This invention relates to mechanisms for successively delivering sheets and particularly to mechanisms for transferring freshly printed sheets from the impression cylinder of a press to a delivery platform, wherein the sheets are piled. Its purpose is to provide an improved mechanism of this general type by means of which sheets may be transferred as rapidly as may be necessary, but delivered in such manner upon the top of the pile that they will not rebound from abutments, such as stripper fingers, and will not be damaged by being too forcibly delivered against stationary members, with the result that a press with which the mechanism is associated may be operated at its full capacity and the delivered sheets piled evenly and uniformly on the delivery platform in an undamaged condition.

Numerous sheet delivery mechanisms have been designed and constructed and with the end in view of accomplishing the rapid delivery of sheets and the piling of such sheets evenly and in an undamaged condition. The present invention, however, provides a mechanism which includes a number of novel features not heretofore employed in connection with sheet delivery devices and which render it more effective in accomplishing its intended purpose. One feature of the invention comprises a novel means for driving at a variable speed an endless conveyor provided with sheet gripping instrumentalities, the linear velocity of each individual sheet gripper being precisely the same as that of the sheet upon the impression cylinder at the instant that the sheet is transferred to the conveyor, so that the sheet is not torn, the driving means thereafter functioning to substantially increase the speed of movement of the sheet toward the delivery platform and finally, as the sheet nears the point where it is to be released, to greatly decrease its speed or even to halt its forward movement entirely if desired, so that, at the moment of release from the conveyor, it will fall gently upon the pile below it and will not strike any abutment member which may be provided with sufficient force to injure the sheet, even though it may be of thin and easily damaged paper. This highly advantageous result flows from the use of a mechanism of simple character, containing but few movable parts, and these of elementary nature. Despite the variable motion imparted to the sheet conveyor, the unbalanced forces developed are relatively small, the power required to operate the delivery mechanism is no greater than that required to operate any ordinary mechanism of this type, and the movements of the various parts are smooth and noiseless.

One embodiment of the invention will be disclosed by way of example, this being illustrated in the accompanying drawings and hereinafter described in detail. It will be appreciated by one skilled in the art, however, that in adapting the invention to presses or other sheet handling mechanisms which vary in type, the design and arrangement of the component elements of the invention may be considerably modified without departure from the intent of the invention.

In the drawings:

Figure 1 is a top plan view, partially broken away, of portion of a printing press with which the improved sheet delivery mechanism has been incorporated, showing in addition to this mechanism the impression cylinder of the press and the delivery platform;

Figure 2 is a side elevation of portion of the mechanism shown in Figure 1, partly broken away, numerous portions of the press with which the present invention is not concerned being omitted; and

Figure 3 is a section on line 3—3 of Figure 2. The impression cylinder of the press is generally indicated at 10 in the drawings and the delivery platform at 11. With the type of press illustrated the impression cylinder revolves twice about its axis for each sheet printed and hence the conveyor mechanism must serve to remove a sheet from the impression cylinder at each second revolution thereof and convey it to a point above the delivery platform 11, where it is released. The conveyor mechanism is generally indicated at C and comprises essentially two horizontally spaced frame members 12 and 13, one end of each of which is disposed in proximity to the impression cylinder, and is provided with an enlargement or bearing through which horizontally disposed rotatable shaft 14 extends, the bearings being indicated at 12' and 13' respectively. From the supporting shaft 14 the frame members 12 and 13 extend upwardly and outwardly and thence horizontally and outwardly to a point just beyond the outer edge of the receiving platform 11, the outer ends of these frame members being supported in the positions shown by means which is not illustrated. Rotatably supported in aligned bearings adjacent the outer ends of the parallel frame members is a transversely extending shaft 15, which shaft is parallel to the previously mentioned shaft 14. Shaft 14 carries sprockets 16 and 17, and shaft 15 has mounted thereon similar sprockets, one of which is indicated at 18, the
four sprockets thus provided serving as supporting and driving means for the two parallel chains indicated at 20 and 21, the chains being endwise guided intermediate the supporting sprockets by means carried by the frame members 12 and 13.

Transversely extending gripper bars are indicated at 25 and 25', the ends of these bars being mounted upon the chains respectively and the bars being equidistantly spaced from each other, that is, the distance from one bar to the other, measured along the chains in either direction, being identical. Each gripper bar pivotally carries a plurality of sheet gripping fingers 28 which may be rocked to approach or recede from abutment or anvil members 27 likewise carried by the gripper bar, the cooperating fingers and abutments 26 and 27 comprising sheet gripping instrumentalities adapted to grip the leading edge of a sheet at the instant of its arrival at a predetermined point and at which point it is released by the sheet grippers of the impression cylinder. The sheet grippers of the conveyor maintain the sheet edge tightly secured until it reaches a point substantially as shown in Figure 2, just above the delivery platform 14, where the sheet is released, the chain moving in the direction of the arrow A (Figure 2), whereupon the sheet is allowed to fall on the pile P. At the point of sheet release the gripping mechanism is either moving very slowly or may be even stationary so that the sheet falls gently into its proper position on the pile and will not violently impact the fingers which may be placed in its path to intercept it. The details of construction of the sheet gripping devices per se may be varied as desired. Many such devices have heretofore been suggested and used, and the invention is not limited to any particular form of such device, but contemplates the use of any suitable sheet gripping means. During the time that each gripper bar is moving from the point at which it engages and grips a sheet at the periphery of the impression cylinder for a substantial part of its travel toward the point of sheet delivery, its speed is increasing and it is only as it approaches the point of sheet release that its speed decreases. After leaving the point of sheet release, its speed is rapidly increased and only decreases again as it approaches the point of sheet seizure. The means for accelerating and decelerating the conveying mechanism so that its gripping mechanisms are moving at the stated speeds at the stated points will now be described.

