R. W. SCOTT & H. SWINGLEHURST.

KNITTING MACHINE FOR NARROW WEBS.

APPLICATION FILED AUG. 12, 1912.

1,237,106.

Patented Aug. 14, 1917.

3 SHEETS—SHEET 1.

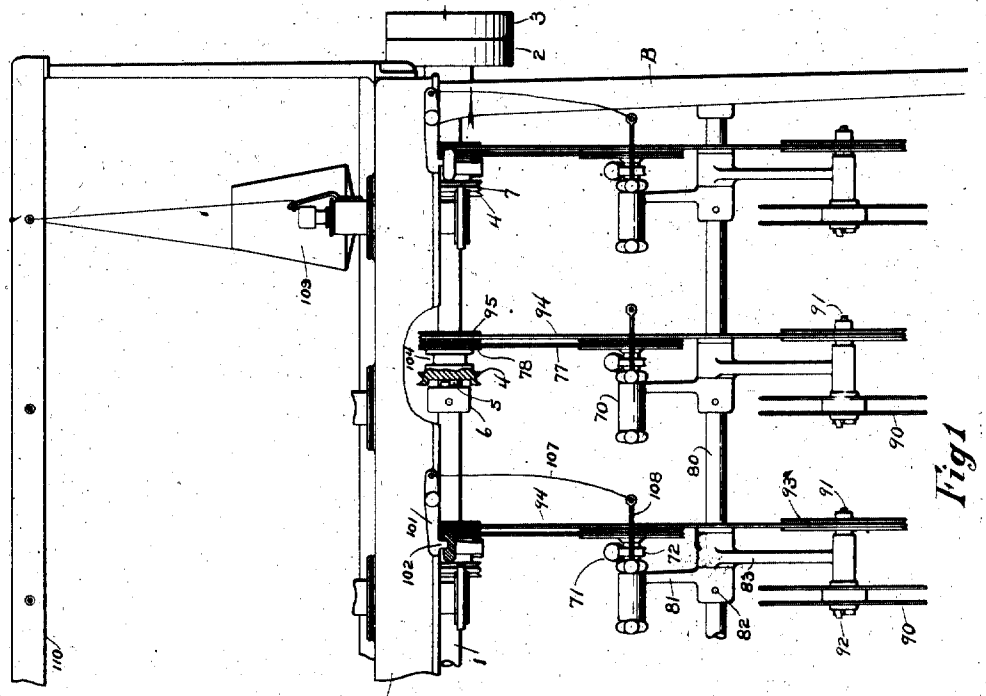

Fig 1

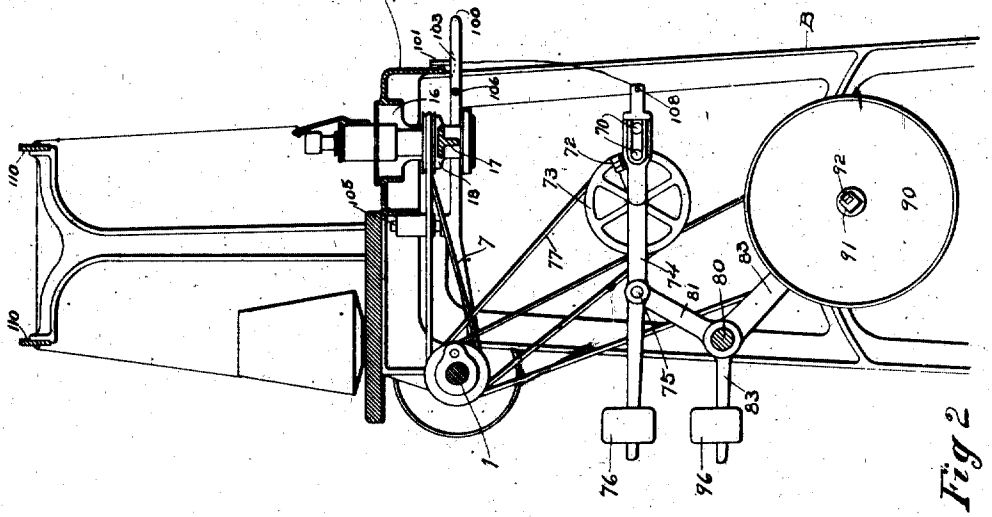

Fig 2

Witnesses
Walter Larbin
Mary F. Griffin

Inventors
Robert W. Scott
Harry Swinglehurst
by Robert C. Sims
their attorney

R. W. SCOTT & H. SWINGLEHURST.

KNITTING MACHINE FOR NARROW WEBS.

