No. 736,422. PATENTED AUG. 18, 1903.

H. B. MORRIS.

MACHINE FOR MAKING PAPER CORD.

APPLICATION FILED NOV. 17. 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

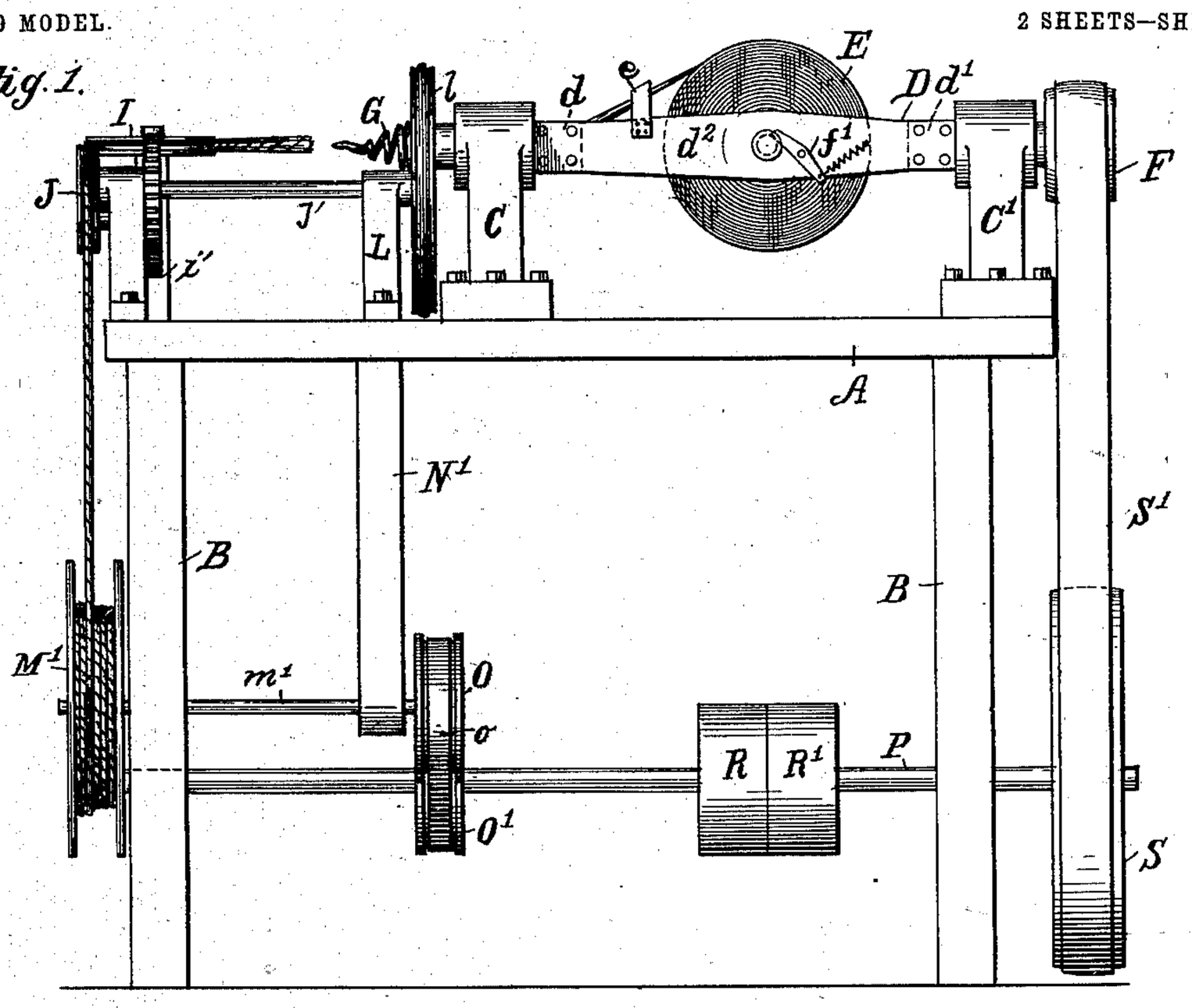

Fig. 2.

