(No Model.) 3 Sheets—Sheet 1.

T. FINIGAN.

MACHINE FOR MANUFACTURING TWINES AND YARNS.

No. 564,275. Patented July 21, 1896.

Fig: 1.

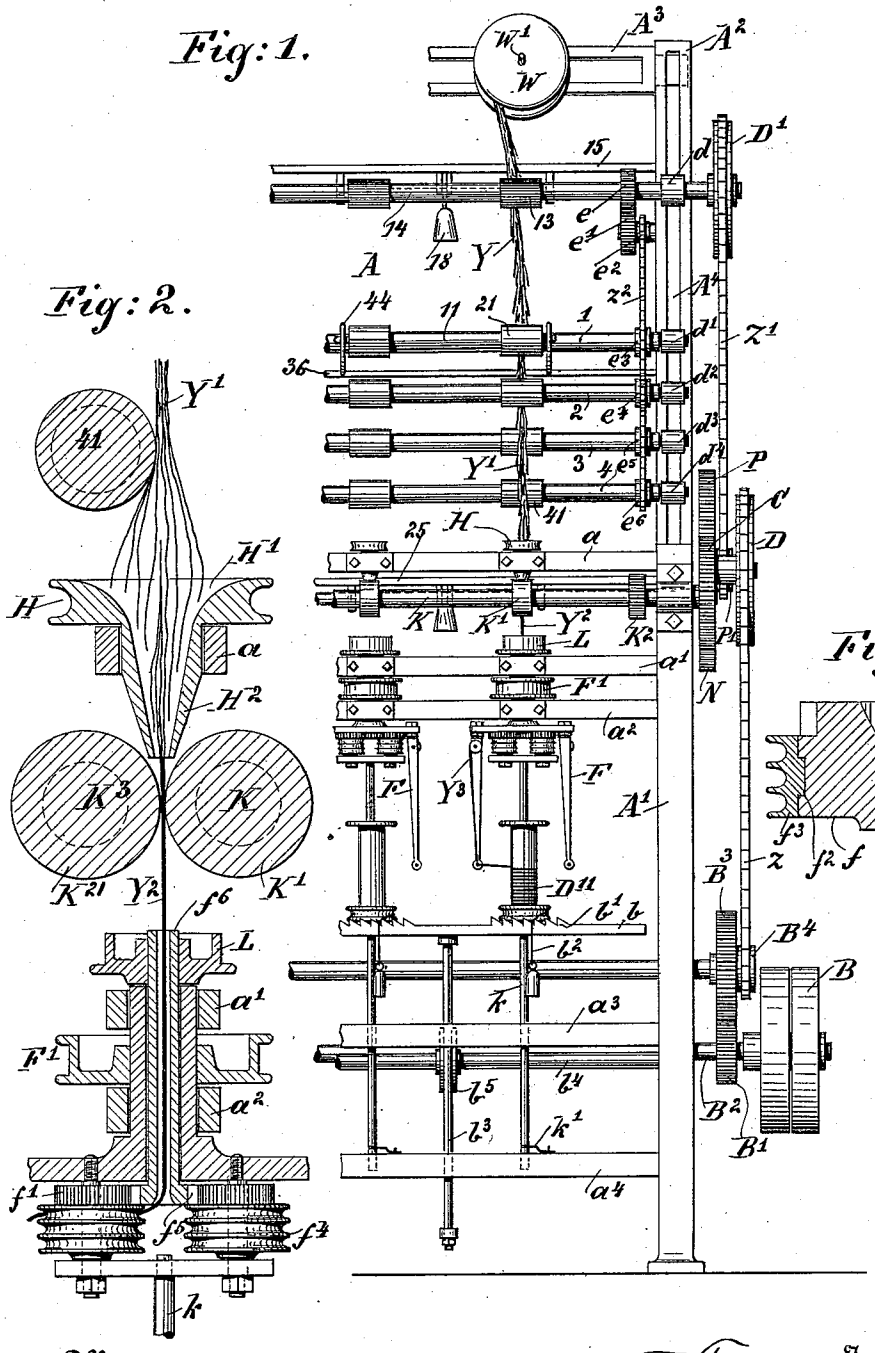
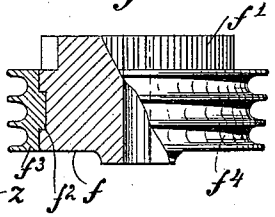


Fig: 2.

