United States Patent [19]

Reynolds

[11] **3,738,124**

[45] **June 12, 1973**

[54] **KNITTING MACHINE STOP MOTION**

[75] Inventor: **Leslie E. Reynolds**, Greenville, S.C.

[73] Assignee: **Deering Milliken Research Corporation**, Spartanburg, S.C.

[22] Filed: **Apr. 8, 1971**

[21] Appl. No.: **132,351**

[52] **U.S. Cl.** **66/163**

[51] **Int. Cl.** **D04b 35/12**

[58] **Field of Search** 66/86, 158, 161, 66/163

[56] **References Cited**

UNITED STATES PATENTS

3,530,690	9/1970	Nickell et al.	66/163
3,628,030	12/1971	Fertig	66/163
3,575,515	4/1971	Fertig	66/163
3,584,225	6/1971	Lindemann et al.	66/163 X
2,438,365	3/1948	Hepp et al.	66/163

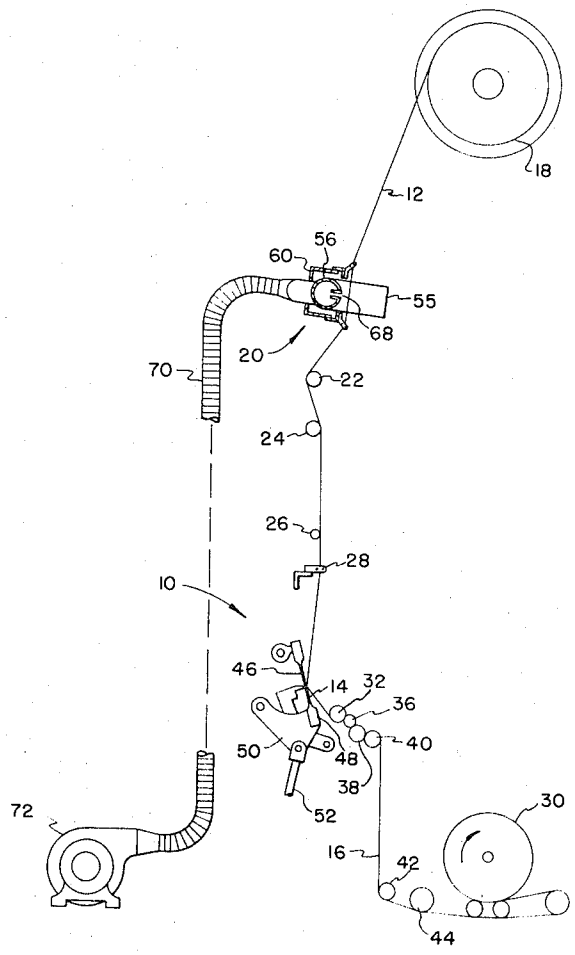
Primary Examiner—Ronald Feldbaum

Attorney—Norman C. Armitage, H. William Petry and Earle R. Marden

[57] **ABSTRACT**

Method and apparatus to detect a yarn break in a knitting machine by blowing the broken end from the warp sheet into the view of a photoelectric detection system which will stop the knitting machine when the broken end is detected.

