(No Model.) 3 Sheets—Sheet 1.

A. MITSCHERLICH.

METHOD OF MANUFACTURING THREAD FROM SHORT FIBERS.

No. 395,914. Patented Jan. 8, 1889.

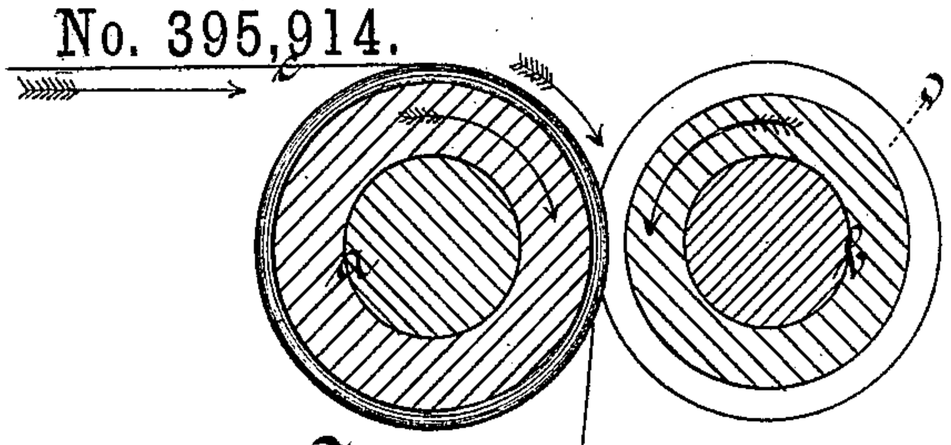


Fig. 1.

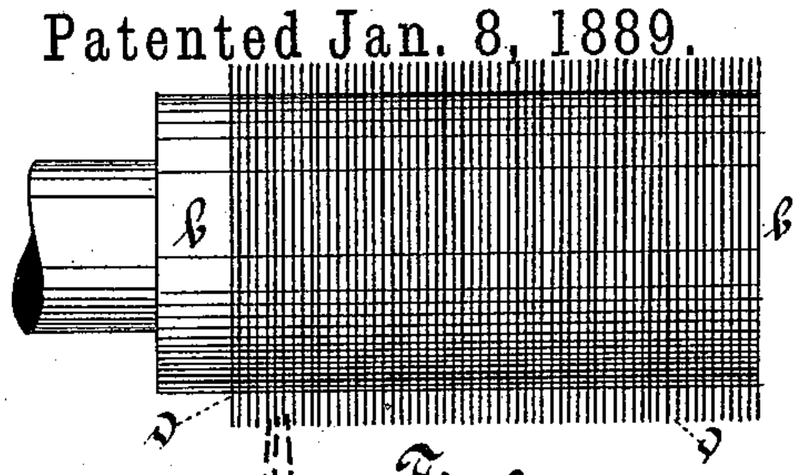


Fig. 2.

