

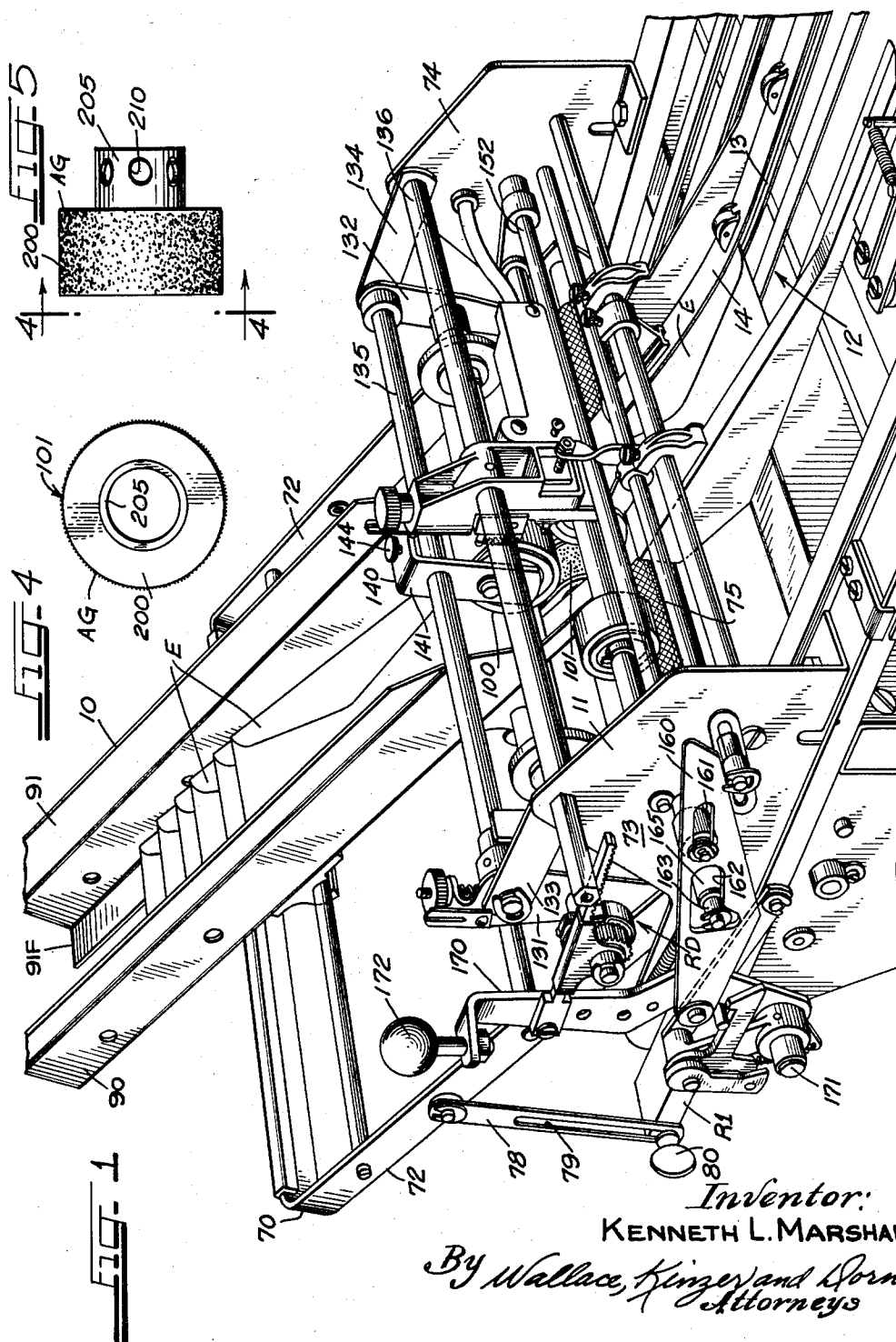
Oct. 23, 1962

K. L. MARSHALL
PRINTING MACHINES

3,059,922

Filed July 27, 1960

