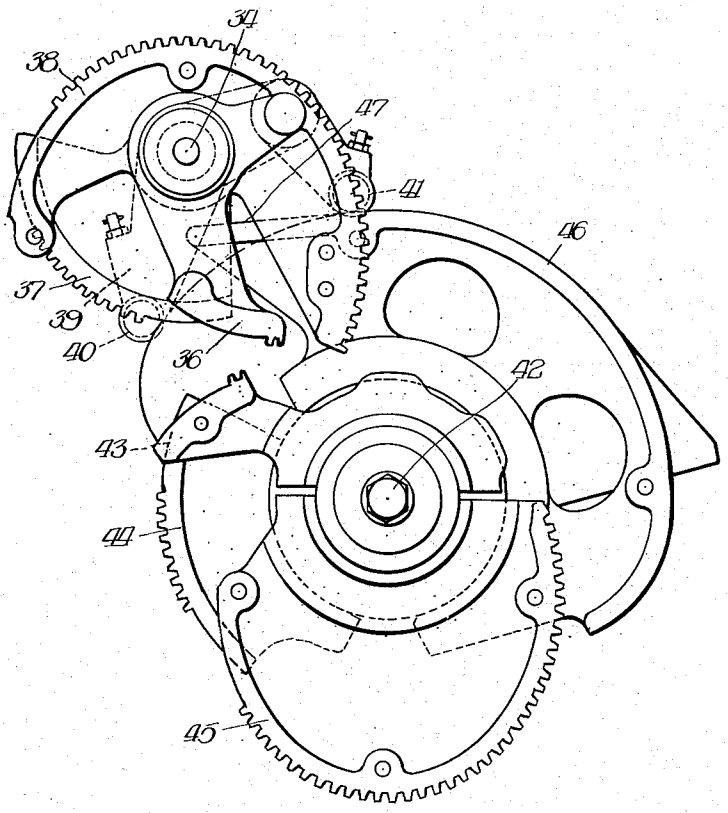
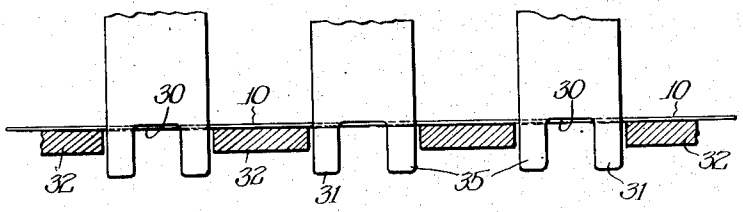


Fig. 5



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UNITED STATES PATENT OFFICE

1,991,003

METHOD OF AND MEANS FOR FEEDING SHEETS

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Application February 6, 1931, Serial No. 513,805

33 Claims. (Cl. 271—53)

This invention relates to a method of and mechanism for feeding and conveying sheet material to operating machines such as printing presses or the like where accurate register of the sheets is essential.

The invention specifically concerns sheet retarding means which will function to decelerate a traveling sheet before it is brought to register.

While the principle of my invention may be applied to any type of sheet feeding mechanism, it is particularly well adapted for use in connection with that class of sheet feeding apparatus in which is incorporated sheet accelerating and transfer mechanism.

In such mechanism, when it is applied to a printing press for example, the sheets to be printed are engaged after having been brought to register and while at rest on a sheet support and are subsequently accelerated to the speed of a moving printing member, such as an impression cylinder, and transferred thereto so that at the time when a sheet is grasped by the sheet holding means of the printing member, the sheet will have attained the surface speed of said member.

In automatically operated sheet handling machinery a stack or pile of the material to be fed is preferably placed on a supporting table where the sheets are separated, and thereupon conveyed individually to registering means where each sheet is properly positioned prior to its being transferred to a sheet receiving member, such as an impression cylinder of a printing press.