Fig: 3.



Witnesses
D. Petri-Palmedo.
Ed. J. Haegele

T. Finigan Inventor
By his Attorney
Oscar F. Gunz.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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T. FINIGAN.

MACHINE FOR MANUFACTURING TWINES AND YARNS.

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Fig: 4.

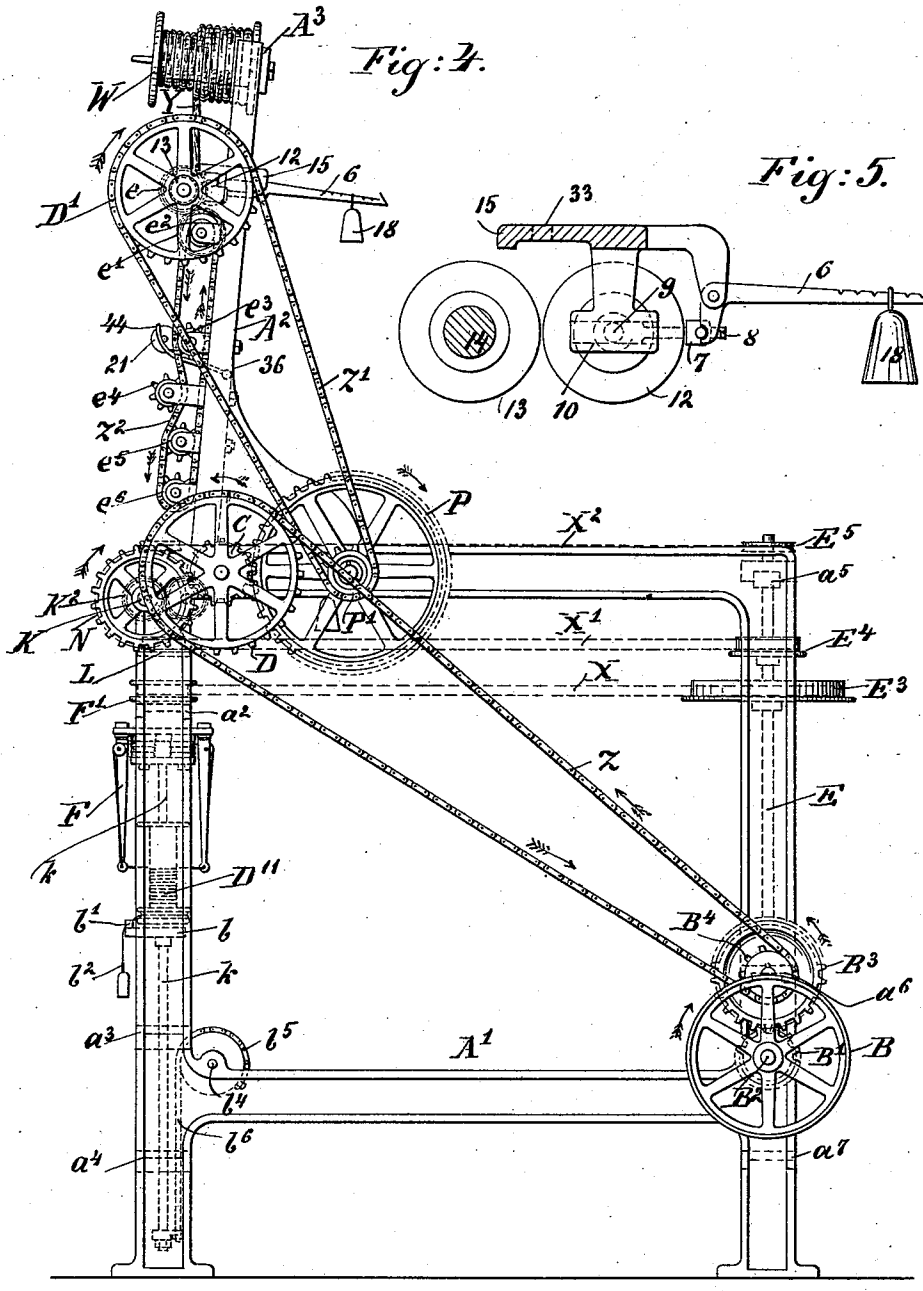

Fig: 5.

Witnesses
D. Peck-Palmer.
Ed. L. Hagele,

T. Finigan Inventor
By his Attorney
Secor F. Gunn.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

T. FINIGAN.

MACHINE FOR MANUFACTURING TWINES AND YARNS.

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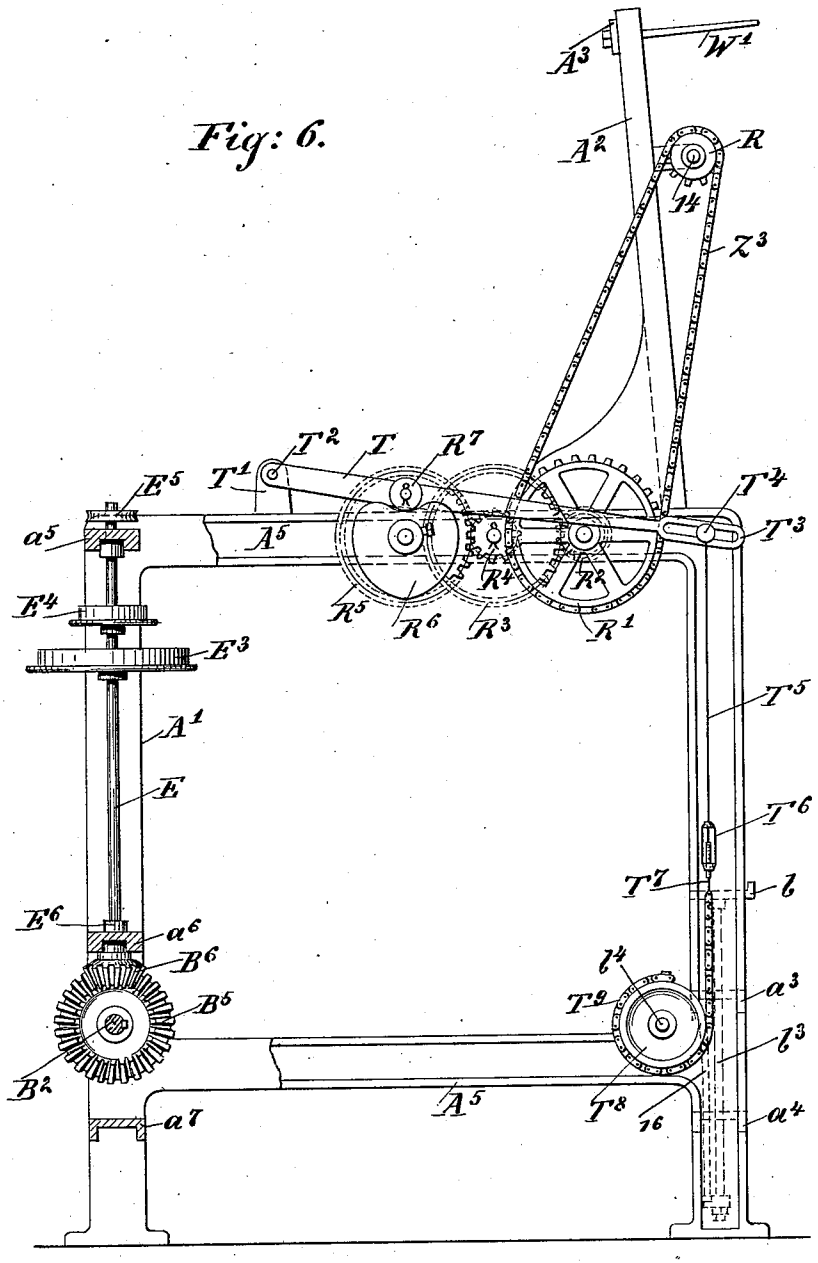
Fig: 6.