1 Claim, 4 Drawing Figures



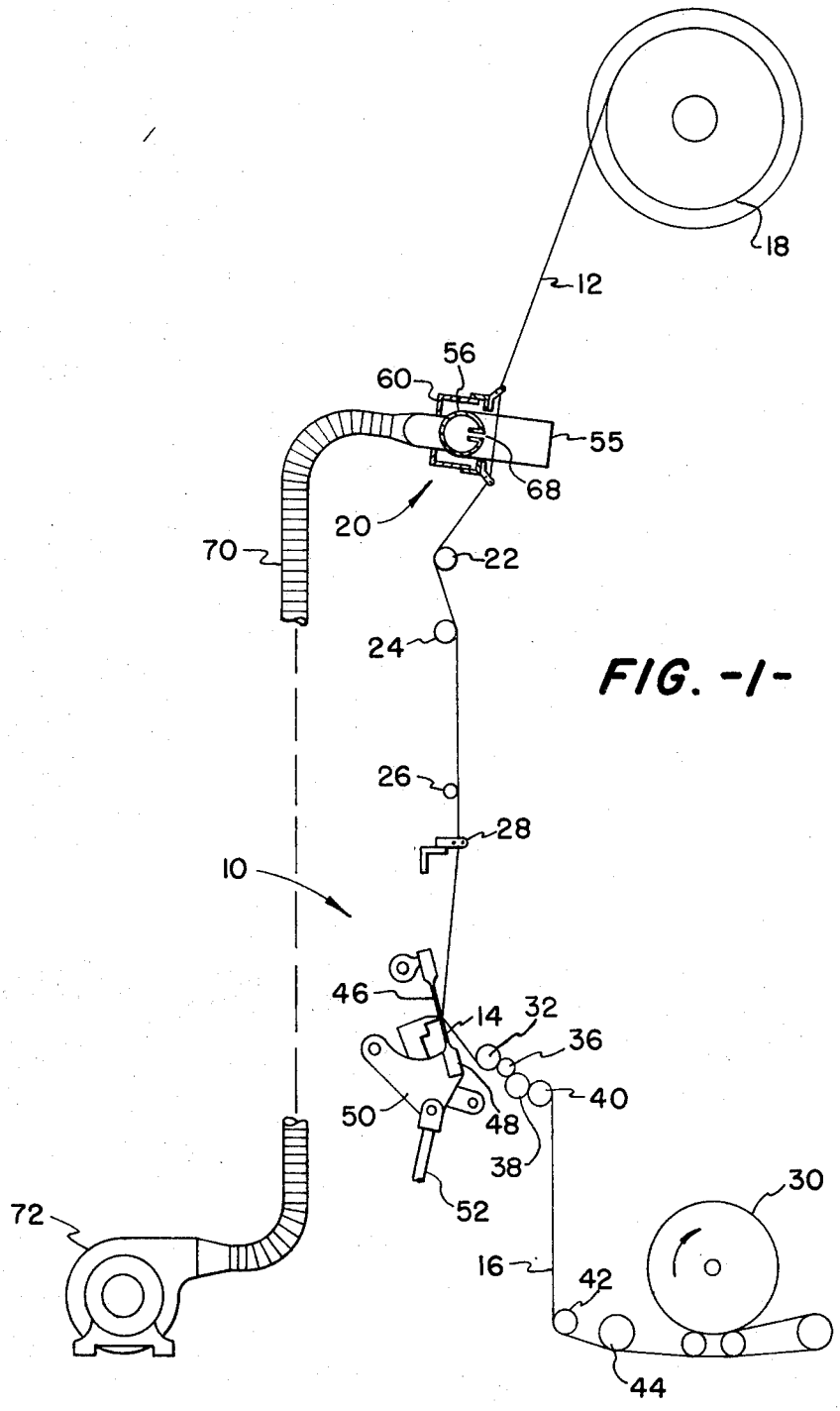


FIG. -1-

INVENTOR.
LESLIE E. REYNOLDS