3 Sheets-Sheet 1



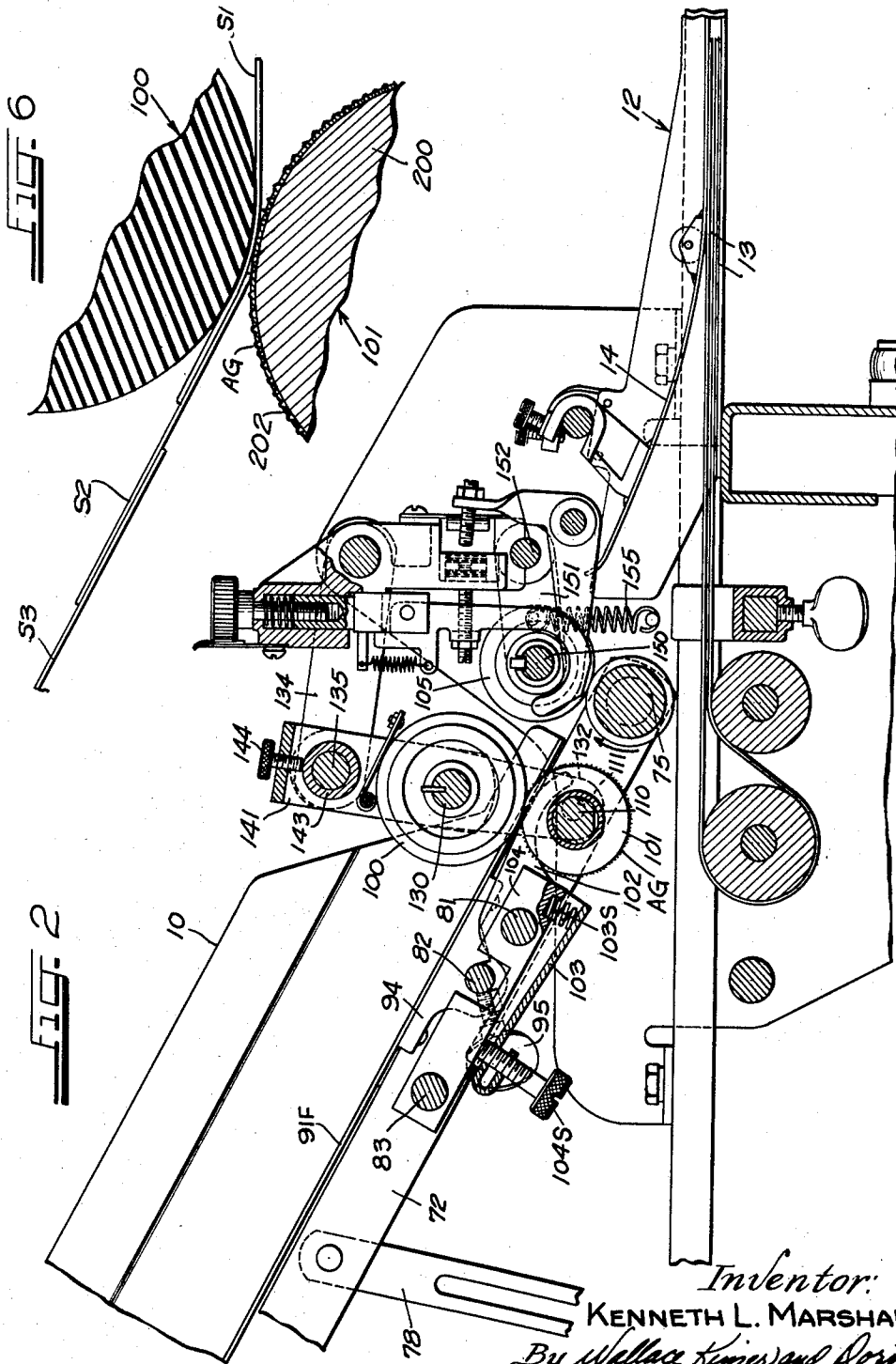
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3 Sheets-Sheet 2