Witnesses
S. Pepi-Palmieb.
Ed. T. Haegele

T. Finigan Inventor
By his Attorney
Oscar F. Gunn.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

THOMAS FINIGAN, OF PATERSON, NEW JERSEY.

MACHINE FOR MANUFACTURING TWINE AND YARN.

SPECIFICATION forming part of Letters Patent No. 564,275, dated July 21, 1896.

Application filed July 25, 1895. Serial No. 557,081. (No model.)

To all whom it may concern:

Be it known that I, THOMAS FINIGAN, a citizen of the United States, and a resident of the city of Paterson, in the county of Passaic and State of New Jersey, have invented a new and useful Improvement in Machinery for Manufacturing Twines and Yarns from Sisal Fibers, whereby material or fibers of a harsh and wire-like nature may be spun finer than hitherto and a cheaper and stronger product rendered available for commercial use, of which the following is a specification.

My invention relates to a new machine for spinning sisal fiber, or fiber obtained from pita or other leaves, which have hitherto been used solely for rope-making, binder-twines, or hammock-nets, which require but a slight twist, irregularity in the body of the line being of little importance.

It has been usual to spin rope and twines upon a jenny by the use of gills drawing the fiber toward the flier, but in the experiments of treating sisal fiber I found it to be impossible to produce a reliable line by their use, and adopted the mechanism fully described in the following specification, and illustrated by drawings, in which similar letters and figures have reference to similar parts.

I may mention that one of the greatest difficulties encountered was caused by the tendency of the ends of the fiber to curl up and leave the body of the sliver in drawing through the nipper and so carrying the adjacent fibers with them, causing wire-drawing of the yarn and forming a bulk of loose fiber at the nipper, which necessitated frequent stoppage for clearing away and mending up. In order to control the loose ends and keep them in line with the body of the sliver, I found that a conical cup or gatherer made to rotate at a certain speed opposite to the rotation of the flier collected the loose ends, and by the loose fibers coming in contact with the internal surface of the bell-mouth they were conducted to the center and incorporated with the body of the fiber being drawn into yarn. I also found that the gills permitted the fibers to slide past each other too rapidly, and similarly caused a wire-drawing of the sliver, and by the use of rolls guiding the fiber during the drawing process, so keeping the strands together as to allow but a sufficient slide to the fiber to keep a uniform size throughout the line, gained an equable product.

I am aware that the use of rollers is general in flax machinery, but has not hitherto been used in the treatment of sisal or other harsh fibers.

I may also mention that I give to the sliver prepared for use a slight twist, which still further tends to incorporate individual strands with each other while in the process of drawing.

In Figure 1 I show a part front elevation of a frame, showing two spindles. Fig. 2 represents a sectional detail view of the rotary gatherer and nipping or drawing rolls with part of the flier-head. Fig. 3 is a detail of a drawing-capstan and gear, showing grooved rubber cover-band. Fig. 4 is an end elevation of a frame, showing arrangement of driving-gear for flier, rolls, &c. Fig. 5 is a detail showing pressure mechanism for the rolls located on girth, part in section. Fig. 6 is a rear end elevation of frame, part sectional, showing the driving arrangement for vertical shafts, building device for bobbins, and driving-motion for the same.