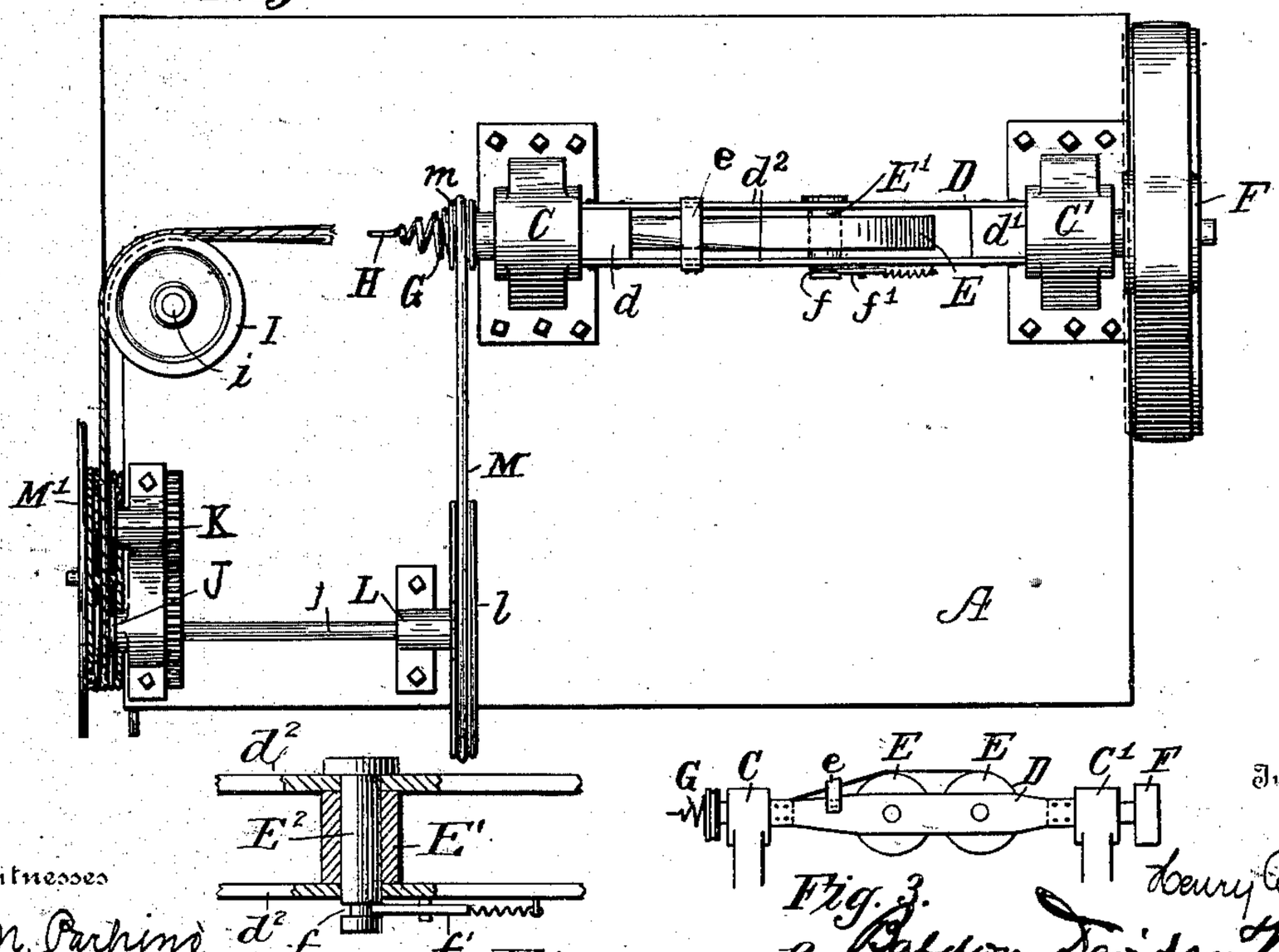

Fig. 9.

Fig. 3.

Witnesses

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.