The speed at which the separated sheets are advanced towards the registering means is usually comparatively high because machines, such as sheet fed printing presses, frequently handle sheets at a rate of 3000 and upwards per hour.

It will be understood that when a sheet contacts with registering guides at such a rate of speed, the sheet may rebound from the guides, or those portions of the leading edge which touch the guides may become indented and thereby impair accurate positioning of the sheet. Therefore with a view to eliminating such conditions and in order to avoid contact of a sheet against the registering guides at a high rate of speed, I have provided means whereby the sheets are slowed down before they reach the registering means so that at the instant when the leading edge of a sheet moves into contact with the front guides it will have nearly come to rest, in other words the velocity of the sheet at that point will have reached its minimum. Consequently a sheet will move very gently against the front guides and any rebounding of the sheet, or indenting of its leading edge will be avoided.

The primary object of my invention therefore is to provide mechanism whereby sheets fed to registering means shall be effectively slowed down and brought to rest for registering purpose.

Another object is to impart such motion to the slowing down i. e. retarding means that at the time when the leading edge of a sheet overtakes said means, the velocity of the latter will be approximately the same as that of the sheet.

A further object of my invention is the provision of means which shall eliminate any unevenness in the leading edge of a sheet to be fed, so that said edge will be presented to the sheet registering means in a perfectly flat and straightened out condition.

With a view to accomplishing these and other objects, I have conceived a mechanism which is exceedingly simple in construction and whereby a number of auxiliary devices which heretofore have been essential, shall be eliminated.

According to my invention, I provide means adapted to be operatively associated with the sheet feeding, i. e. accelerating and transfer mechanism, which means preferably travels in a curvilinear path and is given a decelerating motion which I utilize to slow down a sheet prior to its reaching the registering guides.

Preferably the arrangement is such that at the moment when a sheet engages the retarding means, i. e. when a sheet is placed under control thereof, the speed at which said means travels is merely a fraction less than the speed at which the sheet is fed. In this manner the sheet will not be jarred when it overtakes said means, and therefore during the subsequent slowing down, it will be under perfect control since its leading edge will remain in proper alignment and will finally reach the registering guides at an exceedingly slow rate of speed, in fact the velocity of the sheet will be practically nil at the time when its leading edge engages said guides.

The means whereby I accomplish the straightening or flattening out of a sheet is preferably associated with the sheet retarding means in a manner that during the slowing down of a sheet the leading edge thereof is prevented from curling, while immediately before the sheet is brought to register any unevenness or wave in its leading edge shall be eliminated by means which will straighten out and hold the edge flat until the sheet is taken by the means whereby it is transferred to a printing member or the like

after the sheet has assumed its proper registering position.

I find that the preferred rate of deceleration to be imparted to the retarding element is constant, that is, the angular velocity of said element increases uniformly and the angular displacement increases parabolically.

While I realize that my method of and means for slowing down sheets could be readily applied in connection with various types of sheet feeding or sheet transferring mechanism, I find that it is especially well adapted for use on the rotary type of sheet accelerating and transfer mechanism. Therefore in order to clearly set forth the advantages of my invention I have chosen to illustrate it by way of example as applied to that particular type of mechanism.

In the accompanying drawings Figure 1 shows a diagrammatic view of a printing press and associated sheet feeding mechanism embodying my invention;

Figure 2 is an enlarged detail view of the sheet accelerating and transfer mechanism shown in a position immediately after a sheet has been engaged by the retarding means;

Figure 3 is a similar view but showing the position of the sheet accelerating and transfer mechanism and of the sheet retarding means at the time when the sheet is in contact with its registering means and after it has been engaged by the sheet holding elements;

Figure 4 shows the relative position of the transfer means and sheet holding elements of a printing member immediately after a sheet has been transferred to the latter;

Figure 5 is an enlarged sectional view showing one preferred form and arrangement of the slow-down means in front elevation; and

Figure 6 illustrates one form of operating mechanism whereby motion is transmitted to the sheet transfer means.