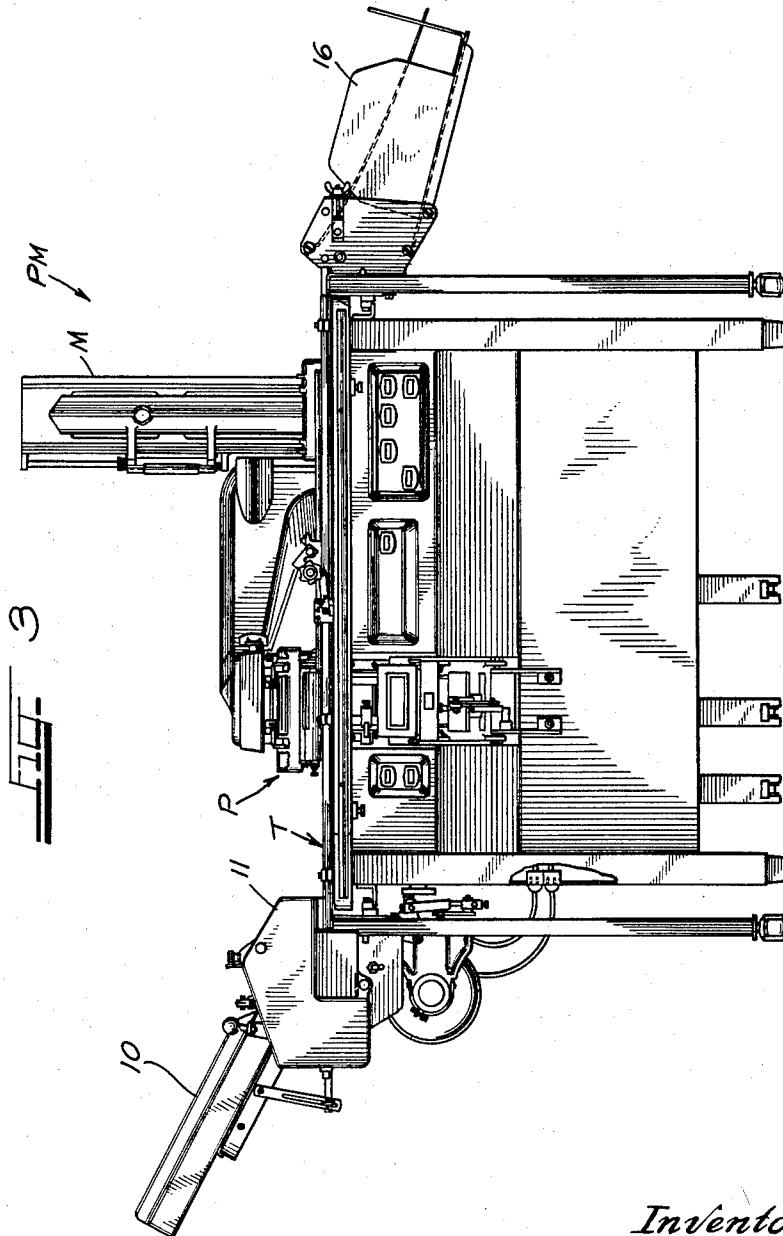
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3 Sheets-Sheet 3



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3,059,922

PRINTING MACHINES

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4 Claims. (Cl. 271-36)

This invention relates to printing machines and in particular to the sheet feed elements that are operative to advance the sheets to and from the station.

In many instances of feeding sheets in printing machines, a relationship is afforded wherein the sheets are supplied from an inclined hopper and in effect are gravity fed into the throat of cooperating feed elements that initially are to advance the sheets one-by-one toward the printing station of the machine. A sheet feeding arrangement of this kind is illustrated in United States Patent No. 2,359,852. Under such circumstances, it is important to encourage the free feeding of the sheet that is at the threshold of the entrance throat of the initial sheet feeding elements, while assuring a retarding or holding action on the sheet that is next to be advanced to the printing station.

Heretofore, the sheet retarding member has been most commonly surfaced with rubber, and while rubber does achieve an effective retarding action because of the frictional characteristics thereof, it does tend to wear smooth after prolonged use, and consequently such rubber retard member has been of cylindrical form to enable the same to be periodically stepped or indexed to displace the flat or worn face and present a fresh face.