APPLICATION FILED AUG. 12, 1912.

1,237,106.

Patented Aug. 14, 1917.

3 SHEETS—SHEET 2.

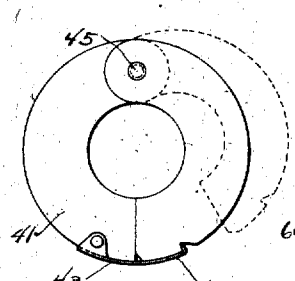

Fig 5

Fig 3

Fig 4

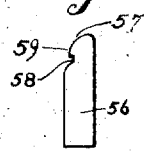

Fig 8

Witnesses

Walter Lapkin

Mary J. Griffin

Inventors

Robert W. Scott

Harry Swinglehurst

by Robert C. Clark

Their Attorney

R. W. SCOTT & H. SWINGLEHURST.

KNITTING MACHINE FOR NARROW WEBS.

APPLICATION FILED AUG. 12, 1912.

1,237,106.

Patented Aug. 14, 1917.

3 SHEETS—SHEET 3.

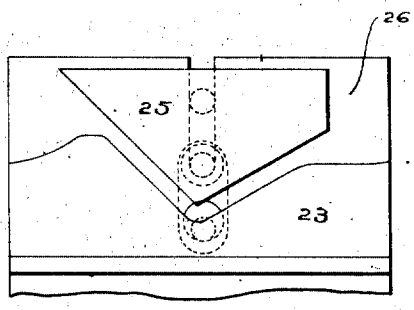

Fig 6

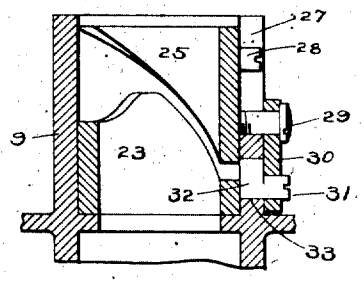

Fig 7

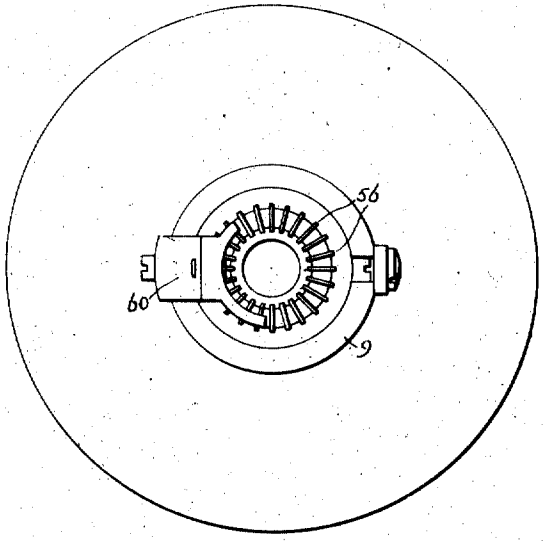

Fig 8

Witnesses
Walter Larkin
Mary F. Griffin

Inventors
Robert W. Scott
Harry Swinglehurst
by Robert C. Ciesla
Their Attorney

UNITED STATES PATENT OFFICE.

ROBERT W. SCOTT, OF BOSTON, MASSACHUSETTS, AND HARRY SWINGLEHURST, OF COLLINGSWOOD, NEW JERSEY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO SCOTT & WILLIAMS, INCORPORATED, A CORPORATION OF MASSACHUSETTS.

KNITTING-MACHINE FOR NARROW WEBS.

1,237,106. Specification of Letters Patent. **Patented Aug. 14, 1917.**

Application filed August 12, 1912. Serial No. 714,525.

To all whom it may concern:

Be it known that we, ROBERT W. SCOTT, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, and HARRY SWINGLEHURST, a citizen of the United States, and resident of Collingswood, in the county of Camden and State of New Jersey, have invented a new and useful Knitting-Machine for Narrow Webs, of which the following is a specification.