Mounted upon the shaft of the impression cylinder 10 is a gear 33 and the teeth of which mesh with those of a cylinder driving element 31 which may be in turn actuated from a suitable source of power by means of any suitable intermediate power transmitting connection. Likewise, fixed upon the impression cylinder shaft is a small gear 32. The teeth of gear 32 mesh with those of a large gear 34 fixed in the frame member 35. A sun gear 36 is rigidly secured to or formed integrally with the stud 34, the teeth of which sun gear mesh with those of a planet gear 37 rotatably supported upon a pin 38 carried by the large gear 33. Planet gear 37 carries an eccentric pin 39, an eccentric surface of which fits within a cylindrical recess formed within a slide block 40. Slide block 40 has a close sliding fit with the parallel walls of a slot 41 formed radially in a large gear 42, the hub of which is also rotatably mounted upon stud 34. Gear 42 is the same in diameter as gear 33 and the teeth of gear 42 mesh with those of a smaller idler gear 45 rotatably mounted upon fixed stud 46, the teeth of idler 45 being in turn mesh with those of the chain driving gear 47 mounted upon shaft 14 previously referred to. It will thus be seen that the sheet delivery mechanism is driven from the impression cylinder and hence that its moving parts must at all times move synchronously with the impression cylinder.

However, by reason of the inclusion of gears 33, 42 and the intermediate sun gear 36, planet gear 37, and connecting pin 39, the variable linear motion of the gripper bars of the delivery mechanism, previously described, is obtained. Thus, while large gear 33 rotates uniformly about the axis of the supporting stud 34, and the planet gear 37 rotates uniformly about pin 38, the pin 39 fixed on the planet gear is caused to describe a cardioid or an epitrochoid curve about the axis of stud 13 and is hence caused to drive the gear 42 at variable speeds, varying from zero, when the pin is in the position in which it is shown in Figure 3, to an angular speed 33% greater than the angular speed of the gear 33, when the pin is in its diametrical opposite position, or is fixed upon the axis of stud 34. The varying velocity of gear 42 is of course communicated to the conveyor chains through the intermediate gearing previously described and the various parts are so designed with respect to each other that the sheet gripping instrumentality which approaches the impression cylinder is caused to move at the exact linear speed of the impression cylinder at the moment of sheet transfer, thereafter to increase in linear velocity as it moves toward the delivery port and finally to decrease in velocity, and actually stop, at or about the instant of sheet delivery. The acceleration and deceleration of the delivery mechanism, however, is so smoothly effected that no noticeable vibration occurs.

As previously pointed out, the conveyor may be so driven by the mechanism described that, at the instant of sheet delivery, or approximately at that instant, it may be either moving quite slowly or may be stationary. If the axis of pin 39 is located on the pitch line of the planet gear 37, the pin will follow a cardioid curve and the angular velocity of the gear 42 will be zero when the pin is in line with the axes of the sun gear and planet gear 37 and between these axes. By moving the axis of pin 39 slightly toward the axis of gear 37, this complete halt in the movement of the conveyor chain can be eliminated and the chain caused to move slowly, which is to be preferred in most cases. The mathematical principle involved is well known and need not be set forth at length.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

In a printing press, a supporting frame, an impression cylinder having an axial shaft rotatably mounted in said frame, means for driving said impression cylinder at a constant angular velocity, and endless variable speed delivery conveyor adapted to receive printed sheets from said cylinder at substantially the peripheral speed of the latter and to deliver them at a reduced speed, an operating shaft for said conveyor rotatably in said frame 18, the eccentric surface of which fits within a cylindrical recess formed within a slide block 40, a pin 41 formed radially in a large gear 42, the hub of which is also rotatably mounted upon a stud 34.
spur pinion fixed on said impression cylinder shaft adjacent said frame, a short stub shaft fixed to said frame and disposed parallel with said first mentioned shafts, a driving spur gear rotatably mounted on said shaft, coplanar with and meshing with said pinion, a sun gear fixed on said stub shaft closely adjacent said driving gear, a planet pinion rotatably carried directly by said driving gear at a point spaced from the center thereof and coplanar with and continually meshing with said sun gear, another spur gear rotatably mounted on said stub shaft, closely adjacent said sun gear and planet pinion, and adapted to be driven at a variable speed, an eccentric crank pin projecting from said planet pinion and slidably engaging at all times within a radial slot in said driven gear, and a gear secured to said conveyor operating shaft and operatively connected with said driven variable speed gear, the entire driving arrangement being of limited transverse and longitudinal extent with relation to the press.

FREDERICK W. SEYBOLD.