BY
Earle A. Marden
ATTORNEY

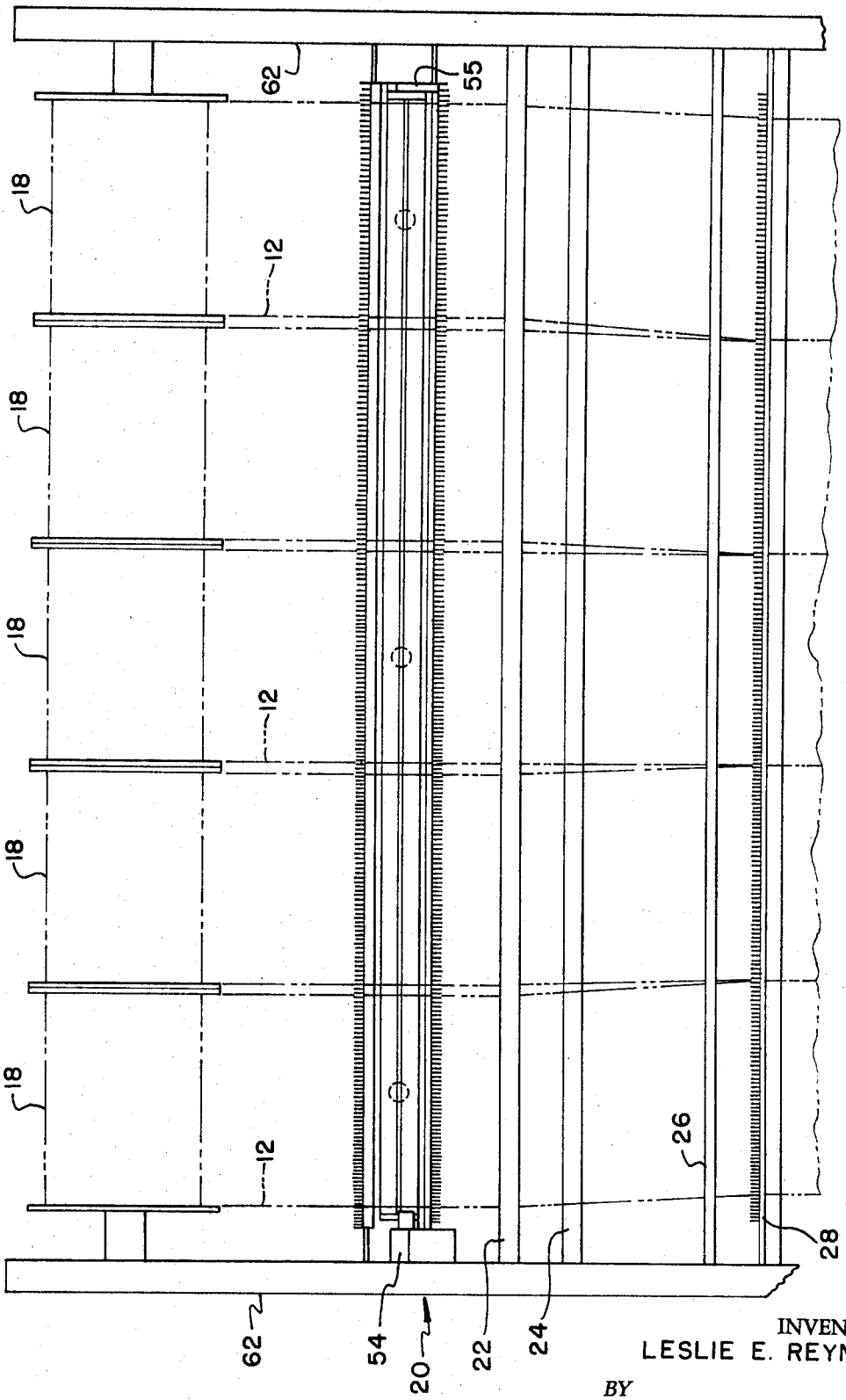
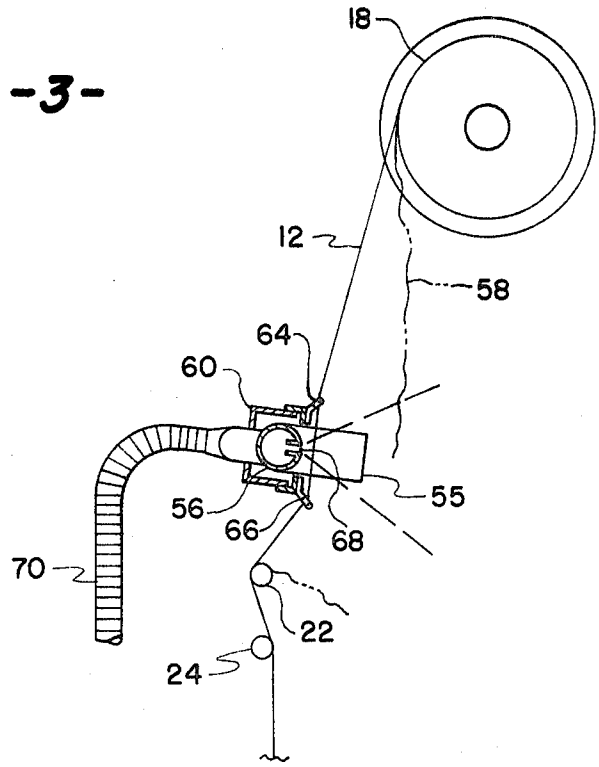