Our invention relates to that class of knitting machines used for the manufacture of narrow tubular fabrics such as are employed largely in place of woven braids and tapes in the manufacture of underwear, and for the making of fabric for gas mantles and the like, and has for its object the simplification of such machines, to the end that they may be built at a low cost, and capable of a high rate of production.

An object of our invention is to provide a machine of the character stated capable of knitting fine gage webs at a high speed, for instance from 1000 to 1500 courses per minute, with due regard to the safety of the mechanism in case of accidents to the needles or the web, and further to provide for the simultaneous operation by the same drive devices, independently of each other, of a number of knitting heads.

To these and other ends our invention relates to the improved knitting instruments proper, of which we will describe certain specific forms only and to the means for supporting and operating said instruments, as pointed out in the claims with respect to the generic invention illustrated by the particular mechanisms selected for illustration, and of which in the accompanying drawings,

Figure 1 is a front elevation of the right hand end of a frame comprising a plurality of knitting units, showing some parts in section;

Fig. 2 is a vertical cross-section of said frame at one of the knitting units;

Fig. 3 is a vertical section on an enlarged scale through one of the knitting heads and its supporting members;

Fig. 4 is an elevation of the cam cylinder;

Fig. 5 is a detail plan of the needle retaining ring;

Fig. 6 is a development of the inner surface of the cam ring;

Fig. 7 is a detail section on a radial plane of the cam-cylinder;

Fig. 8 is a plan of a knitting head showing the yarn guide;

Fig. 9 is a detail view of one of the web-holders.

A suitable casting or table A is supported by end-frames B at a convenient height, to provide a frame or housing for the working parts.

At the rear of the frame or housing is mounted a main shaft 1 carrying fast and loose drive pulleys 2 and 3 and upon which are slidably mounted a series of driving wheels 4, each having clutch lugs 5, which are capable of being thrown into and out of engagement with one of the clutch members 6 fast on shaft 1. Each of the driving wheels 4 carries a quarter twist belt 7, through the agency of which rotary motion is imparted to the cam ring of the knitting head. The gearing heretofore employed in driving the head of a knitting machine is by this means avoided.

The knitting head, which is of very simple and durable construction, consists of the needle cylinder 8, which also acts as a spindle for the reception of the cam ring 9, which has integrally formed with it the extension 10 carrying the grooved wheel 11 for the belt 7. The lower portion of the cylinder is reduced to form a shoulder 12 and is threaded at 13 either right or left handed, depending upon the direction of the rotary motion of the cam ring, to take a hand-nut 14 having an oil receiving channel 15 in its upper face.

The table A is recessed as shown at 16 in Figs. 2 and 3. An integral cross-bar 17 is provided at the bottom of each recess, having a central boss 18 in a bore in which the needle cylinder is seated, and against the upper machined face of which shoulder 12 of the cylinder is tightly drawn by the nut 14.

The cam ring is prevented from rising by lugs 19, 19 which are secured for ad-

justment as by screws 20, to the part 10 of the cam ring. These lugs have inturned feet which pass through openings 21 in the cam ring, and engage with an annular slot 22 formed in the needle cylinder as shown in Fig. 2.

Within the cam cylinder 9 an advancing or clearing cam 23 is seated upon the shoulder 24 formed in said cam cylinder. The form of this cam, shown in Figs. 6 and 7, is such as to adapt it to be made from steel tubing from which the cam may be cut by a milling operation, then hardened, ground and polished on its working face, and fitted within the recess provided for it. Owing to the construction reliance may be had on friction only to hold it in place. The complete circular form of the cam ring makes it capable of being made from tubing of a standard size requiring no special fitting.

The stitch or draw cam 25 is of similar construction, except in this instance it is desirable to provide an opening for the removal upwardly of broken needles, and the annulus or tube section from which the cam is made is cut through longitudinally at 26 for this purpose.

The remaining section of said annulus is, however, more than 180° in circumference and therefore it will be confined to its fit within the internal face of the cam cylinder, requiring only to be positioned in a rotary sense and in a vertical sense. We find this construction of importance, avoiding by it any necessity for holding the stitch cam 25, which must be adjustable, against the face of its carrying cylinder, by guide grooves or screws as in the prio art.

Extreme nicety of adjustment s desirable in machines of this class, by which it is intended to produce at a high rate f brics of small diameter and fine gage. We provide for this by the particular adjustment for the cam 25 shown in Figs. 3, 4, 6 and 7.