A, Fig. 1, represents a frame of my invention and consisting of end frames A' A^5, held together by girths or rails a a' a^2 a^3, &c., on the upper table of which the inclined standards A^2 are secured, a frame and standard being located between each of the end frames for each four or more spindles for rigidity. The upper ends of the inclined standards A^2 are held in line by the creel-frame A^3 and the rails 15 and 36. At the rear of the frame, near its lower part, a longitudinal driving-shaft B^2 is located in suitable bearings formed in the framing, provided with the driving-pulleys B and the gear-pinion B' at its outer extremity. A gear-wheel B^3, in mesh with the pinion B' and provided with a sprocket-pinion B^4, is located upon a suitable stud secured to the frame A'. Located at intervals on shaft B^2 bevel gear-wheels B^5 are secured in gear with the pinions B^6, which are secured to the lower ends of the vertical driving-shaft E, giving motion to the flier F, tube f^6, and gatherer H by the pulleys E^3 E^4 and the grooved wheel E^5, the shafts E being held in position vertically by bearings in the girths or rails a^5 a^6 and by collars E^6, secured by set-screws

in proper alinement opposite each flier, as in Fig. 4. From the sprocket-pinion B^4 an endless link belt Z is carried upward to a sprocket-wheel D, which is located on the hub of the pinion C.

A gear-wheel N in geared contact with the pinion C is located on the outer end of the roller-shaft K, which extends the whole length of the frame, a similar pressing-roller shaft K^3 being provided behind and geared to shaft K by the pinions K^2, shaft K being located in bearings formed in the framing $A' A^5$, &c., and shaft K^3 held in adjustable bearings suspended from the rail 25, as shown in Fig. 1, and provided with pressing-rollers, levers, and weights, similar to arrangement shown in Fig. 5. On the shaft K rollers K' are secured and located centrally with each flier-head, and on the shaft K^3 rollers K^{21} are secured similarly, so as to form a pair of nipping or drawing rolls for each flier, as in Figs. 1 and 4.

On the outer end frame A', located upon a suitable stud, is a gear-wheel P, mounted upon the hub of a sprocket-pinion P', the wheel P being in geared contact with the pinion C. An endless link belt Z' connects the sprocket-pinion P' with the sprocket-wheel D', which is secured to the outer end of the shaft 14, which is mounted in bearings *d*, adjustably secured in the slots A^4, formed in the inclined standards A^2 at each end of the frame and on the intermediate stands. At intervals in vertical line with the fliers fluted rollers 13 are located on the shaft 14, and at the back of said shaft similar fluted rollers 12 are located in pairs on pivoted shafts 9, which are suspended at each end in the adjustable cradle-bearings 10, forming part of the rail 15, secured to the upper part of the inclined standards A^2, a projecting fork extending outwardly between each pair of rolls, forming a pivot for a bell-crank lever 6, which is provided with an adjustable weight 18 at one end and a fork-bearing at the other to receive projecting pins on the nut 7, located on the screw 8, which by a suitable end partly embraces the pivot-shaft 9, as in Fig. 5. At the end of the shaft 14 on the inner side of the frame A^2 a gear-wheel *l* is located in contact with the pinion *l'*, located upon a suitable stud secured to the frame A^2. A sprocket-pinion l^2 is located on the hub of the pinion *l'*. An endless link belt Z^2 connects the sprocket-pinion l^2 with the sprocket l^6, located on the roll-shaft 4, which is provided with the smooth rolls 41, located opposite each flier.

The shaft 4 is located in adjustable stands d^4, secured in the slot A^4 in the stands A^2. The roller-shafts 1, 2, and 3 are similarly carried in adjustable bearings d' d^2 d^3, located in the slot A^4. In front of the roll-shaft 1 a pair of smooth pressing-rolls 21 are secured to the pivoted shaft 11 and located loosely in the inclined cradle-arms 44, formed on the rail 36, which is secured to the stands A^2, as in Figs. 1 and 4, and act as feeding and clamping rolls for the fiber, as will appear hereinafter. On the outer end of the shaft 1 on the inner side of the stand A^2 is a sprocket-wheel l^3, and similarly on shafts 2 and 3 the sprocket-wheels l^4 l^5, which interlock the upper and under sides of a link belt Z^2, as shown in Fig. 4. On the extreme upper part of the frame and secured to the stands A^2 a creel-frame A^3 extends the length of the frame, provided with the pins W', suitably located for the bobbins W.