In Figure 1 of the drawings, I have illustrated diagrammatically one embodiment of my invention as applied to a rotary press, which includes a sheet transfer mechanism of the type referred to above and whereby a sheet to be printed is transferred from the sheet feeding and registering means at an accelerating speed to the impression cylinder of the press.

The sheets 10 stacked on the feed board 11 are separated one by one from the pile and removed in succession therefrom by means of separators 12, which may be of any well-known design, and whereby the separated sheets are conveyed between a drop roller 13 and forwarding tapes 14 in order to advance the sheet towards registering guides 15 provided adjacent the front edge of the registering table 16. At that point, after a sheet has been properly registered, it will be engaged by the sheet holding elements on the transfer gripper mechanism 17 while the sheet is at rest and then removed from the registering table 16 at an accelerating speed, so that when the grippers 18 of the impression cylinder 19 take over the sheet from the transfer mechanism 17, it will have assumed the surface speed of the cylinder 19. The transfer mechanism, after it has released a sheet, will continue to rotate and subsequently its speed will be retarded so that the mechanism will come to a stand still when it has again reached its sheet engaging position.

The sheet 10, while being carried around by the cylinder 19, will receive its impression as it passes between said cylinder and the form or plate on the cylinder 20, which plate will be inked in any well-known manner by inking mechanism such as indicated at 21.

The printed sheet is then transferred from the cylinder grippers 18 to the delivery grippers 22 mounted on endless chains 23, which pass around a delivery reel 24 and sprocket wheels 25 to bring a sheet into position over a delivery board 26 onto which the printed sheets 10 are deposited.

In Figures 2 and 3 I have shown the sheet transfer mechanism and associated parts on an enlarged scale in order to clearly illustrate their function for slowing down and registering a sheet prior to its being transferred to a printing member or the like. The sheet accelerating and transfer mechanism 17 includes sheet engaging grippers 27 which are pivotally mounted at 28, and may be operated in any well-known manner to open and close. Preferably the arm 29 of the transfer mechanism is provided at its outer end with a shoulder 30, which serves as a means for straightening out the leading edge of a fed sheet as will be hereinafter described, and which in this particular form of arrangement also acts as a support or pad for the grippers 27. The arm 29 furthermore is provided with a projection or projections 31 which extend into the path of a fed sheet and which will operate to slow down a sheet for registering purpose as will be explained later. Obviously any desired number of grippers 27 and cooperating parts may be arranged on the transfer mechanism, depending on the width of the sheets to be handled.

In order to provide clearance for the grippers 27 and projections 31, the front edge of the registering table 16 is recessed so that a plurality of tongues 32 will be formed which will function to support the leading portion of a sheet across its entire width.

The front registering guides 15 are mounted to swing about the axis 33 in order to move into and out of their registering position as is well known in the art.

As indicated above, the sheet accelerating and transfer mechanism 17, which is mounted to rotate about the axis 34, transfers a registered sheet from the table 16 to the grippers 18 at an accelerating speed, in other words, the sheet will be engaged by the grippers 27 while at rest and advanced at an increased velocity so that when the sheet is presented to the grippers 18, it will have reached the surface or uniform speed of the cylinder 19. Thereupon the transfer mechanism continues to rotate until it reaches a point at which the slow down fingers 31 are located in a position approximately as indicated in broken lines in Figure 2 where the deceleration of the transfer mechanism commences.

While on the accompanying drawings I have shown the slow down fingers 31 as being integral with the transfer gripper mechanism, it will be readily understood, however, that said fingers could be conveniently arranged and operated independently of the transfer grippers. The method of transferring sheets as illustrated is in itself not novel in the art and therefore does not immediately concern my invention, which, as stated above, has for its primary object the control and slowing down of a sheet for registering purpose. Furthermore, it would be practical to apply the principle of my invention in connection with other types of sheet transferring means, such as

oscillating stop gripper mechanism, according to which the transfer grippers, instead of performing a complete revolution, merely oscillate between the sheet registering means and the impression cylinder or the like for the purpose of transferring a sheet to the latter at an accelerating speed. The arrangement could also be such that a registered sheet can be taken over direct by the grippers of an impression cylinder or the like, a method which is well known in the art of sheet handling equipment.