In an endeavor to eliminate the need to index or step a rubber retard roller as aforesaid, it has been proposed to resort to a retard roller of the shaped emery or corundum type, but experience has shown that the pores of such roller tend to become clogged and glazed over by flecks of paper loosened from the sheets being fed. Again, such condition requires a stepping or indexing action of the retard roller, and eventually a state is reached where the roller must be replaced because all of the possible faces have become ineffective.

The primary object of the present invention is to construct sheet feed apparatus in a printing machine to include an element having a layer of sharp-edged abrasive grains permanently bonded to a supporting member and under circumstances where the sheets being fed can be engaged by the abrasive grains. The abrasive grains are long-wearing and are loosely scattered substantially in a mono-particle layer on the supporting layer, and consequently there is no pronounced tendency for the sheets being fed to wear down the long-wearing abrasive grains or to induce a glazed surface after prolonged operation. Another and related object of the present invention is to eliminate the need for periodically indexing sheet retarder elements, heretofore composed of rubber or emery material, incidental to presenting a fresh or unworn face of the retard element.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principle thereof and what is now considered the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

FIG. 1 is a perspective view of a portion of a printing machine embodying the present invention;

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FIG. 2 is a sectional view of the apparatus as illustrated in FIG. 1;

FIG. 3 is a front elevation of the machine that includes the portion illustrated by perspective in FIG. 1;

FIG. 4 is an end elevation of a sheet feed roller construction in accordance with the present invention and taken substantially on the lines 4-4 of FIG. 5;

FIG. 5 is a front elevation of a sheet retarder element constructed in accordance with the present invention; and

FIG. 6 is a fragmentary section view on an enlarged scale showing the cooperative action between certain feed rollers to be described hereinafter.

The present invention is illustrated as embodied in a printing machine PM, FIG. 3, which is of the kind illustrated in United States Patent No. 2,359,852. In this machine, individual printing devices, bearing embossed type characters, and of the kind shown for example in United States Patent No. 2,132,412, are advanced one-by-one from the bottom of a supply magazine M of the machine. Each such device is arrested in a cycle of the machine at a point immediately under the platen P which defines the printing station of the machine. For those of the printing devices selected to have imprints made therefrom, the platen P is operated so as to produce an impression on a sheet fed to the printing station. Following the cycle of the machine in which an imprint is to be made, each printing device is advanced out of the printing station to a receiving hopper, and the sheet that was printed is also advanced out of the printing station, and in the subsequent cycle of the machine, new printing relationships are established.

The present invention relates to an improvement in the sheet feed mechanism utilized in a machine as PM, although it will be appreciated that the machine PM in the present instance is illustrative of but one kind of machine in which the present invention or variations thereof can be advantageously adopted. Thus, the sheets to be printed in the present instance are assumed to be in the form of envelopes E, FIG. 1, that are cascaded within a supply hopper 10 so as to tend to move by gravity toward the sheet feed means as will be described hereinbelow. The sheets E have the faces or sides thereof to be printed disposed downwardly, and this is the relationship that prevails as each sheet is halted at the printing station. At the printing station, each of the aforesaid printing devices is arrested with embossed type characters on the printing plate thereof disposed upwardly, and with the sheet to be printed disposed in overlying relationship so that the impression is produced on the downwardly disposed face of the sheet. After an envelope as E or other sheet has thus been imprinted, sheet feed means are then effective to advance each printed sheet into a receiving hopper 16, FIG. 1, such subsequent advancing operations being in the nature of that disclosed in aforesaid United States Patent No. 2,359,852. Again, sheets in the form of envelopes E are merely illustrative of the wide variety of sheets that can be fed to or from a printing station and which can be handled in accordance with the present invention, and the improvements disclosed herein can be utilized in association with various different forms of sheet feed mechanism.

The feeding movement of the sheets E is downward and to the right as viewed in FIGS. 1 and 2, and such movement is induced by having the hopper 10 accordingly sloped with the sheet feeding means here involved disposed just to the right of the supply hopper 10 in a mounting structure 11 adjacent the throat or input end of a guideway 12 that leads to the printing station referred to above. The guideway 12 is equipped with sheet advancing means comprising one or more constantly driven belts 13, and hold-down flanges as 14 which maintain each

sheet in operative friction engagement with at least one of the belts 13.

