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# ROBUST MEDIA ROLL PARKING CONTROL

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# Robust Media Roll Parking Control

**Abstract:** A robust media Parking mechanism allows each roll of print media in a multi-roll printing system to be placed in a Parked position that allows it to be subsequently moved automatically to a Ready-to-Print position without operator intervention.

This disclosure relates to the field of printers.

A technique is disclosed that implements a robust media Parking mode for each roll of print media in a multi-roll printing system in order to allow automatic roll switching without user intervention.

Some printers have a multi-roll configuration in which it has two rolls simultaneously loaded and available. The rolls are installed in respective roll drawers with lateral hubs that connect the roll to a servo controller Rewinder mechanism. The two roll drawers are arranged one on top of the other, and both drawers are disposed in the printer below the print platen. Thus media from a roll is fed and drawn upward, against gravity, to the print platen. An automatic roll switching capability enables the printer to switch the active roll being used for printing. This capability includes a mechanism for "parking" a roll of media - that is, sending the front edge of a first roll to a position where it leaves the media path of the printer clear for the second roll to be moved to the Ready-for-Print position, but allows the media on the first roll to subsequently be automatically taken up again for printing. The Parking position of each roll is located inside its roll drawer, where an optical barrier sensor can see it. Each drawer includes a motorized Picking Arm mechanism that, when moved forward, tractions on the media to move it forward up to the printing platen. Because the vertical paper path that extends upwards from each roll drawer up to the print platen, it is challenging to control the movement of a media roll that is being returned from its Ready-to-Print position to its Parking position without losing the media in the process and requiring subsequent operator intervention to reload the media.

According to the present disclosure, and with reference to the Figure, a robust media roll parking control with early media fall detection and automatic recovery is achieved by using a servo-motorized Picking Arm system and a servo-motorized Rewinding system along with their corresponding encoders.

Depicted are a roll drawer 10 housing a roll 20 of print media 30. The roll 20 is mounted on a spindle connected to a Rewinder 40. A Picking Arm mechanism shown generally at 50 is movable between positions 50A-B. The media 30 is drawn along an upward media path 60 and onto the print platen for printing.

The Picking Arm mechanism 50 can traction media forward, but not backward, by application of a positive signal that moves the Arm forward into position 50A and tractions the media 20 once its rollers touch it. Applying a negative signal retracts the Arm from the media into position 50B, where its rollers move freely without conveying any movement to the media 20. When the Picking Arm mechanism 50 is in the picking position 50A with its rollers touching the media 30, the Arm behaves as a media holding mechanism. If an external force on the media 30 tries to rewind it (e.g. the Rewinder 40 within the roll drawer 10 beneath the platen), the Picking Arm acts as a brake and does not let the media 30 move. When media 30 is drawn upwards from the roll 20 into the Ready-to-Print position, the media 30 is held by a Grit Roller mechanism at the print

platen level that controls media advances for printing. When moving the media backward beyond the Grit Roller position, the Grit Roller no longer holds the media and the only means for holding it is the Picking Arm mechanism 50. So in order to park the media, the Rewinder 40 rewinds the media 30 back onto the roll 20 with the collaboration of the Picking Arm mechanism 50, which retracts back to position 50B release the media 30 and allow the Rewinder 40 to rewind it. Because gravity will pull the media 30 downward along the media path 60 when it has been released, the Picking Arm also moves quickly to position 50A to pick the media 30 again if a movement faster than the requested speed is detected. It does so quickly, before the media 30 falls beyond the limit point at which the Picking Arm mechanism 50 can hold it. In other words, the Picking Arm mechanism 50, using only a single motor, implements a highly-responsive release-brake behavior based on the speed at which the media 30 is moving downward along the media path 60 as it is being rewound. If it did not do so, the media 30 would be unloaded, instead of parked, adversely affecting productivity and dependability because a printer operator would be needed to manually reload the media 30 in the printer.

A special servo control for the single motor of the Picking Arm during a Parking operation implements this functionality in which the Picking Arm mechanism 50 acts as a very fast brake-release mechanism while the Rewinder 40 applies a constant pulling voltage to rewind the media 30. This special parking behavior uses special servo constants to achieve the brake-release behavior. It is a derivative control system in which the servo responds only to the speed error, but not to the position error. In other words, it is like a PID control system with the Proportional Term and Integral Term constants set to 0 (Kp=0 and Ki=0). The derivative term and its constant Kd are tuned so as to perform the release-brake effect. The Kd value should be selected to be big enough so that it ensures that when the speed Error is maximum, the applied sign retracts the PickingArm from the media. Therefore, the Kd value will depend on the actual target parking speed and the frictions of the Picking Arm mechanism. The Kp servo constant is set to exactly zero to ensure that the PickingArm mechanism 50 does not react to position error, thus keeping the rollers in the Picking Arm mechanism 50 in contact with the media 30 and moving with it as the media is rewound. The speed of the rollers will be the speed of the media 30 itself. Encoders are read to measure the precise actual position of the media front edge, rather than estimating it from other characteristics such as speed. When it has been detected that the media 30 has achieved the parked position, the servo parking movement is halted, a Picking forward movement to move the Picking Arm mechanism to position 50A is requested so as hold the media before it completely returns to the roll 20, and the Rewinder 40 is stopped.