Therefore I need not deal at length with the actual construction of the sheet transferring means, but I shall more specifically disclose my novel method and means for accomplishing the object of my invention.

Referring to Figure 2, it will be readily understood that after a sheet 10 has reached the face 35 of the slow down fingers 31, the tapes 14 over which the sheet passes will continue to urge it forward so that normally during the deceleration of the fingers 31, the front edge of the sheet, due to the angular position of the face 35 with relation to the edge of a fed sheet, will have a tendency to divert from its path of travel and curl upwardly. This tendency, however, is effectively overcome according to my invention by imparting to said fingers during their slowing down motion a relative movement to the fed sheet so that the leading edge of the sheet will remain in its proper plane. In the arrangement shown, in which the fingers 31 are mounted above the registering table 16 and travel in a curved path, said relative movement will be in a downward direction. Therefore, due to the engagement of a fed sheet with the face 35, the leading edge of the sheet will be urged downwardly and consequently will remain flat on the table 16, so that it will reach the front registering guides 15 in a straightened out condition.

The angular relation of the face 35 to the path of a fed sheet at the time when a sheet engages said face, will also avoid any rebounding of the sheet or indenting of its leading edge, because the face 35 on the fingers 31, rather than being an obstruction to a sheet when it contacts therewith, will actually support the sheet at its front edge, as will be clearly evident from the position indicated in Figure 2.

The speed of the slow down fingers 31, at the moment when a sheet overtakes them, is approximately that at which the sheet travels, necessarily somewhat less. The retardation of the sheet is gradual and preferably parabolic, as explained above, that is to say, the curve representing the angular speed of the slow down means during the retardation of a sheet is that of a parabola.

The front registering guides 15 are about to swing upwards into their operative or registering position when the slow down fingers 31 have reached a location approximately as shown in Figure 2, so that a sheet will be brought to bear against said guides just before it comes to rest. Due to the extremely low velocity of a sheet at the time when it reaches the registering guides, any rebounding of the sheet from the guides is eliminated and consequently the registering position of the sheet will not be disturbed.

In order that the leading edge of a sheet to be registered will be free to align itself perfectly with its registering means, the slow down fingers 31 will pass slightly beyond the stops 15, as is clearly indicated in Figure 3.

The relative position of the cooperating parts as shown in Figure 3 is that at which a sheet has been registered and immediately after the grippers 27 have closed on the sheet for the purpose of transferring it to the cylinder 19. Prior to the commencement of the transfer motion of the grippers 27, the registering guides 15 will move out of their operative position into a position shown in Figure 4 to clear the path for the sheet. In Figure 4 the sheet is shown in its position on the cylinder 19 after the grippers 18 have engaged it and after the transfer grippers 27 have opened and released the sheet. From that point on the transfer mechanism 17 will continue to rotate, preferably at a uniform speed, until the position indicated by broken lines in Figure 2 is again reached, where the deceleration will commence as explained above.

The function of the shoulders 30 for finally flattening out the leading edge of a sheet, and which shoulders in the preferred form shown, also serve as supports or pads for the grippers 27, is illustrated in Figures 2 and 3. During the slowing down motion of the retarding elements or fingers 31, said shoulders will gradually approach the top of a fed sheet until the position in Figure 3 is reached, when said shoulders will be located in the plane of the sheet, see also Figure 5.

It will be seen that by arranging a plurality of retarding elements 31 and shoulders 30 so that they will be distributed over the entire width of a sheet 10, the latter will be under positive control while it is being slowed down, and when it has reached its registered position, i. e. the end of its deceleration, the leading edge of the sheet will be presented to the registering guides in a perfectly flat condition due to the cooperation of the shoulders 30 with the sheet supporting tongues 32.