The supply hopper or tray 10 is laterally adjustable to accommodate sheets of differing sizes and also to permit vertical adjustment to vary the degree of downward slope. To this end, a generally U-shaped frame 70 is located beneath the tray 10 and extends rearwardly. The arms 72 of the frame 70 extend in the direction of the mounting frame 11 as will be apparent in FIG. 1 and the free ends thereof are located at the inside faces of the side plates 73 and 74 included in the frame 11. The lower ends of the arms 72, FIG. 2, are pivotally mounted on the axis of a roller 75, and this roller constitutes part of the sheet advancing means which move the sheets to the guideway 12 as will hereinafter be described. Thus, the roller 75 cooperates with a positively driven upper roller to direct a sheet removed from the supply hopper 10 into the entrance throat of the guideway 12, and thereafter the sheet is advanced toward the printing station by the aforesaid belts 13.

The supporting frame or bail 70 may be turned relative to the axis of the roller 75 at different angles, and this is achieved through a pair of vertically disposed adjusting links as 78, FIGS. 1 and 2, which are pivotally connected at their upper ends to related ones of the arms 72. Each link is slotted at 79, and a wing-headed clamping screw 80 has a portion disposed in the slot 79 to clampingly support the related link 78 to the side of a horizontal rail element as R1 located on opposite sides of the machine.

Referring to FIG. 2, it will be noted that a plurality of mounting bars 81, 82 and 83 extend between the arm members 72. The cross bar 82 is used in affording lateral adjustment of elements that afford the bottom support for the tray or hopper 10. Thus, the hopper 10 includes a pair of side flanged elements 90 and 91, FIG. 1, that have horizontally and inwardly directed flanges 91F, FIG. 1, formed at the lower edges thereof to provide the bottom supporting elements of the hopper 10 on which marginal portions of the sheets or envelopes as E are supported. Referring to FIG. 2, each supporting flange 91F is provided with a bracket as 94 secured thereto, and the lower surface of each such bracket is slotted or notched to embrace the transverse supporting rod 82, suitable set screws 95 being provided to apply a clamping force between the related bracket 94 and the cross rod 82. By loosening the screws 95, the members 90 and 91, FIG. 1, can be shifted closer together or farther apart as the case may be on the rod 82, depending upon the size of the sheets to be fed. As explained in Patent No. 2,359,852, a second support rod and related clamping mechanism (not here shown) are utilized in affording lateral adjustment for the flanged elements of the tray 10.

The sheets are fanned or cascaded as shown in FIG. 1 such that the top sheet will have a leading edge in advance of the leading edges of the underneath sheets in the hopper 10. The top-most or leading sheet is to be separated from the remainder incidental to feeding the same into the throat of the guideway 12, and the separating means includes a feed or separating roller 100, FIG. 2, and a stationary lower or retard roller 101 that are related one to another so as to define a bight into and through which the separated sheet is to advance toward the roller 75. The relationship is such that the feed roller 100 is periodically driven to advance the top-most or forward-most sheet in the hopper, and the retard roller 101 is of such nature as to assure that the next rearward sheet is prevented from being advanced in the direction of the roller 75. This retarding action is a positive one achieved by a distinct tooth surface on the retarding roller 101 as will hereinafter be described in detail.

In order to take into account variations in sheet dimensions and, in particular, sheet thickness and surface characteristics, provision is made for exposing the pe-

riphery of the retard member 101 to a selected extent. Thus, in order to expose the peripheral edge of the retard roller 101 to a selected extent with respect to the leading sheet in the hopper 10, guide fingers 102, FIG. 2, are disposed on opposite sides of the retard roller 101, and these fingers are pivoted on the bar 81. The two guide fingers are interconnected by a web plate 103 to be movable in unison, and a coil spring 103S has the upper end disposed in a mounting opening in a block 104 so as to apply a downward force to the plate 103. An adjusting screw 104S has the threaded end thereof acting on a surface of the block 104, and by turning the screw 104S appropriately, the fingers 102 can be raised or lowered to expose less or more of the periphery of the retard element 101.

The block 104 and the guide fingers 102 are freely shiftable on the mounting bars 81 and 83 so as to move with the retard element 101 as it is adjusted along its supporting shaft as will be disclosed hereinafter.