The disclosed technique advantageously enables robust and reliable automatic roll switching mechanism for a drawer-based multi-roll printer. This allows unattended operation for producing the entire length of the sum of the simultaneously loaded rolls without user intervention. It provides a cost-effective and more reliable solution because it controls media using a single mechanism (the Picking Arm) and a single motor, rather than multiple mechanisms and/or motors or actuators. It does not require tuning for different media types because the control is based on real-time encoder measurements rather than utilizing media characteristics like type, thickness, slipperiness, etc.

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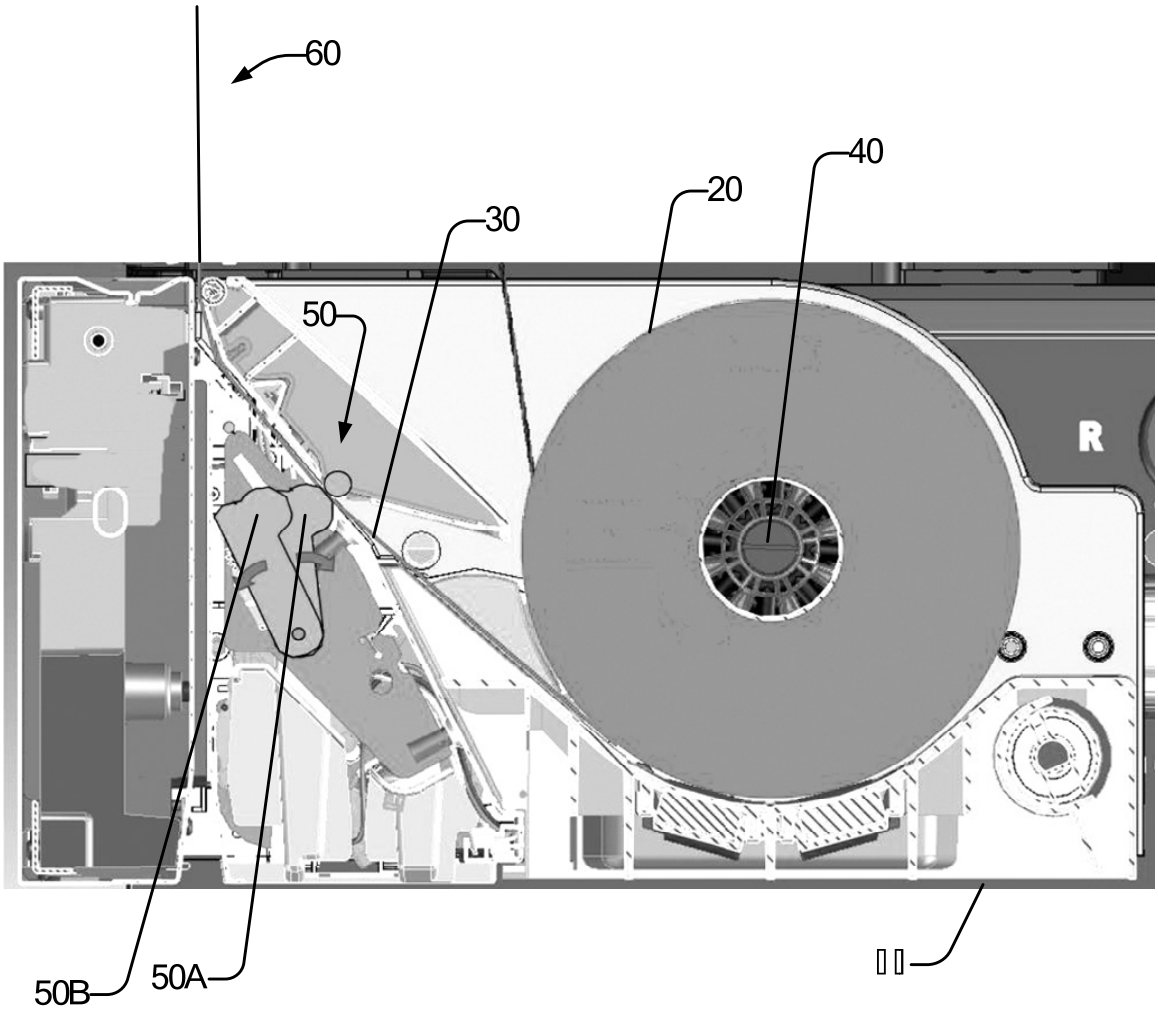
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