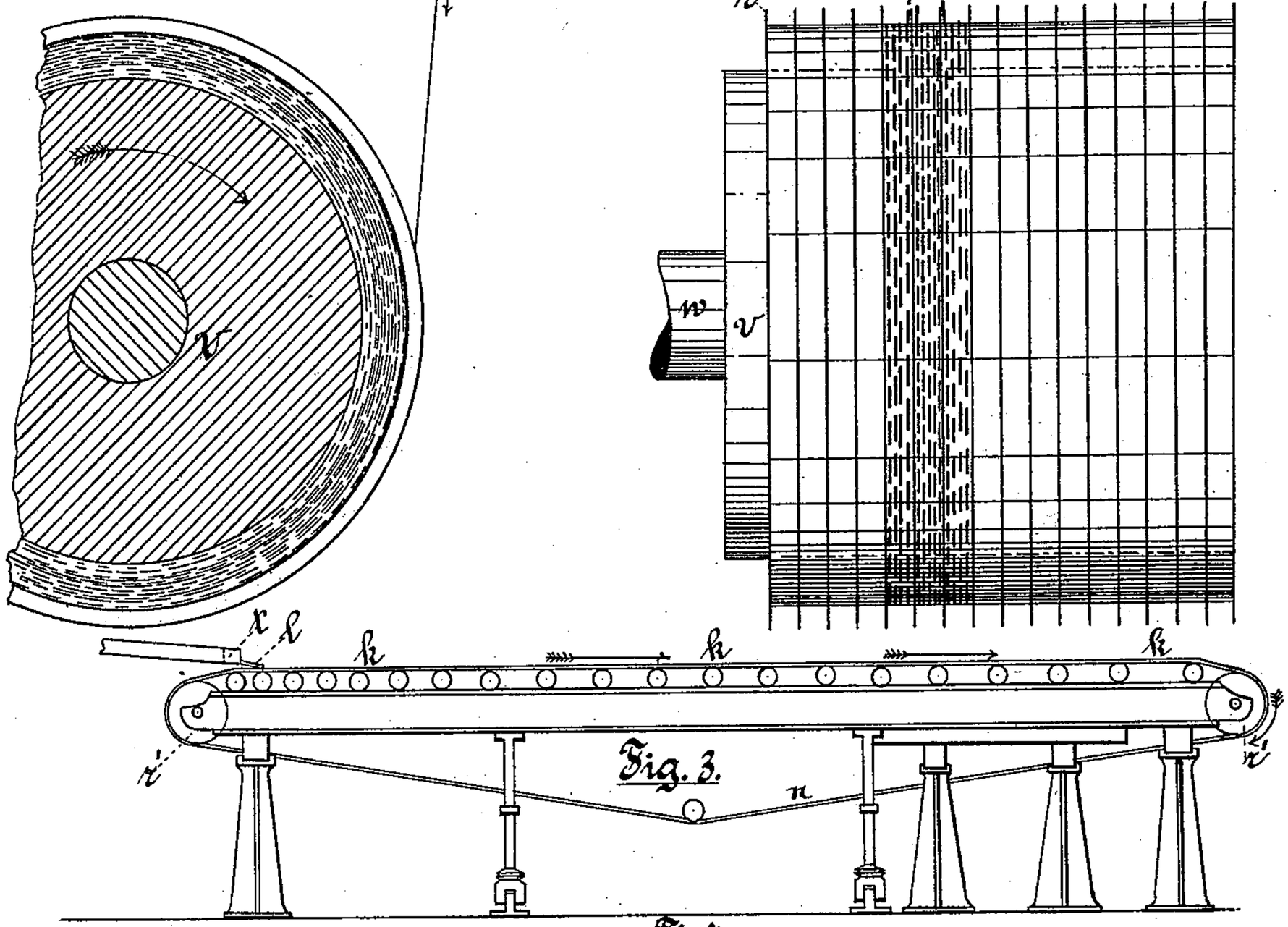


Fig. 3.

Fig. 4.

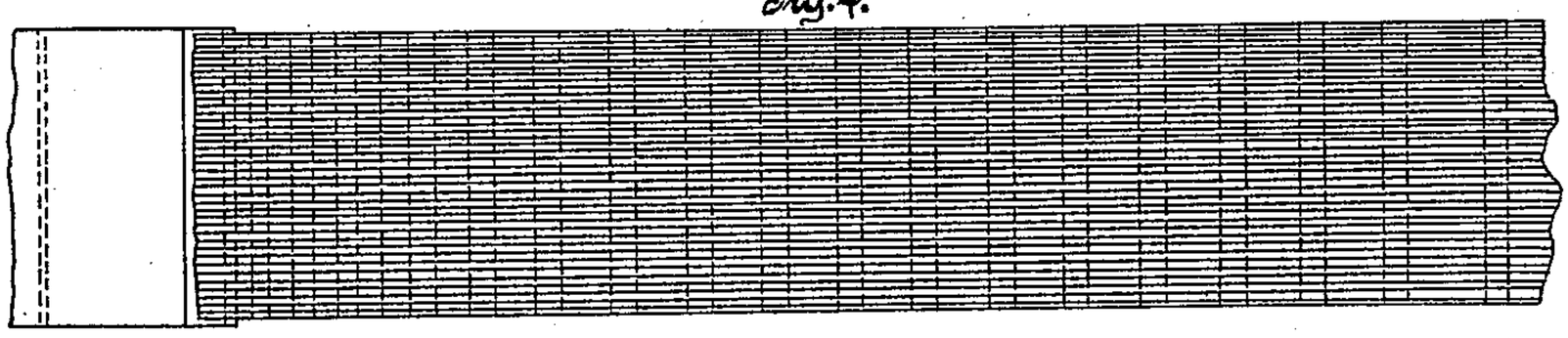
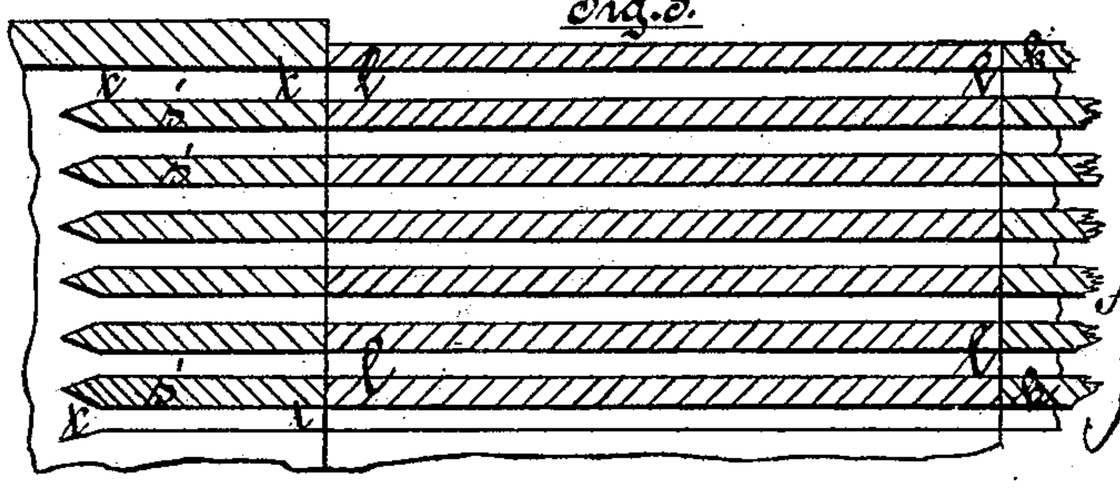