The driving means for imparting to the sheet transfer mechanism its rotary, accelerating and decelerating motions may comprise any suitable mechanical movement, which in turn may be of any desirable or known design. In Figure 6 I have illustrated merely by way of example one form of mechanism whereby the actuation of the sheet transfer elements will be accomplished.

Gear sectors 36, 37 and 38 are rigidly mounted on the transfer gripper shaft 34 to rotate therewith. Said shaft also carries a bracket 39 provided with cam rollers 40 and 41.

The shaft 42 which is the driving shaft has rigidly mounted thereon complementary gear sectors 43, 44 and 45 as well as a cam member 46. These gear sectors together with the cam 46 rotate as a unit in the direction indicated by the arrow.

It will be seen that in the position shown in Figure 6, the rollers 40 and 41 ride over the cam 46 at which time the shaft 34 and consequently the sheet accelerating and transfer gripper mechanism will be at rest. Upon continued rotation of the shaft 42, the extension 47 of the cam 46 and over which the roller 41 rides, will cause the shaft 34 and gear sectors thereon to rotate in an anti-clockwise direction and the gear sector 43 carried by the shaft 42 will subsequently move into meshing relation with the complimentary gear sector 36 carried by the shaft 34. While these two sectors are in mesh, the shaft 34 and therewith the transfer mechanism will be given an accelerating motion until the sector 44 meshes with the sector 37 at which time the sectors 36 and 43 will again move out of mesh. At this point the transfer mechanism on the shaft 34 will have reached its uniform velocity which is equal to the surface speed of the impression cylinder or the like to which a sheet is to be trans-

ferred. The uniform speed is maintained so long as the sectors 37 and 44 remain in mesh and until the elliptical gear sectors 38 and 45 move into meshing relation.

It has been found that under certain conditions, it is desirable to gain additional time for the purpose of registering a sheet. This is accomplished by the provision of elliptical gears such as sectors 38 and 45 which, after the uniform speed has been reached for transferring a sheet from the transfer mechanism to the printing member or the like, will produce additional acceleration of the transfer mechanism and consequently time will be gained in order to permit of a longer dwell of said mechanism for the purpose indicated above.

However, normally it will not be essential to produce any additional acceleration so that the provision of elliptical gears is merely optional and will not become necessary in the majority of constructions. Therefore in order to continue the uniform motion, after a sheet has been transferred, the gear sectors 37 and 44 may be extended correspondingly, while complementary gear sectors will be arranged to produce the deceleration of the transfer mechanism until the rollers 40 and 41 again ride over the cam 46 during which period the transfer mechanism will remain stationary for the purpose set forth.

As indicated above, various modifications could be embodied in the design as well as in the arrangement of my novel sheet controlling means without departing from the principle of my invention; therefore, I wish it to be understood that I intend to cover any such constructions and applications of my invention that will come within the scope of the appended claims.

I claim:

1. In a printing press, rotary sheet transfer elements including sheet slow down means adapted to engage the leading edge of a moving sheet and to decelerate same before the sheet is brought to register at rest.

2. In a printing press, rotary sheet transfer elements including sheet slow down means moving in a curvilinear path and adapted to engage the leading edge of a moving sheet and to decelerate same before the sheet is brought to register at rest.

3. In a printing press, rotary sheet transfer elements including sheet slow down means having accelerating and decelerating motion and adapted to engage the leading edge of a moving sheet and to decelerate same before the sheet is brought to register at rest.

4. In combination, sheet registering front guides, and sheet transfer elements traveling in a continuous path and including sheet slow down means adapted to engage the leading edge of a moving sheet and to bring it substantially to rest before the sheet is presented to said front guides.