Located in suitable bearings formed in the rail *a'* above each flier and centrally in line with each spindle *k* rotary gatherers H are placed to receive the yarn and conduct it to the rolls K' K^{21}. The gatherer H is provided with a groove for the driving-cord X^2 and has a bell-mouthed conical orifice H' through it, and at its lower extremity H^2 formed conical to enable its exit to approach as near as possible the point of contact between the rollers K' K^{21}, drawing the fiber, as in Fig. 2.

Located in bearings formed to receive the same in the rails *a'* a^2 fliers F with open arms of the usual construction are assembled, driven by the pulleys F'. The inner tube f^6 by its pulley L, the gear-pinion f^5 in contact with the gears *f'* of the capstans *f* operate the same. The capstans are provided with a circumferential groove f^2 to interlock and engage a projection formed on the inner surface of a grooved rubber ring f^3. The grooves f^4 are formed to conduct the yarn, as in Fig. 3. A spindle *k* is located in suitable holes in the rails a^3 a^4 and passing through the builder-rail *b*, the upper end engaging the capstan-bar on the flier and the lower end loosely secured to the lower rail a^4 by a catch *k'*, engaging an annular groove, as in Fig. 1.

At the rear end of the frame, as in Fig. 6, a sprocket-pinion R is secured to the end of the shaft 14, and an endless link belt Z^3 connects the same with the sprocket-wheel R', which is mounted upon the hub of the gear-pinion R^2, located upon an adjustable stud secured to the end frame A^5. A similar adjustable stud carries the gear-wheel R^3, in contact with the pinion R^2, and which has located upon its hub the pinion R^4, in geared contact with the wheel R^5, upon which the heart-cam R^6 is secured, and also mounted upon a stud secured to the frame A^5.

A roller friction-wheel R^7 in contact with the heart R^6 is located upon a stud secured to the lever T, which is pivoted at its outer end by the stud T^2 secured to the bracket T' on the frame A^5. The other end of the lever T is provided with an elongated slot T^3, in which the stud T^4 is located, and to which the rod T^5 is pivoted and coupled by the turnbuckle T^6 and adjusting-screw T^7 to the chain T^9, which is fastened to the periphery of the pulley T^8, secured to the outer end of the builder-shaft b^4, as in Fig. 6. The shaft b^4, which extends the whole length of the frame and is carried in suitable bearings, is provided at intervals with pulleys b^5, to which chains b^6 are secured at one end, the other

being connected by an adjusting-screw to the foot of the builder-rods b^3, secured to the builder-rail b. The rail b upon which the bobbin D'' sits is provided on its upper sides with raised edges, the front being provided with notches b' to adjust the tension-cord b^2 and the back having holes in which the cord may be secured by a knot in the usual manner. The bobbin D'' is provided with a groove on its lower end for tension purposes.

Having described the construction of my device, I will now proceed to describe the use or operation of the same.