A vertical slot 27 is milled in the wall of the cam cylinder in which a pin or screw 28 fast in the cam 25 has vertical freedom of movement without play in a horizontal sense. At a lower point in said stitch cam 25 a headed and shouldered screw 29, also movable freely in the slot 27, carries the upper end of link 30, the lower end of which surrounds the eccentric member 31 of a stud 32 fitting in a bore 33 in the wall of the cam cylinder. The eccentric member 31 is slotted to be adjusted by a screw driver. By loosening the screw 29 a very delicate adjustment of the stitch cam in a vertical sense may be made and the adjusting members may be clamped without altering the adjustment by tightening said screw 29 against the link 30 and the wall of the cam cylinder, which may be flattened at this point, as at 34, to give a better holding surface.

The needles of this machine are relatively free, typically working without sufficient friction in their grooves to support them against gravity. In order to retain them in their grooves, we provide a circumferential groove 40 in the needle cylinder above the top of the cam cylinder, the bottom of which is substantially of the same diameter as the outer face of the shanks of the circle of needles 50. In said groove, resting upon the shoulder formed by the walls of the deeper needle grooves, beneath and held down by the flange 42, which is penetrated by the needle grooves, we provide a retaining ring 41 which is split diametrically and hinged at 45. Said ring is provided with a spring latch 43 having a finger grip 44, to enable it to be released to open the ring upon its diameter when it is necessary to remove or insert a needle.

The needle-cylinder 8 is grooved for the needles only on its upper half, leaving the portion 46 an unbroken cylinder, except for the bearing groove 22.

Beneath the shoulder 24 upon which the advancing cam rests we provide the cam cylinder with an annular groove 51, and through the wall of said cylinder communicating with said groove we provide at least one opening 52. The bottoms of the needle grooves which are milled in the needle cylinder, slope outwardly in the region of the annular opening 51, so that an obstruction such as a broken needle or a mass of lint accumulating in the needle grooves will upon working down opposite the annulus 51 be thrown out into said annulus and ultimately out through the opening 52, owing to the air blast set up by the rotation of the cylinder 9, within which the walls of the needle grooves behave as stationary vanes. When the cylinder 9 is rotated at the speeds adopted this structure has a marked effect as a fan. To this end to increase the effect of the air blast to clear the annulus 51, we may slope the opening 52 so as to make it tangential to the annular space 51 and pointing in the direction of rotation, as shown in Fig. 4.

The cam cylinder is further provided with a flange 54 of sufficient size to cover the opening 16 in the machine table A. This flange serves as a hand wheel to manually move the cam cylinder for adjustment, and may be utilized to counterbalance any eccentrically disposed weights found to be distributed about the cam cylinder, as by milling out portions as at 55 in Fig. 3 to restore balance.

We find in practice, however, that the long tubular needle cylinder 8 is sufficiently resilient to permit high speeds of the elements rotating upon it even when they are not in perfect balance, the cylinder 8 deforming under the eccentric strain and taking a central position with respect to the nutating

mass to a sufficient degree to permit any practicable speed of motion of the needles in the grooves.

To permit a maximum utilization of this effect, we find it desirable sometimes to provide a very loose running fit on the cylinder, especially at the portion 46 of the bore in the cam cylinder 10, and to set the lugs 19 to lift the pulley 10 sufficiently from boss 18 to permit a small degree of rocking motion of the cam cylinder.

In preëxisting machines of small diameter, although so far as we are aware there has been no attempt to drive them at the speeds which we find in practice our machine is capable of attaining, great difficulty has been experienced in preventing the knit web from rising upon the upward movement of the needles to clear their latches. Reliance has been had upon weighted take-ups of various forms.

In the case of a "press-off" due to the breaking of the yarn it is very difficult, on account of the small diameter, to run a piece of fabric upon the needles to start the machine. We avoid these difficulties by the provision of stationary web-holders 56 having an upward grooved bevel 57 and a notch 58 defining an annular groove, the external diameter of which is close to the internal diameter of the backs of the needles. In this position, the noses 59 of the web-holders serve upon the down draft of the needles to draw off or sink sufficient yarn between the needles (which are supplied by the yarn guide 60 attached to the cam cylinder) to form the stitches. The use of the structure mentioned permits the old or last formed course to be more promptly knocked over the heads of the needles upon the passage of the tops of the needles below the knocking-over line determined by the bottom of the notch 58 than would otherwise be the case.

