# TAPE WINDER

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 USC §119(e) to U.S. Provisional Patent Application 60/046,353 filed on May 13, 1997, the entirety of which is incorporated by reference herein.

## FIELD OF THE INVENTION

This invention relates generally to a device for reviewing information printed on a roll of paper tape or other rolled flexible material, and particularly to a reeling device for winding a length of tape from one roll to another so that information printed thereon may be reviewed.

## BACKGROUND OF THE INVENTION

It is common practice in retail stores, restaurants, and the like to review cash register tapes in order to monitor the transactions recorded on such tapes. This is usually done by observing the tape as it is manually unwound from the used roll. Alternatively, the prior art illustrates devices such as those shown in U.S. Pat. No. 4,116,468 to Marten, U.S. Pat. No. 4,469,287 to Pfster et al., and U.S. Pat. No. 4,753,396 to Neumann for winding tape from a supply roll to a take-up roll, and allowing review of the tape between these rolls. However, the tape winding devices of the prior art suffer from several disadvantages.

First, the spindles upon which the tape rolls ride tend to be mounted on the tape winders in enclosed fashion, wherein the spindles are journaled within apertures in the sidewalls of the tape winders. This tends to make it difficult to remove the spindles from the sidewalls of the tape winders so that tape can be rapidly and easily loaded and unloaded from the spindles.

Second, the tape winders of the prior art lack means for tensioning the tape as it is being reviewed so that slack does not develop in the tape. If slack develops, the tape can become difficult to read and mark, and it can also cause the tape to become dirtied or ripped if the tape contacts objects outside the tape winder. Most commonly, slack will develop in a tape winder owing to the rotational inertia of the spindles upon which the tape rides. One spindle of a tape winder will almost invariably be carrying a greater amount of tape than the other spindle, and therefore that spindle will have greater inertia. As a result, the heavier spindle will tend to resist cessation of rotation when its motor is deactivated, with the lighter spindle coming to an earlier stop and the heavier spindle continuing to rotate for at least several turns. Where the heavier spindle is the take-up spindle, this is not of great concern because the heavier take-up spindle will simply pull a small length of additional tape from the supply spindle. However, when the heavier spindle is the supply spindle, this tends to cause the supply spindle to eject a length of slack tape. Slack can also develop due to differences in the sizes of the tape rolls borne by each spindle. As an example, a larger diameter tape roll will supply excess tape to a smaller diameter tape roll rotating at the same speed, resulting in slack. Similarly, a smaller diameter tape roll cannot supply sufficient tape to a larger diameter tape roll traveling at the same speed, resulting in tension and possible ripping of the tape.

Third, the tape winders of the prior art also have the problem that they do not accommodate tape rolls having differently sized axial bore diameters, as when a tape is wound about a spindle which is larger or smaller than standard size, or when the tape at the center of the roll is damaged or creased. Quite often, the axial bores at the centers of tape rolls do not have consistent sizes, and therefore the bore of a particular tape roll may be too large to tightly fit over a given spindle or too small to fit over a spindle at all.

There is a need in the art for a tape winder which facilitates review of elongated flexible materials such as cash register tapes; which maintains the tape in a spooled condition after review; which addresses the aforementioned disadvantages of the prior art devices; and which is compact, reliable in operation, and easy and inexpensive to manufacture, operate and repair.

## SUMMARY OF THE INVENTION

The invention is directed to a tape winder in accordance with the claims set out at the end of this disclosure. In one preferred embodiment, the tape winder includes a supply spindle and a take-up spindle wherein the take-up spindle takes up tape from the supply spindle. Each spindle is rotatably mounted within a pair of sidewalls, preferably by providing a slot in each sidewall wherein the ends of the spindle axle may be removably inserted. Each slot terminates in a pocket region, and drive means for releasibly engaging and rotatably driving the spindles are located on the sidewalls adjacent each pocket region. Thus, when the ends of the spindle axles are inserted within the slots to rest within the pocket regions, they are rotatably received by the pocket regions, and the spindles are releasibly engaged by the drive means so that they may be rotatably driven to wind tape from the supply reel to the take-up reel and vice versa. The tape winder is easy to use because the spindles may be rapidly inserted and removed from the winder, allowing exceptionally convenient installation and replacement of tapes on the spindles.

In another preferred embodiment, a tape winder is provided in accordance with the tape winder described above, but the slots in the sidewalls include a narrowed throat region adjacent the pocket region. The axles of the spindles are snapfit (or closely fit) through the throat region to rest within the pocket region. The throat region retains the axes of the spindles and prevents them from being disengaged from the drive means or ejected from the slot when the drive means are actuated and/or suddenly accelerated. This throat region can be integrally formed as a detent on the surface of the slot, or it can be provided by a separate structure mounted in association with the sidewalls, e.g., a key which provides lands or protrusions on either or both sides of the slot to form a narrowed throat region adjacent the pocket.

In another preferred embodiment, the tape winder includes tensioning means in association with either or both of the spindles for maintaining tension on the tape during winding, and after the drive means are deactivated. The tensioning means prevent slack from generating and thereby insure that the tape remains protected within the tape winder, and at the same time, they maintain tension at a level such that ripping or fraying of the tape does not result. This may be done by simultaneously driving both spindles and driving the supply spindle with lesser torque than the take-up spindle. The relative difference in torque between the spindles will cause the take-up spindle to maintain tension on the tape. The supply spindle can even be driven with low-magnitude negative torque, i.e., it can be driven in a direction opposite that of the take-up spindle. In this case, the high-magnitude positive torque on the take-up spindle