FIG. -2-

INVENTOR.
LESLIE E. REYNOLDS
BY
Earle R. Marden
ATTORNEY

FIG. -3-



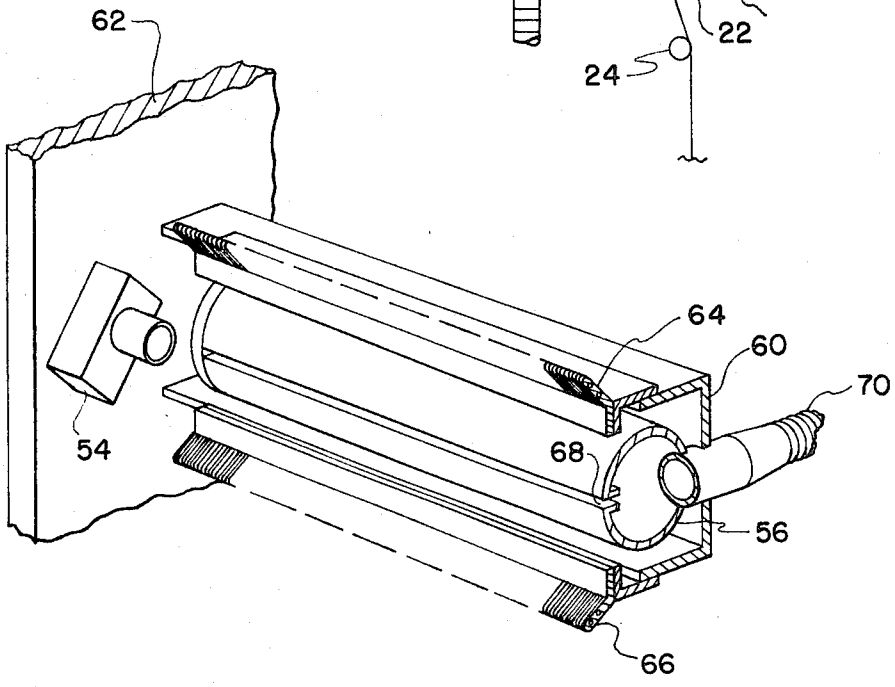


FIG. -4-

INVENTOR.
LESLIE E. REYNOLDS

BY
Earle R. Marden

ATTORNEY

KNITTING MACHINE STOP MOTION

The present invention relates to yarn inspection apparatus for continuously monitoring a large group of yarns arranged to move substantially in unison in side-by-side relation in the form of a warp or warps in one or more feed planes, the groups of yarns in each plane being hereinafter referred to as a yarn sheet, and detecting occurrence of any broken yarn ends in the yarn sheet for producing a defect signal.

Feeding of yarns in large groups as yarn sheets occurs in many different types of yarn handling apparatus, such as knitting machines, particularly of the tricot or warp knitting machine type, in weaving machines, in feeding of yarns from a warping machine to the beam or beams of knitting machines, and similar yarn making and textile manufacturing installations. When breakage occurs in any of the yarns making up such a yarn sheet, the sudden release of tension on the yarn, its twist characteristics, and the condition of the yarns in such yarn sheets cause the broken yarn end to engage and become entangled with or cling or adhere to an adjacent yarn rather than the broken yarn end falling freely out of the plane of the unbroken yarns. Immediate detection of any broken yarn end is essential for a number of reasons, as to avoid costly waste from production of defective fabric by the knitting machine into which the yarns are being fed, and to avoid rapid multiplication of yarn breakage as broken yarns cling to adjoining yarns and exert stresses thereon, which would increase the time required to correct the breakage situation and place the knitting machine back in service. Mechanical stop motions such as have been heretofore used in some types of textile machines having a relatively small number of yarns in each warp sheet are not readily suitable for other types of textile machines, such as tricot knitting machines and the like devices having several thousand yarns in each yarn sheet, because of the lack of sufficient space for the yarn sensing elements of such mechanical stop motions and because their effective use usually requires the released portion of the broken yarn to normally move freely beyond the plane of the yarn sheet.

Heretofore, it has been proposed to provide such textile knitting machines with photoelectric broken end detectors, wherein a light beam is directed transversely across the width of the yarn sheet and is spaced slightly to one side of the plane of the yarn sheet, in association with some type of pressurized air tube located adjacent the opposite side of the yarn sheet directing air currents therethrough in a direction to propel any broken yarn ends through the light beam so as to vary the intensity thereof and produce an output signal from the photocell indicating detection of the broken yarn. Such systems, however, have been subject to considerable problems, due to the long light path involved, the considerable vibration present in such textile machines and the difficulty of making such optical detection systems compatible with this vibration, the difficulty of detecting very fine deniery yarn as now frequently used in such textile machines over the long light paths involved, the vulnerability of such systems to respond to spurious signals, because of their sensitivity to electrical surges from starting and stopping of other machines, line voltage fluctuations, and the presence of particles of dust and lint in the region of the detecting system. Also, it is difficult to find appropriate places to locate both the sizable light transmitting and light receiving units of such systems in the limited space available in knitting machines, as the machine parts frequently restrict severely the space where the yarn can be monitored. Additionally, the difficulties of alignment and preservation of alignment of such devices, and the high skills required for realignment of such systems when they get out of adjustment, have all posed serious practical problems in attempted commercial use of such optical broken yarn detectors. Examples of prior patents disclosing this type of optical broken yarn detector systems are found in U. S. Pat. No. 2,438,365 to Hepp, and U.S. Pat. No. 2,711,093 to Edelman et al.