This effect is due to the fact that the new loop is drawn through the old loop at the verge or top of the needle cylinder from yarn which has already been measured off and sunk, either completely or partially, by the noses 59 of the web-holders. The penetrating movement of the needle hook with respect to the old loop takes place therefore when the needle hook is charged with comparatively loose yarn and the strain upon the old loop, when it is penetrated by the new loop, is to that extent lessened. For this reason the down draft of the needles when web-holders of the form shown are provided has much less tendency than under other circumstances to maintain the last course knit stretched to its full diameter. The effect of this in turn is to clear the last course knit while within the diameter defined by the backs of the needles, so that the next advancing movement of the needles takes place well outside of the previously knit course.

A contributing advantage of this structure lies in the partial independence of the length of the stitches from the downward stroke of the needles. The noses 59 of the sinkers having drawn nearly enough yarn for the stitch, the accidental failure to adjust the cam 25 to take the needles an additional distance to complete a stitch of the length desired does not prevent knitting, but merely results in a fabric of the maximum stiffness for which the dimensions of the noses 59 were adjusted.

For most of the uses of the fabric, as for bindings, pipings, casings, etc., it is flattened lengthwise and creased in this position, before it is sewed or fastened in place. We have found that it is important to give the fabric its permanent form after it is knit and before extensive folds or creases are impressed in it at the wrong point, and to this end we have provided a take-up mechanism of ordinary construction shown as comprising the rolls 70, the worm and worm wheel 71 and 72 respectively, and the grooved pulley 73 mounted upon the swinging arm 74. As shown in Figs. 1 and 2 a separate mechanism of this character is provided for each head on the frame. A longitudinal strut 80 on said frame carries, for adjustment by the screws 82, a series of arms 81, on which the frames 74 of the take-up devices are pivoted at 75. The usual counterbalance 76 is provided for the take-up which is operated by tightening and slackening the belts 77 operated by the grooved pulleys 78, each on a sleeve connected to a clutch pulley 4.

The effect of the take-up rolls 70, which are counterbalanced so as to maintain a very light draft upon the forming tubes of fabric, is to mash or flatten the tubes longitudinally, the line of fold coming upon certain needle wales diametrically opposite each other.

In some cases when using hard, springy yarns, such as silk and artificial silk, of which the fabric is often composed, it is desirable to retain the folded condition of the web until it is used, and we therefore provide the reels 90 upon which the fabric is wound under tension after passing the take-up. The reels 90 are mounted on one squared end of short shafts 91 carried by arms 83 pivoted on the strut 80. Spring latches 92 take against the end of the squared bore in the hub portion of the reels to removably latch them in place. When full a reel may be removed and taken, without unwinding its contents, to a sewing machine or the like employing it in the manufacture of garments. Fast on the other end of the shaft 91 there is a grooved pulley 93 coöperating with the belt 94 carried by a grooved wheel 95 attached to the wheel 78. A rearward extension of the arms 83 carries a counterbalance 96 for the reels 90. The operation of the reels is similar to that of

the take-ups, the friction belt 94 slipping upon one or the other of these pulleys as the tension on the winding fabric lifts the arms 83.

It will be noticed that the take-up elements of the knitting heads as well as the drive wheel 4 are clutched and unclutched from the drive shaft 1 by the same clutch mechanism 5 and 6. A shipper lever 100 pivoted at 105 on the underside of the table A and having at its other end a pin taking in the groove 104 of the sleeve carrying the wheels 4, 78 and 95 under the tension spring 106 tends to maintain said clutch members in their open position. A series of latches 101 on the front of the table A having lugs 102 are provided to hold the shipper levers 100 in position to render the clutches operative by the engagement of the lugs 102 with notches 103 in the upper face of the levers. The tail of each lever 101 is connected by a cord or chain 107 to a pin 108 on the take-up frame 74.

In case of a press-off the dropping of the take-up to its extreme position will pull upon the cord 107 and release the clutch, stopping the movement of that knitting-head, its take-up and winding mechanism, without affecting the operation of the remaining heads.