The feeding action of the roller 100 is an intermittent one in a counter-clockwise direction as viewed in FIG. 2 so as to advance successively the leading edge of each withdrawn sheet between the roller 75 and a cooperating upper roller 105. These latter two rollers complete withdrawal of the sheets one by one and advance the same into the entry throat of the guideway 12. During the time that the feed roller 100 is active, the roller 105 is elevated above roller 75 to enable the withdrawn sheet to advance freely therebeneath. After the sheet has thus been advanced, the roller 105 is lowered, producing clamping pressure on the sheet in cooperation with the roller 75 which, it may be noted, is constantly driven in a clockwise direction as viewed in FIG. 2. The way in which these actions are accounted for will be described hereinafter.

The retard roller 101 is adjustably supported in the machine by a shaft 110 having eccentric end elements 111, FIG. 2, supported in the arms 72. The rollers 100 and 101 are slightly spaced at their opposed surfaces. By turning the retard roller 101 about the axes of the eccentrics the retard roller can be moved radially to adjust this spacing.

The roller 100 is mounted and arranged to maintain an established relationship with the retard roller 101 at times when the supply hopper is adjusted. To this end, the roller 100 is mounted on a shaft 130, FIG. 2, which at its opposite ends is journaled in a pair of vertically extending links 131 and 132, FIG. 1, that are inboard of the frame plates 73 and 74. The lower ends of the links 131 and 132 are pivoted on the eccentric elements 111 and are maintained in substantially vertical positions by a pair of positioning links 133 and 134 that have their left-hand ends pivotally connected to the upper ends of the links 131 and 132 by means of a shaft 135 which connects the upper ends of the two links 131 and 132. The right-hand ends of the two links 133 and 134 are pivotally mounted on a shaft 136 which is stationarily supported between the two mounting plates 73 and 74 as shown in FIG. 1. The eccentrics 111 are carried in the arms 72 as was mentioned, and adjustment of shaft 110 is as described in Patent No. 2,359,852. It will be seen from this that when the mounting frame 70 is raised or lowered, the links 131 and 132 are likewise moved as will be evident from FIG. 2, and this maintains the predetermined relationship between the roller 100 and 101.

However, it should be noted that means are afforded to move the roller 100 to an adjusted position. Such is attained through use of a U-shaped bracket 140, FIG. 1, which is hung on the cross rod 135 in such a manner that the leg elements 141 of the bracket 140 depend below the rod 135. The lower ends of the leg elements 141 embrace the shaft 130 which carries the separator roller. A thumb screw 144 is threadedly mounted in the horizontal or bight portion of the U-shaped member 140, and the threaded end of this screw is adapted to in effect apply

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a holding force to a sleeve 143, FIG. 2, that surrounds shaft 135 to thereby maintain the yoke 140 in an adjusted position as will be evident in FIG. 2.

It was mentioned that an intermediate drive is transmitted to the separator roller 100. This is an automatic operation during the course of normal, continuous operation of the machine, but the arrangement is such that rotation can be imparted to the roller 100 manually as well. Thus, referring to FIG. 1, a one-way rack and pinion drive RD is afforded to impart a counter-clockwise drive to the shaft of roller 100. As is described in United States Patent No. 2,359,852, such operation is attained automatically through the medium of lever 170 (which carries the rack) and a shaft 171, and intermediate connections are afforded between shaft 171 and lever 170, shaft 171 being rocked each time the printing mechanism of the printing machine is operated through a printing cycle. Additionally, a knob 172 is affixed to the upper end of lever 170, and this enables a manual withdrawing action to be imparted to the roller 100, as described in Patent No. 2,359,852.

Rocking movement of shaft 171 is also used to drive the upper advancing roller 105. There may be several of these rollers, each supported on a shaft 150, and shaft 150 in turn is carried at the ends of arms 151, FIG. 2. The arms 151 are fixed to a rock shaft 152, and by operating this shaft in a manner to be described below the upper advancing roller 105 is elevated to an inactive position or lowered to an active position where it bears against the lower advancing roller 75 which is of knurled form as will be evident in FIG. 1, noting that the upper advancing roller 105 is rubber surfaced and is constantly driven during operation of the machine.