5. In combination, sheet registering front guides, and sheet transfer elements traveling in a continuous curvilinear path and including sheet slow down means moving therewith and adapted to engage the leading edge of a moving sheet and to bring it substantially to rest before the sheet is presented to said front guides.

6. In combination, sheet registering front guides, and sheet transfer elements traveling in a continuous path and including sheet slow down means having accelerating and decelerating motion and adapted to engage the leading edge of a moving sheet and to bring it substantially to rest before the sheet is presented to said front guides.

7. In a sheet conveying apparatus, the combination of a sheet support, a member for performing an operation on a sheet, transfer gripper elements to transfer a sheet from said support to said member, and sheet slow down means carried by said transfer elements to slow down and substantially stop a sheet prior to its being registered and transferred to said member.

8. In sheet conveying apparatus, the combination of a sheet support, a member for performing an operation on a sheet, sheet transfer elements traveling in a continuous path and adapted to transfer a sheet from said support to said member, said transfer elements including a rotary sheet slow down means operative to slow down and substantially stop a sheet prior to its being transferred to said member.

9. In a sheet registering means, a sheet retarding element moving in a curvilinear path above the sheet and downwardly through the plane thereof, said element being adapted to engage a moving sheet to cause preliminary register and to slow it down before the sheet is brought to final register.

10. In a sheet registering means, a sheet retarding element moving in a curvilinear path above the sheet and downwardly through the plane thereof, said element being adapted to engage a sheet traveling in a rectilinear path to cause preliminary register and to slow it down before it is brought to final register.

11. In combination with sheet registering means, a sheet retarding element moving in a curvilinear path and adapted to engage a sheet traveling in a rectilinear path to slow down and substantially stop it before it is brought to register, the angular position of said retarding element with relation to the leading edge of the sheet being such that said edge is biased downwardly by said element, during its slowing down motion.

12. In combination with sheet registering means, a sheet retarding element moving in a curvilinear path and adapted to engage a sheet traveling in a rectilinear path to slow it down before it is brought to register, said retarding element having such relative movement to the plane in which the sheet travels so as to avoid diverting of the leading edge of a sheet from its path.

13. In sheet transfer mechanism including sheet engaging elements having accelerating and decelerating motion, registering means, and a retarding element traveling in a curvilinear path at a decelerating speed and adapted to slow down and substantially stop a moving sheet before it is brought to register.

14. In sheet transfer mechanism including sheet engaging elements having accelerating and decelerating motion, registering means, and a sheet retarding element traveling in a curvilinear path and adapted to engage and slow down a moving sheet before it is brought to register, one of said engaging elements acting to flatten out the leading edge of a sheet before it is registered.

15. Sheet feeding means, comprising in combination mechanism including intermittently moving sheet carrying elements to engage a sheet while at rest and to transfer it to a sheet receiving member, means to convey sheets towards said mechanism, the carrying elements having accelerating and decelerating motion arranged to cause a sheet to be slowed down by the deceleration.

16. Sheet feeding means, comprising in combination mechanism including intermittently moving sheet carrying elements to engage a sheet while at rest to transfer it to a sheet receiving member, means to convey sheets towards said mechanism, slow down fingers extending into the path of sheets fed to said elements, and means cooperating with said fingers to straighten and flatten out the leading edge of a sheet.

17. Sheet feeding means, comprising in combination mechanism including intermittently moving sheet carrying elements to engage a sheet while at rest and to transfer it to a sheet receiving member, means to convey sheets towards said mechanism, and slow down fingers having accelerating and decelerating motion, arranged to slow down a sheet and to avoid curling up of the leading edge thereof prior to the sheet being transferred to said sheet receiving member.

18. In a printing press, sheet transfer elements including slow down means comprising a member for decelerating a fed sheet and having a relative movement with respect to the sheet when in engagement therewith to prevent curling of the leading edge of the sheet.

19. In a printing press, sheet controlling means comprising a member arranged above the path of a sheet for decelerating a fed sheet and having a relative movement with respect thereto when in engagement therewith to prevent curling of the leading edge of the sheet.