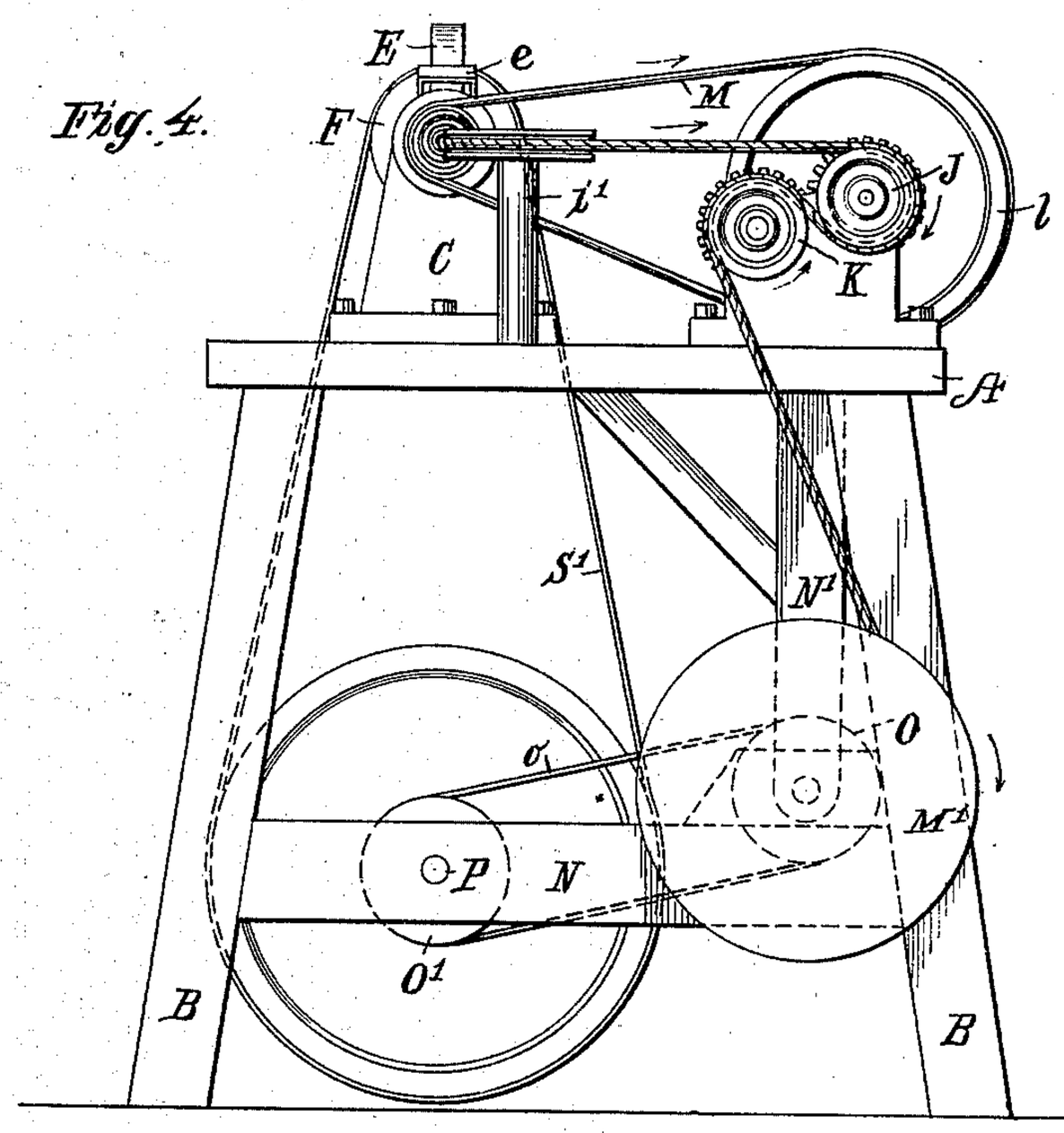

Fig. 5.