The roller 105 is urged toward its lower or active position by spring means 155, FIG. 2, anchored to the arms 151 supported on shaft 150. In producing the desired up and down motion of the arms 151, a cam plate 160, FIG. 1, is located outward of the frame plate 73 and has one end thereof pivoted to arm 170. A guide slot 161 is formed in the cam plate 160, and a guiding element carried on the projecting end of shaft 152 is located in the slot 161. The cam plate 160 has a second cam slot 162 formed therein, and the lower edge of this slot is engaged by a roller 163 carried on the end of an arm 165, FIG. 1, in turn fixed to shaft 150. The springs 155 tend to urge the cam roller 163 into engagement with the lower edge surface of the cam slot 162. When lever 170 is in the position shown in FIG. 1, the upper advancing roller 105 is engaged with the constantly driven or lower advancing roller 75 and roller 163 is spaced slightly from the lower surface of slot 162. On the other hand, when lever 170 is shifted to the left as viewed in FIG. 1, the upper rise at the lower portion of the cam slot 162 strikes roller 163 causing rock shaft 152 to be rocked clockwise as viewed in FIG. 2 thereby disengaging rollers 105 and 75. This therefore occurs at the time roller 100 is driven to feed its withdrawn sheet to the right toward roller 75 as viewed in FIG. 2, and when lever 170 returns during the course of oscillation of shaft 171, roller 105 is lowered and a pressure relationship is established on the withdrawn sheet between rollers 75 and 105, whereupon the withdrawn sheet is advanced with a positive force to the right into the guideway as viewed in FIG. 2. During this course of events, the next sheet to be withdrawn has had a positive retarding action applied thereto in a novel manner, preventing the withdrawal of two sheets, as will now be described.

Under the present invention, the retard roller 101 or equivalent retard element or sheet engaging member has a roughened or toothed surface afforded by a scattering of sharp-edged, long-wearing abrasive grains bonded to the main supporting body of the sheet supporting or retard element. Advantageously, such roughened or toothed surface is afforded by small grains of tungsten carbide or like abrasive material copper-brazed to a metallic body,

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and illustrative of this is tungsten carbide of 80 mesh size copper-brazed to a steel supporting body. The distribution of the grains need be no more than a single layer of elemental grains with considerable spacing between grains up to about seventy percent coverage of a unit of area of the supporting body. About three percent coverage is the minimum. Grain size can be varied from 24 mesh to 320 mesh. Tantalum carbide and titanium carbide can be used as substitutes, especially in view of the fact that these two abrasives together with the preferred tungsten carbide can be copper-brazed or silver soldered to a steel supporting body, or can be bonded to steel using an epoxy bonding resin. The following table condenses particle sizes and distributions that are within the purview of the present invention, such being applicable to particles of titanium carbide, tantalum carbide or tungsten carbide bonded to a ferrous metal supporting body by any one of the above mentioned bonding techniques:

TABLE I

Mesh Size Range	Particle Size (inches)			Area Coverage (in. ²)
	Min.	Max.	Average	
24 to 320-----	0.018 0.0006	0.043 0.0013	0.027 0.0024	0.033 to 0.700 0.033 to 0.700

The supporting body for the retard element or sheet engaging member 101 is preferably of steel 200, FIGS. 4-6, advantageously in cylindrical form, and the individual grains of hard abrasive material such as tungsten carbide AG are bonded thereto in a random, mono-particle thickness layer by a thin copper braze film 202, such copper braze being compatible with the ferrous metal supporting body 200 and the carbide grains. Equivalent materials can be used in view of the physical requirements apparent hereinafter.

The support body 200 for the abrasive grains is advantageously of sleeve form and is secured to a collar or sleeve 205, FIGS. 4 and 5, which in turn is adjustably mounted on the shaft 110. Thus, the collar 205, FIG. 5, projects beyond one side of the retard roller 101, and is provided with a plurality of openings 210 in spaced relation about the circumference thereof enabling a set screw to be passed through a selected one of the openings 210 to clamp the retard roller in a selected position on the shaft 110, FIG. 2.