The sliver or rove Y being prepared with a slight twist, about four turns to the foot, is wound upon the bobbin W and placed upon the pin W' and entered between the rolls 12 and 13. Motion by belt is given to the pulley B and shaft B^2, and by the bevel-gears B^5 B^6 to the vertical shafts E and the pulleys E^3 E^4 E^5, which by the belts or cords X X' X^2 impart motion to the fliers F, tube f^6, and gatherer H. The pinion B' on the driving-shaft B^2 imparts motion to the gear-wheel B^3 and sprocket B^4, located on a stud secured to the frame A', which by the endless link belt Z gives motion to the gear-wheels P and N by the sprocket-wheel D and gear-pinions C, which are carried by a stud. The gear-wheel P, having upon its hub the sprocket-pinion P', by the endless link belt Z' imparts a rotary motion to the shaft 14 by the sprocket-wheel D'. The shaft 14 by its fluted rollers 13 meshing with the pressing-rollers 12 conducts the sliver or rove downward to the roller on shaft 1 and its pressing-roll 21. The shaft 14 by the pinion l, in gear with the wheel l' and sprocket-wheel l^2, gives motion to the endless link belt Z^2 and by the contact of its links, on the inner or the outer sides, rotates the sprocket l^3 and shaft 1 by its inner side, the sprocket l^4 and the shaft 2 by its outer surface, the sprocket l^5 and shaft 3 by its inner surface, and round the sprocket l^6 drives the shaft 4, with its roller 41, which may be of larger diameter than those on shafts 1, 2, and 3. The sliver Y after passing through the hole 33 in the rail 15 and between the fluted rolls 13 and 12 passes then downward and between the roll on shaft 1 and the loose pressing-roll 21, then under the roll on shaft 2 and over the rolls on shafts 3 and 4, and then enters the bell-mouthed cup H' and through the rotary gatherer H is entered between the drawing-rollers K' K^{21}, the shafts of which, K K^3, being geared together by the pinions K^2 and forced into contact by levers and weights, as in Fig. 5, draws the fibers of the rove Y' and reduces it in size to form yarn, after which it is passed through the tube f^6 to and around the drawing-capstans f over a wharve and through an eye on one arm of the flier F, and then is wound upon the bobbin D''. The capstans are covered with rubber for the purpose of coöperating with the rollers K' K^{21} to make a uniform draw of the fibers as the action of the flier putting twist into the yarn up to the nip of the drawing-rollers binds the fibers together as they pass through the rolls K' K^{21}. It is evident that the fiber being of a harsh and hard nature and of different diameter that in passing through the rollers K' K^{21} they do not get the same amount of nip to draw them, but directly being incorporated in the yarn by the action of the twist given by the flier they are moved along at the uniform speed of the capstans, which have the same surface speed as the drawing-rollers K' K^{21}, less the contraction caused by the twist, the rubber covering of the capstans permitting the yarn to frictionally adhere to their surfaces owing to the drag on the bobbin by the cord and weight b^2, adjusted in the notches b' of the building-rail b. The rotation of the shaft 14, which at its rear end is provided with a sprocket-pinion R, giving motion by the endless link belt Z^3 to the sprocket-wheel R' and pinion-gear R^2, which are carried on an adjustable stud, secured to the frame A^5, and imparts motion to the compound wheels R^3 R^4, also carried on an adjustable stud, in their turn driving the gear-wheel R^5 and heart-cam R^6, also mounted on an adjustable stud. The heart-cam R^6 on its rotation causes the lever T by its contact-roller R^7 to rise and fall, raising and lowering the rod T^5 T^6 T^7, and causing the chain T^9 to unwind or permit it to be wound upon the pulley T^8. When the chain T^9 is unwound from the pulley T^8 on the builder-shaft b^4, the chains b^6 are wound upon the pulleys b^5, raising the builder-rods b^3 and the builder-rail b to which they are secured, carrying the bobbin D'' upward. The rail b and the rods b^3 and chains are so arranged as to keep the roller R^7 pressed to the surface of the heart-cam R^6 to insure an equal lay on the bobbin. It is obvious that the filling of the bobbin is regulated by the relative speed of the shaft K and the number of revolutions of the heart R^6, and the length of the traverse by the throw of the heart-cam and the relative distances of the pivot T^2, roller R^7, and stud T^4 on the lever T and the diameters of the chain-pulleys T^8 and b^5.

I may, to more fully describe the action of the rollers 1, 2, 3, and 4 and their influence on the rove between the feeding-rollers 12 and 13 and the drawing-rollers K' K^{21}, state that the rove being held by the feeding-rollers 12 and 13 and passed between the rolls 1 and 21 retains the twist, thence passing under the roll on shaft 2, where it is nipped by the rise to the roll on shaft 3, relieving the rove of strain above this roll, and passing over the roll on shaft 4 to the drawing-rolls K' K^{21} it is untwisted as far back as the roll on shaft 2, permitting the rove to be drawn gently and equally between those points.