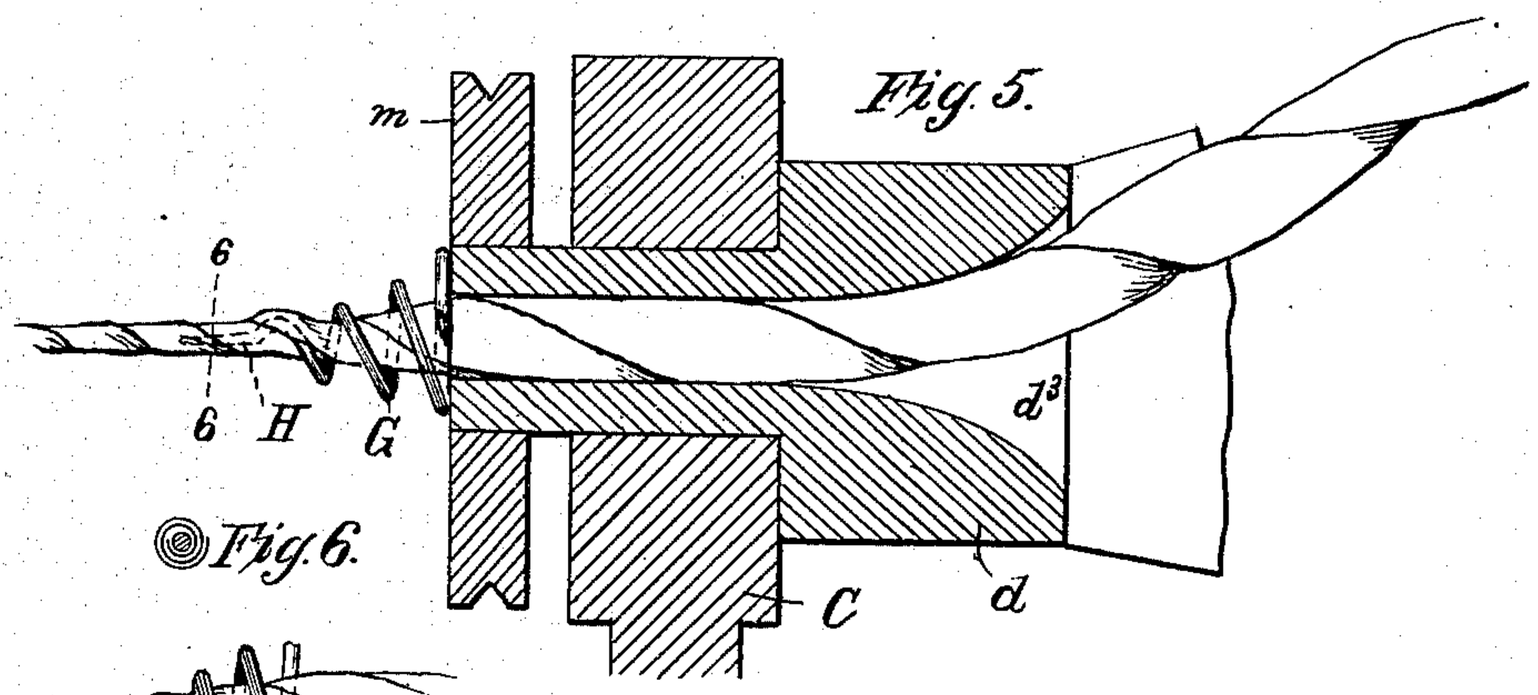

Fig. 6.

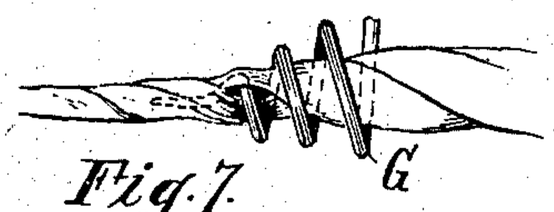

Fig. 7.

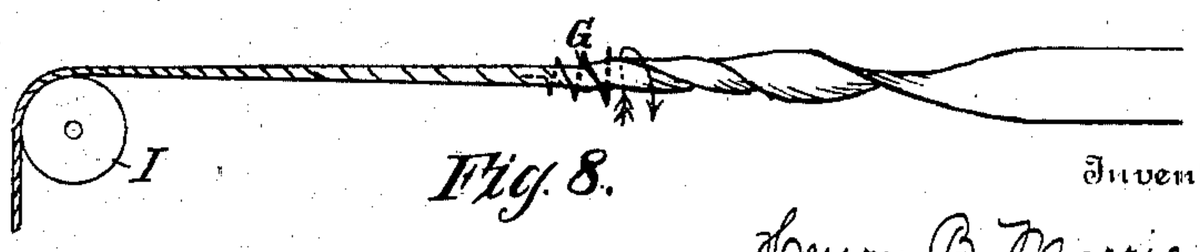

Fig. 8.

Witnesses

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No. 736,422. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

HENRY B. MORRIS, OF MICHIGAN CITY, INDIANA.