The abrasive grains AG are essentially non-wearing under the circumstances, and hence do not become smooth or glazed during extended use of the machine. Moreover, being discontinuous, widely spaced, and only of mono-particle thickness projecting from the supporting surface 200, the abrasive grains do not become clogged by such flecks as might loosen from the sheets being fed. In other words, the retard member or sheet supporting element 101 under the present invention is effective practically for the life of the machine and does not glaze over or become flattened due to use, and hence requires no refurbishing either from the standpoint of replacement or periodic indexing to present a fresh face.

The action of the carbide abrasive grains AG can be readily visualized by reference to FIG. 6. The top-most sheet S1 being withdrawn overlies the next sheet S2 to be withdrawn by the cooperating action of the members 100 and 101. The sheet S1 glides on the sheet S2 and is advanced over the toothed surface of roller 101 by roller 100, but while this is occurring, the sharp points or edges of the retard member 101 act to prevent the sheet S2 from being so advanced. In the next feeding cycle, sheet S2 alone is presented to the bite of rollers 100 and 101 (slightly spaced) and is free to glide on the next bottom-most sheet S3 which in turn has its leading edge positively retarded by the grains AG. By having resort to tungsten carbide or the like in a thin, random scattering

on the surface of the sheet supporting member as 101, a positive retarding action is attained and contact pressure need not be established between the cooperating elements 100 and 101 which engage opposite sides of the sheet being fed or advanced. It will be appreciated that the abrasive grains have no objectionable wearing action on the sheets, since the essential requirement is that these only project sufficiently and be of sufficient array as to present a retarding line of teeth in the path of the leading edge of the underneath or next-to-be-advanced sheet. In fact, the sheet being advanced is only contacted by a thin line of abrasive grains beyond those halting the next-to-be-advanced sheet.

From the foregoing it will be seen that I have made possible a sheet retarding or supporting member in a machine of the kind described that need not be indexed periodically to the degree heretofore required to present a fresh, unworn or unclogged face. Thus, I resort to long-wearing, naturally sharp abrasive grains in a sparse scattering substantially of mono-particle thickness and like space distribution on the supporting surface. The present invention can also be advantageously employed in other environmental sheet feeding operations in printing machines other than specifically disclosed herein by way of illustration, and hence while I have illustrated and described a preferred embodiment of my invention it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a printing machine wherein sheets to be printed and the resultant printed sheets are respectively to be fed toward and from the printing means, sheet feed means comprising a rotatable feed roller and an opposed member associated therewith defining a feed bight spaced from the printing means of the machine, said opposed member having a surface engageable with one face of such a sheet and characterized by projecting sharp-edged abrasive particles bonded thereto substantially in a mono-particle thickness distribution.

2. In a printing machine wherein sheets to be printed

and the resultant printed sheets are respectively to be fed toward and from the printing means, sheet feed means comprising a rotatable feed roller and an opposed roller associated therewith defining a feed bight spaced from the printing means of the machine, said opposed roller including a metallic body having bonded to the surface thereof in projecting relation individual particles of sharp-edged abrasive material, said particles being distributed substantially in a single thickness layer to expose the sharp edges thereof to such a sheet.

3. In a printing machine wherein sheet to be printed and the resultant printed sheets are respectively to be fed toward and from the printing means, sheet feed means comprising a rotatable feed roller and an opposed retard member associated therewith and defining a feed bight spaced from the printing means of the machine, said retard member including a metallic-supporting body having brazed to the metallic surface thereof individual particles of long-wearing tungsten carbide abrasive material distributed substantially in a mono-particle layer to leave spaces between the individual abrasive particles exposing sharp edges thereof to the sheet.

4. In a printing machine wherein sheets to be printed and the resultant printed sheets are respectively to be fed toward and from the printing means, sheet feed means comprising opposed sheet feed members defining a sheet feed bight spaced from the printing means of the machine, one of said opposed members having a surface engageable with one face of such a sheet and characterized by projecting sharp-edged abrasive particles bonded thereto, said particles covering not more than about seventy percent of the surface area of the supporting body associated therewith, said particles being selected from the group consisting of tungsten carbide, tantalum carbide and titanium carbide and having a particle size in the range of about 24 to 320 mesh.

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