The yarn supply is from cops, cones, or bobbins 109 conveniently resting upon pins on the rear of the table A from which the yarn extends upwardly through bores in the overhead guides 110, which are supported by T-standards at the ends of the machine frame.

We find it unnecessary to provide any stop-motion actuated upon the breakage of the yarn or the jamming of a needle since in the one case the release of the fabric stops the head and in the other case the small mass of the rotating parts permits the driving belt to slip without damage to the head.

It is important to prevent the splashing of oil from one head on the fabric from the neighboring heads. In addition to the channel 15, to collect waste oil, we provide shoulders 112 on the cross-bar 17, to take drops of oil from the lower face of the pulley 11, before they are freed and thrown off centrifugally. The oil collected by the shoulders 112 flows down the surfaces of the cross-bar 17 and into the channel 15.

Having described our invention what we claim and desire to secure by Letters Patent is:—

1. In a knitting machine, a rotary cam element, and means to support it for rotation about an axis variable in response to its mass and speed.

2. In a knitting machine a fixed needle cylinder of a height greatly in excess of its diameter, grooves in said cylinder, needles in said grooves, annular bearing surfaces formed on said cylinder, a cam cylinder loosely surrounding said needle cylinder having needle cams thereon, and adjustable lugs entering between said bearing surfaces, and a flexible friction belt for rotating said cam cylinder at high speeds.

3. In a knitting machine, a vertical needle cylinder of a height greatly in excess of its diameter, whereby said cylinder is laterally resilient, a fixed mounting for the lower end of the said cylinder, and a rotary cam-cylinder freely surrounding said needle cylinder and having a bearing thereon above its fixed portion, whereby said cam-cylinder is capable of rotation at high speeds about an axis of rotation out of coincidence with its axis of figure.

4. In a knitting machine, a longitudinally grooved needle-cylinder and independent needles therein, a cam-cylinder supported by the needle cylinder and means for adjusting the longitudinal position of the cam-cylinder, fixed web-holders having noses within the external diameter of the needles, and notches beneath said noses, an advancing cam, a stitch cam and means for adjusting the stitch-cam longitudinally of the cam-cylinder.

5. In a knitting machine, a carrier and independently movable needles therein, a cam carrier and cams for acting on the needles, comprising a cam having a guide pin working in a slot in said cam carrier, a stud in said cam-carrier having an eccentric part, a link surrounding at one end said eccentric part, and a screw in said cam having a bearing in the other end of said link.

6. In a knitting machine, a machine table presenting a circular opening, a cross-bar diametrical of said opening and beneath it, a needle-cylinder mounted centrally upon the cross-bar, and a cam cylinder mounted for rotation on the needle cylinder having a drive-pulley thereon beneath the plane of said table.

7. In a knitting machine, a machine table presenting a circular opening, a cross-bar diametrical of said opening and beneath it, a needle-cylinder mounted centrally upon the cross-bar, and a cam-cylinder mounted for rotation on the needle-cylinder having a drive-pulley thereon beneath the plane of said table, and a circular flange above said table covering said circular opening.

8. In a multiple head knitting machine, a frame for supporting the parts, relatively fixed needle cylinders, rotary cam cylinders each having a bearing on one of said needle cylinders, a drive pulley on the lower part of each cam cylinder, and an oil wiping shoulder on a part of the frame near the periphery of each pulley.

9. In a knitting machine, a frame for supporting the parts, a relatively fixed needle-cylinder having a shoulder and threaded

lower end in a bore in the frame, a rotary cam-cylinder having a bearing on said needle-cylinder, a drive mechanism for said cam-cylinder, and a nut to hold the needle-cylinder seated having an annular oil-pocket in its upper face.

10. In a knitting machine, a needle cylinder having grooves terminating in slopes to an unbroken surface, in combination with a cam cylinder surrounding the needle cylinder, said cam-cylinder having, opposite the bottoms of the grooves, an annular recess to receive broken parts or lint from the grooves, and an opening from the outside of said cylinder communicating with said annular recess.

In testimony whereof we have signed our names in the presence of the subscribing witnesses.

ROBERT W. SCOTT.
HARRY SWINGLEHURST.

Witnesses for Scott:
ALBERT E. PAGE,
WALTER LARKIN.
Witnesses for Swinglehurst:
CHARLES H. BREAITHWAITE,
J. H. BOND.