MACHINE FOR MAKING PAPER CORD.

SPECIFICATION forming part of Letters Patent No. 736,422, dated August 18, 1903.

Application filed November 17, 1902. Serial No. 131,656. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. MORRIS, a citizen of the United States, residing in Michigan City, in the county of Laporte and State of Indiana, have invented certain new and useful Improvements in Machines for Making Paper Cord, of which the following is a specification.

This invention relates to cord making or spinning machines of the class in which flat continuous strips of paper of uniform width are twisted or spun into cords that are circular in cross-section.

The primary object of my invention is to provide simple and effective means for twisting the paper in such manner as to give it a uniform pitch or twist and a smooth even surface, thus producing a cord of a neat appearance and of a greater durability than one of irregular formation.

Another object of my invention is to so construct and operate a machine of this class that the paper shall not be subjected to such strain as would tend to break it from time to time, and thus prevent the continuous rapid formation of a cord of indefinite length.

In most machines heretofore employed for making paper cord from a strip or ribbon of paper the material is during the process of spinning drawn through an orifice to reduce it to the predetermined size of the cord. In some such machines this orifice has been made of a funnel shape, the smaller end of which is of approximately the same size as the finished cord; but this necessarily implies that the paper shall be piled up in the funnel and compressed there, requiring considerable force to reduce it and pull it through the orifice. This is especially true by reason of the fact that the twisting is practically all done before the cord passes through the small orifice, and when the paper is moist or dampened, as is usually the case, it is somewhat weakened and often not able to resist the strains incident to the spinning operation. For these reasons in the operation of the prior machines the cord has been often broken during the process of spinning, necessitating the stopping of the machine and the formation of the cord, and thus largely reducing the output of the machine. I have also discovered that in being spun from a flat strip the paper is apt to be twisted unevenly at different points, owing to uneven dampening or to inequalities in its texture, and the paper is often thicker in some places than in others, resulting in the formation of bunches of material which it is difficult to draw through a small orifice designedly made to reduce a twisted cord to its final diameter.

In my improved machine I discard the compressing-orifice of the prior machines and provide means for loosely twisting the paper as it passes through a revolving mandrel, while the final twisting and compressing is done outside the mandrel and by devices which do not unduly impede the progress of the cord as it passes to the take-up or storage reel. In my machine the paper to be wound is revolved with the mandrel and with a tapering guide, which gives a loose twist to the paper, while the main twisting is done between the end of said guide and another guide placed in line therewith, which also serves to compress the twisted cord and give it its final form. I designedly so organize the mechanism that the spool of paper shall be carried by a revolving head and that the fixed point and the revolving head, between which the main twisting is done, shall be located some distance apart in order that the paper may not be bunched tightly when passing through the first guide, but shall be twisted most tightly near the fixed point or after leaving the first guide. If the spool of paper were held in a fixed frame and the outer end of the cord adjacent that end being reeled were revolved, such good results would not be obtained. In order to still further insure the formation of a regular and even cord, I arrange at the exit of the first guide carried by the spinning-head and in line with its longitudinal axis a finger or projecting wire, which I call a "horn," around which the paper is wrapped while being twisted. This insures that the paper shall be twisted about a common axis instead of an irregular one, and thus a cord of practically uniform thickness is obtained, the paper being prevented from bunching more at the center in some places than in others. I preferably make the first guide of wire formed into a tapered spiral having an open spiral slot, as this enables me to conveniently locate the finger or horn in line with the axis

of the guide, to provide means for gradually reducing the diameter of the loosely-twisted tube while being formed without allowing it to be too much compressed or compacted, and to cause the paper to coil gradually and evenly and to be wrapped properly around the horn.

In the accompanying drawings, Figure 1 shows a side elevation of a machine embodying my improvements. Fig. 2 is a top plan view thereof. Fig. 3 is a detail view, on a reduced scale, illustrating a modification. Fig. 4 shows a front elevation of the machine. Fig. 5 is a detail view, on an enlarged scale, of the first guide and parts connected therewith, showing the manner in which the paper is loosely coiled and passed through and delivered from the guide and its horn. Fig. 6 shows a cross-section on the line 6 6 of Fig. 5. Fig. 7 is a detail view illustrating the manner in which the paper passes through the first guide. Fig. 8 is a diagram further illustrating the manner in which the paper is twisted between the second guide or fixed point and the first guide. Fig. 9 is a detail view showing the manner of connecting the coil of paper with the spinning-head.