It is evident that without the rollers 1, 2, 3, and 4 and the riding roller 21, which with the roller 1 forms a pair of feeding and clamping rolls, that the sliver or rove would pass directly to the gatherer and thence to the

drawing-rollers, and thereon starting the machine the action of the drawing-rollers, which are traveling at their surface about eight times faster than the feed, would be to untwist the rove or sliver up to the nip of the feed-roller, and in doing so the friction or binding between the fibers would be lost, and owing to the distance between feed and drawing rollers having to be greater than the length of the fibers—namely, three feet or more—the rove would immediately part and break down.

By putting in the rollers 1 2 3 4 and riding roller 21 and placing them so as to be adjustable in relation to the rove and yarn to be spun, especially roller 1 and riding roller 21, it enables me to make a uniform parting-point of the fibers which have entered the drawing-rollers from the fibers which are being fed down from the feeding-rollers and thereby producing a uniform yarn or twine.

Instead of the rove being untwisted up to the feeding-roller it actually untwists only up to roller 2, and by the help of the gatherer, which is rotating in an opposite direction to the twist of the rove on the bobbin, it opens up the rove and allows the fibers which are traveling fast to bring the others into a straight line with them to the center of the gatherer. The amount of twist still left in the rove above roller 2 has also an effect in uniform drawing.

Without the rollers or without the twist and without the relation of the rollers to the rove it is certain that the fibers gripped by the drawing-rollers would pull the fibers apart irregularly and break the rove down.

Having described the construction and operation of my invention, what I claim, and desire to secure by Letters Patent, is as follows:

1. In a machine for spinning sisal fiber, the combination with a support for bobbins, a flier for spinning the fiber drawn from the bobbins, means for rotating said flier; a gatherer, means for rotating said gatherer; supporting-rolls between said gatherer and bobbin-support, a pair of feeding and clamping rolls between said supporting-rolls and bobbin-support and within a distance of the gatherer, less than the length of the fiber being spun and drawing-rolls between the gatherer and flier, substantially as herein shown and described and for the purpose set forth.

2. In a machine for spinning sisal fiber, the combination with a support for bobbins, a flier for spinning the fiber drawn from the bobbins, means for rotating said flier; a gatherer, means for rotating said gatherer; rotative supporting-rolls between said gatherer and bobbin-support, means for rotating said rolls, a pair of feeding and clamping rolls between said supporting-rolls and bobbin-support and within a distance of the gatherer, less than the length of the fiber being spun, means for rotating said feeding and clamping rolls; and drawing-rolls between the gatherer and flier, means for rotating said drawing-rolls; substantially as herein shown and described and for the purpose set forth.

3. In a machine for spinning sisal fiber the combination with a support for bobbins, a flier for spinning the fiber drawn from the bobbins, means for rotating said flier; a pair of feeding-rolls directly below the bobbins, means for rotating said feeding-rolls; a gatherer, means for rotating said gatherer; supporting-rolls between said gatherer and the feeding-rolls, means for rotating said supporting-rolls, a pair of clamping and feeding rolls, between the uppermost supporting-rolls and the feeding-rolls below the bobbins, and within a distance of the gatherer less than the length of the fiber being spun, means for rotating said clamping and feeding rolls; and drawing-rolls between the gatherer and flier, means for rotating said drawing-rolls; substantially as herein shown and described and for the purpose set forth.

4. In a machine for spinning sisal fiber, the combination with a support for bobbins, a flier for spinning the fiber drawn from the bobbins, means for rotating said flier; a gatherer, means for rotating said gatherer; supporting-rolls between said gatherer and the bobbin-support a pair of adjustable feeding and clamping rolls between said supporting-rolls and bobbin-support and within a distance of the gatherer, less than the length of the fiber being spun, an endless linked belt for rotating said supporting-rolls and the adjustable feeding and clamping rolls, and drawing-rolls between the gatherer and flier, means for rotating said drawing-rolls; substantially as herein shown and described and for the purpose set forth.

THOMAS FINIGAN.

Witnesses:
RICHARD A. HEALY,
EDWARD D. CUNDELL.