20. In a printing press, sheet transfer gripper mechanism including gripper and cooperating pads and a member moving in a curvilinear path for decelerating a fed sheet and having a relative movement with respect thereto when in engagement therewith to prevent curling of the leading edge of a sheet, said gripper pads being adapted to flatten out said leading edge for registering purpose.

21. In sheet conveying apparatus, the combination of a sheet support, a printing cylinder, and intermittently actuated transfer gripper mechanism for transferring a sheet from said support to said cylinder and including sheet slow down means operative to slow down and stop a sheet prior to its being registered and transferred to said cylinder.

22. In sheet conveying apparatus, the combination of a sheet support, a printing cylinder, intermittently actuated transfer gripper mechanism for transferring a sheet from said support to said cylinder, and sheet slow down means coaxial with said transfer gripper mechanism and operative to slow down and substantially stop a sheet prior to its being registered and transferred to said cylinder.

23. In sheet feeding mechanism, the combination of a sheet carrier whereby a sheet will be grasped and carried to a moving printing member, and means associated as a unit with said carrier to slow down and bring a moving sheet to substantial rest so that it may be brought to register before it is grasped by said carrier.

24. In sheet feeding mechanism, the combination of a rotary sheet carrier whereby a sheet will be grasped and carried to a moving printing member, and means associated as a unit with said carrier to slow down and bring a moving sheet to substantial rest so that it may be brought to register before it is grasped by said carrier.

25. In combination with sheet feeding means, a sheet retarding element moving in a curvilinear path above and into and out of the sheet path to slow down and stop a sheet for registering purpose.

26. In combination with sheet feeding means, sheet registering means, a sheet retarding element moving in a curvilinear path above and into and out of the sheet path to slow down and stop a sheet for registering purpose, said retarding element passing beyond said registering means after a sheet has reached its registering position.

27. In combination with sheet feeding means, sheet registering means, a sheet retarding element moving in a curvilinear path above the plane in which the sheet travels to engage, slow down and stop a sheet for registering purpose, said retarding element passing beyond said registering means after a sheet has reached its registering position.

28. In combination with sheet feeding mechanism, sheet registering means, rotary sheet retarding means, supporting means extending across the full width of a fed sheet to support the leading edge of the sheet while being registered, and means on said retarding means cooperating with said supporting means to flatten out a sheet for registering purpose.

29. In combination with sheet transfer mechanism including grippers and gripper pads, sheet registering means, sheet retarding means associated with said transfer mechanism, and sheet supporting means extending across the full width of a fed sheet to support the leading edge of the sheet while being registered, said gripper pads cooperating with said sheet supporting means to flatten out a sheet for registering purpose.

30. In combination with sheet transfer mechanism, sheet engaging grippers traveling in a curvilinear path, sheet retarding element associated with said grippers and rotating above the sheet and in the same direction as said grippers to engage a sheet and slow it down for registering purpose, the sheet engaging portions of said grippers traveling in a plane below the path of the sheet during the slowing down of a sheet.

31. In intermittently operating sheet transfer mechanism having accelerating and decelerating motion, the combination of means whereby the deceleration of said mechanism is utilized to slow down a sheet of material for registering purpose.

32. The method of feeding sheet material to printing presses or the like consisting in advancing separated sheets towards registering means, slowing down the sheets by deceleration and then stopping them, preventing curling of the leading edge of a sheet during the slowing down of the sheet, registering the sheet, and transferring the registered sheet at an accelerating speed to a printing member.

33. The method of feeding sheet material to printing presses or the like consisting in advancing separated sheets towards registering means, slowing down the sheets by deceleration and then stopping them, preventing curling of the leading edge of a sheet during the slowing down of the sheet, flattening out the sheet along its entire front edge, registering the sheet, and transferring the registered sheet at an accelerating speed to a printing member.

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