The main frame of the machine may be of any suitable construction. As shown, the table A is supported on legs B and in turn supports standards C C′, carrying bearings for the rotary spinning-head D, which, as shown, consists of a front mandrel d and a rear mandrel d', arranged in line with each other, journaled in the standards, and connected by horizontal plates d^2, in which the spool of paper E is carried. One end of the rear mandrel d' carries a belt-pulley F. The opposing ends of the front and rear mandrels are preferably squared, as shown, to receive the ends of the plates d^2, which are secured thereto in the manner shown in Figs. 1 and 2. The paper E is of a kind and quality suitable to form a cord of the desired size and strength, the size of the cord of course being regulated to some extent by the width of the paper. This paper is in the form of a flat coil arranged on a spool E′, arranged loosely on a pin E^2, which is headed at one end and provided at its opposite end with an annular groove f, engaged by a spring-latch f', the arrangement being such that the spool may freely revolve in the spinning-head and the coil of paper may be readily detached therefrom by merely lifting the latch, drawing the pin out laterally from its bearings in the plates d^2, and lifting the coil, with the spool, from between the plates. A new spool may be attached to the spinning-head by these devices in an obvious manner. The rear mandrel may be solid; but the front mandrel is hollow, as indicated in Fig. 5, the rear end of the bore being slightly flared at d^3, while the main part of the bore is circular in cross-section. The paper passes from the top of the coil to the flared rear end of the bore of the front mandrel, being guided when the coil is large by a U-shaped guide e. The coil of paper is located at such distance from the mouth of the mandrel that the paper shall not pass thereto too abruptly when the coil of paper is large, but shall pass at a gradual inclination in the manner indicated in Fig. 1.

In Fig. 3 I have shown a slight modification, which I will now refer to. It merely consists in mounting two coils of paper in the spinning-head so that the cord may be formed of two strips twisted together instead of one twisted strip. One strip of paper is merely led over the top of the other strip, and thereafter the two strips are treated as one by the twisting mechanism. I employ this modification when it is desired to produce a larger and stronger cord.

The paper after passing through the cylindrical bore of the front mandrel is led through the device G, which I call the "first" guide, and past the horn H to a guide-wheel I, which I also call a "forming-wheel." The guide G is tapered gradually forward from the front end of the mandrel d, and the horn H is located in line with the axis of the guide. Preferably the guide G is formed from a stout piece of wire coiled and tapered in such manner as to produce the tapered guide-passage, before referred to, and to form an open spiral slot extending from the front end of the mandrel to the horn. The guide or forming wheel I is mounted to revolve about a vertical axis afforded by a stud i on a standard i', erected on the top of the table A. This wheel I performs three functions. It serves to support and guide the cord on its way from the spinning-head to the take-up reel, to provide a stop to limit the operation of twisting, and to provide means for smoothing down the twisted cord while or just after having been twisted into its final form or to its final diameter. This wheel is formed on its periphery with a groove semicircular in cross-section, and the left-hand extremity of its periphery is in alinement with the first guide and the bore of the front mandrel. The twisted cord is brought into contact with about one-fourth of the circumference of the forming-wheel, and in the operation of the machine it is found that the process of twisting is stopped by this wheel before the cord leaves it. The cord revolves or twists for a short time after coming into contact with the wheel, and at that time any irregularities which the cord contains are smoothed out and pressed down. After leaving the forming-wheel the twisted cord passes in a straight line to a feed-wheel J, which is geared to another wheel K. These wheels are positively driven in the manner hereinafter described, while the forming-wheel is driven only by the cord which passes around it. The feed-wheels J and K have grooved peripheries and are geared to revolve synchronously. The cord passes about halfway around each wheel in such manner as to produce a tension in connection with a positive feed, which will insure the cords being