It is therefore an object of the invention to provide a photoelectric broken end detector which is efficient in operation and properly located in relation to the yarn sheet of a knitting machine to consistently locate a broken end and stop the knitting machine when located.

Other objects and advantages of the invention will become readily apparent as the specification proceeds to describe the invention with reference to the accompaning drawings, in which:

FIG. 1 is a schematic side view of a knitting machine equiped with a photoelectric broken end detector;

FIG. 2 is an elevation view of a portion of the knitting machine looking into the take-up side of the machine;

FIG. 3 is a side elevation view of a portion of the knitting machine showing a yarn end break; and

FIG. 4 is a cut-away perspective view of the air support tube.

Looking now to FIGS. 1 and 2, a conventional warp knitting machine 10 is shown modified in a manner hereinafter described. Warp yarn 12 is supplied to needle bar 14 for knitting into knit fabric 16 from warp beams 18 successively over broken end detector 20, guide bars 22, 24 and 26 and sley bar 28. The knit fabric 16 is delivered from needle bar 14 to the cloth roll 30 under quality roll 32, over roll 36, under tension roll 38, over tension roll 40, and under guide bars 42 and 44 to the take-up roll 30.

Looking at FIG. 1, the knitting operation is only schematically shown since the particular kniting operation is not part of the invention. Knitting bars 46 (actuated through suitable linkage not shown) cooperates with needle bar 14 to form the knitted fabric. Needle bar 14 is carried in arms 48 which are fastened in a rocker shaft 50. Needle bar 14 is driven by pushrod 52 which is driven by suitable drive linkage (not shown). The drive for the cloth roll 30, needle bar 14 and warp beams 18 can be from the same main drive through suitable gearing or the drive for each can be separate, if desired.

The photoelectric broken end detector 20 per se is commercially available and operates basically in a manner described in U. S. Pat. No. 3,530,690 and consists of a detector beam assembly 54 which directs a high intensity light beam toward the retro-reflective target 55 to return the beam to the detector assembly 54. When a warp end breaks, air from air manifold 56 blows the yarn end 58 (shown in phantom in FIG. 3) between the detector beam assembly 54 and the retro-reflective target 55 to generate a signal from the photo-transitors of the detector beam assembly 54 in the manner taught in U. S. Pat. No. 3,530,690, supra. This signal can then be employed to actuate an audible signal device or actuate a stop motion on the knitting machine.

It has been found that the broken end detector **20** has to be properly located in order to be efficiently employed to detect all ends that may break. For best operation of the detector **20,** it should be located at a position where the warp yarns are substantially parallel to and spaced from one another to prevent entanglement when air is blown from the air manifold **56** to blow out the broken end. To this end a U-shaped bracket member **60** is mounted to the frame **62** of the knitting machine **10** below the warp beams **18** and has sley points **64** and **66** mounted on the top and bottom to maintain the warp yarns **12** substantially parallel and spaced from one another. The air manifold **56** is mounted in the U portion of the member **60** with the air outlet slot **68** directed towards the back of the sheet of warp yarns **12.** Air is supplied to the air manifold **56** by an air hose **70** which at one end is connected to the air manifold and at the other end to a fan or air compressor **72.**

As discussed previously, the broken end detector assembly is located near the warp beams so that the sley points **64** and **66** can maintain the warp ends substantially parallel to and spaced from one another since it is necessary as the warp yarn is being knit into fabric to bring the warp ends in towards one another since the needles of the knitting machine are closely spaced to one another. This location allows room for the broken warp end to be blown into the light path of detector

beam assembly **54** without adhering to the other adjacent warp ends.

Although I have described specifically the preferred embodiment of my invention. I contemplate that changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the scope of the claims.

That which is claimed is:

1. Apparatus for detecting broken yarns in a yarn sheet of a plurality of warp yarns from a warp beam of a knitting machine comprising:

a warp beam, a plurality of knitting needles, means to supply yarn from said warp beam to said needles, a U-shaped support member supported between said warp beam and said needles, said support member being supported adjacent said warp beam and having an air manifold supported thereby, a sley bar mounted above and below said air manifold to maintain a plurality of yarns separate and parallel to one another, means mounting a photoelectric detection means in front of said air manifold and means supplying air under pressure to said air manifold to blow a broken yarn end into the path of a light beam from said photoelectric detection means.

* * * * *