fed uniformly. The shaft *j* of one of the feed-wheels is continued rearwardly and is supported on an upright L, the rear end of the shaft having fixed to it a large band-pulley *l*, which is geared, by means of a belt M, to a small pulley *m* on the front end of the front mandrel *d*. After leaving the feed-wheel K the cord passes to a take-up or storage wheel M′, which is attached to the front end of a shaft *m′*, mounted in bearings in the lower front cross-piece N and a hanger N′, depending from the table. The shaft *m′* carries on its rear end a pulley O, which is connected by a belt *o* to a pulley O′ on the main driving-shaft P, mounted in bearings in the lower cross-pieces N of the main frame. The driving-shaft carries fast and loose pulleys R R′ and also a large belt-pulley S, which is belted to the pulley F on the spinning-head. It will thus be seen that the spinning-head is driven directly from the main driving-shaft by means of the belt S′. The take-up reel is driven from the main driving-shaft by means of the belt *o*, while the feed-wheels are driven from the spinning-head by means of the belt M. The pitch given to the cord in twisting will depend upon the speed of rotation, the speed of feed, and the distance between the spinning-head and the guide-wheel I. These are properly regulated in my machine and when once determined are uniform, and therefore a cord of uniform twist or pitch is always produced. The belt *o*, which connects the driving-shaft with the shaft of the take-up reel, is comparatively loose. The speed of the driving-shaft is such and the relative diameters of the driving and driven pulleys are so arranged that when the winding of the cord on the take-up reel is first started and while the winding diameter or periphery of the reel is therefore small the reel shall be turned fast enough to wind up the cord as rapidly as it comes from the feed-wheels, thereby keeping it taut in the feed-wheels. At this time the belt does not slip or slips but little. The speed of the feed-wheels is regular, and thus the cord is held at a uniform tension and is fed at a uniform speed, the reel merely serving to take up the slack after the cord has passed the feed-wheels and to hold the cord taut in the feed-wheels to enable them to feed most efficiently. As more cord is formed the diameter of the coil on the take-up reel increases, and unless some means were provided for reducing the speed of the reel the cord would be wound too rapidly. By making the belt *o* comparatively loose and allowing it to slip the speed of the take-up reel will be gradually reduced as the diameter of the coil increases, and any tendency to wind the cord faster than it is fed by the feed-wheels is avoided.

I have not heretofore described fully the manner in which the paper is twisted while passing through the front mandrel and the front guide and while revolving between the fixed point afforded by the forming-wheel and the horn of the first guide. It is important that this operation should be clearly understood. As I have before stated, the orifices in the front mandrel and in the front guide are not such as to compress tightly the paper while passing through them. On the other hand, care is taken that a comparatively loose tube formed of twisted paper shall be produced by these devices in order that the paper shall not be bunched or banked up inside the guide in such manner as to unduly delay its forward movement. The discharge-orifice in the tapered guide G is of materially greater diameter than the finished cord, as indicated in Fig. 8. In the operation of my machine as the spinning-head revolves the paper is twisted to a greater or less extent all the way back from the forming-wheel to the periphery of the coil of paper E, the tightest and, in fact, the main twisting occurring between the front end of the horn and the periphery of the forming-wheel. The appearance of the paper between the supply-coil and the forming-wheel is clearly illustrated in Figs. 5 and 8, where it will be seen that when passing through the front mandrel the paper is very loosely coiled and when passing through the tapered front guide it is somewhat reduced, but is still loose, gradually growing tighter and tighter as it approaches the forming-wheel. The paper is wound around the horn H, which is arranged in the central longitudinal axis of the guide. This serves to prevent the paper from being compressed toward the center in some places more than in others, and thus insures the formation of a tube or twisted cord of uniform nature. Generally the paper does not traverse the entire length of the spiral slot of the front guide; but it generally twists around a portion of the front coil and that inclined part of the wire which connects the horn to the front coil. It will thus be seen that the construction is such as to first coil the paper loosely and then twist it somewhat more tightly around the horn, the paper when just leaving the horn being really in tubular form; but before passing the forming-wheel I the paper is reduced to a smooth, hard, and solid cord. The spinning-head is revolved in the direction indicated by the arrows. The wire of the front guide is coiled in an opposite direction, the effect being to assist the spiral movement of the paper or tend to deliver it from the front end of the horn instead of to retard its forward movement, as would be the case if the wire were coiled in an opposite direction to that shown or if the spinning-head were revolved in a contrary direction to that indicated.

Another feature of the machine to which I wish to call attention is that by providing means for twisting or spinning the paper loosely only while passing through the first guide I avoid an objection incident to some other machines involving the use of a funnel-shaped guide with a small orifice. In

such machines whenever projecting edges or other parts of the paper are detained in the funnel until they are spun down small enough to go through it the portion of the cord which has not yet arrived at the funnel is during this delay twisted to a greater extent than usual, making this portion tighter or of smaller diameter, and thus unlike the other portions of the twisted cord, it being remembered that the pitch or twist of the cord depends on the distance traveled while it is being spun combined with the rapidity of its rotation. In my machine, as before stated, the distance between the horn and the forming-wheel, in which space the cord is free to twist, is arranged with reference to the rate of feed and the speed, and the forward movement of the cord cannot be so impeded by the guides as to cause any appreciable difference in the spinning of the cord at any particular point.

I claim as my invention—

1. A machine for spinning paper cord comprising a tapered guide, the discharge-orifice of which is of materially greater diameter than the finished cord, and within which the paper is loosely twisted, a guide separated from the tapered guide a sufficient distance to permit the cord to pass thereto freely without external compression, and to be reduced to its final diameter between the two guides solely by a twisting action imparted to the cord, and means for revolving the paper, and for feeding it forward at such relative speeds as to reduce the paper to a solid cord of the final diameter between the two guides.

2. A machine for spinning paper cord comprising a tapered guide, the discharge-orifice of which is of materially greater diameter than the finished cord, and within which the paper is loosely twisted, a grooved guide-wheel separated from the tapered guide a sufficient distance to permit the cord to pass thereto freely without external compression, and to be reduced to its final diameter between the two guides solely by a twisting action imparted to the cord, and means for revolving the paper and for drawing it from the tapered guide and around the guide-wheel at such relative speeds as to reduce the paper to a solid cord of the final diameter between the tapered guide, and the guide-wheel.

3. A machine for spinning paper cord comprising a tapered guide, the discharge-orifice of which is of materially greater diameter than the finished cord, and within which the paper is loosely twisted, a horn attached to the guide and projecting forwardly in line with the axis of said guide, another guide separated from the tapered guide a sufficient distance to permit the cord to pass thereto freely without external compression, and to be reduced to its final diameter between the two guides solely by a twisting action imparted to the cord, and means for revolving the paper, and for feeding it forward at such relative speeds as to reduce the paper to a solid cord of the final diameter between the two guides.

4. A machine for spinning paper cord comprising a rotary tapered guide within which the paper is loosely twisted, a horn projecting therefrom and revolving therewith around which the paper is wound while being further twisted, and means for revolving the paper and for feeding it forward at proper relative speeds, substantially as described.

5. A machine for spinning paper cord comprising a revolving guide within which the paper is loosely twisted, a horn at the front end of the guide around which the paper is wound while being further twisted, a take-up reel, a guide interposed between the horn and the take-up reel, and means for revolving the paper and for actuating the take-up reel.

6. A machine for spinning cord comprising a tapered spiral guide having an open spiral slot, a spinning-head to which said guide is attached, a guide between which and the tapered guide the paper is twisted into its final form, and means for revolving the paper, and for feeding it forward while revolving.

7. A machine for spinning paper cord comprising a tapered spiral guide having an open spiral slot, a horn attached to the guide and projecting forwardly therefrom in line with the axis thereof, a spinning-head to which said guide is attached, and means for revolving the paper, and for feeding it forward at proper relative speeds.

8. A machine for spinning paper cord comprising a revolving spinning-head by which the paper is carried, a tapered guide carried by and revolving with the head, a horn projecting from said guide, a guiding-wheel to which the paper passes from the first guide, means for revolving the spinning-head, and means for drawing the paper around said guiding-wheel.

9. The combination of a spinning-head by which the paper is carried, a tapered guide carried by the spinning-head and having an open spiral slot, a horn projecting from said guide, a guiding-wheel to which the paper passes from the first-mentioned guide, feed-wheels engaging the cord and drawing it forward, and a take-up reel which receives the cord from the feed-wheels, and which is driven by yielding connections with the driving-shaft.

In testimony whereof I have hereunto subscribed my name.

HENRY B. MORRIS.

Witnesses:
ARTHUR N. GITTINGS,
HARRY W. MILLER.