Fig. 5.



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(No Model.) 3 Sheets—Sheet 2.

A. MITSCHERLICH.

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Fig. 6.

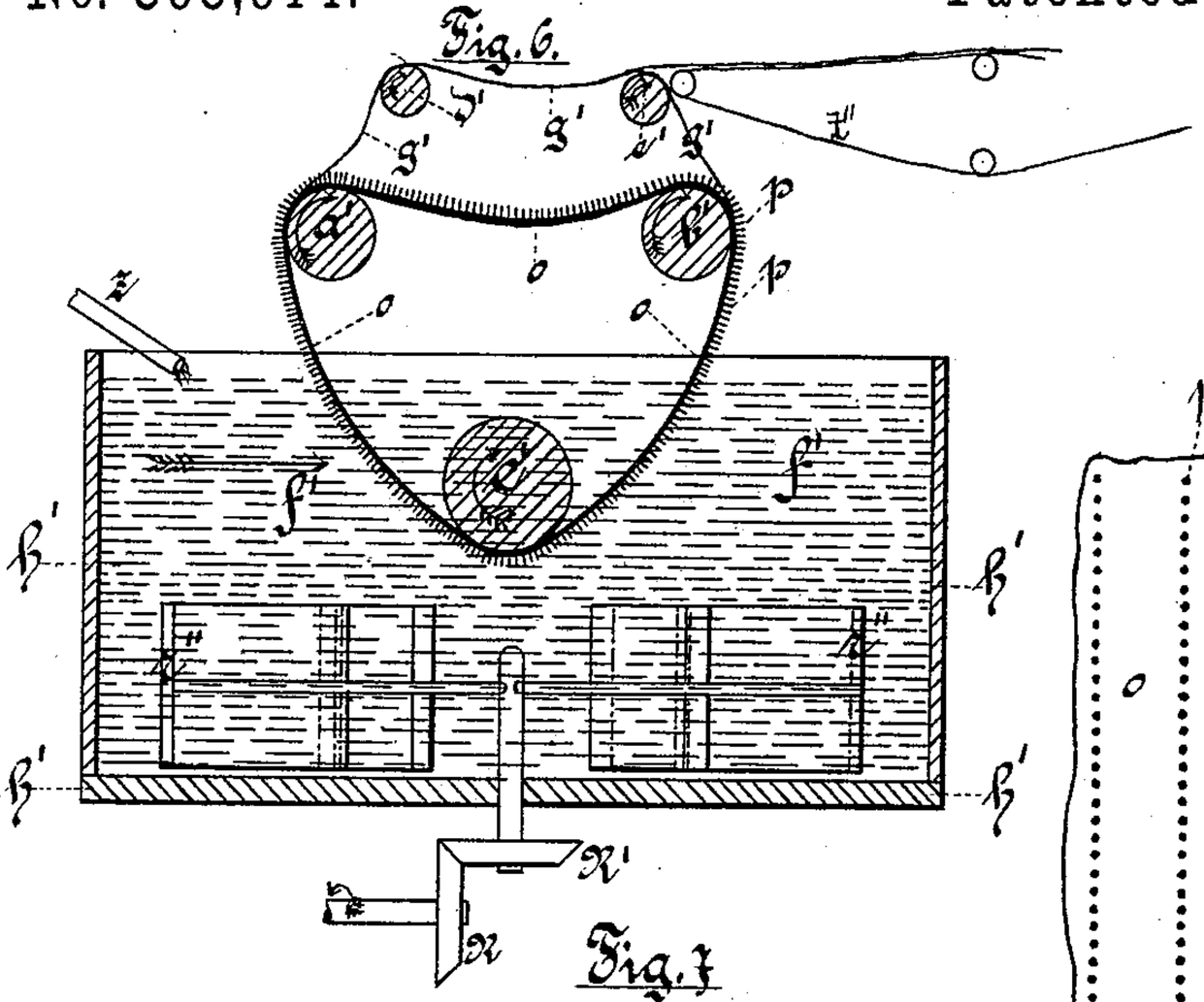


Fig. 7.

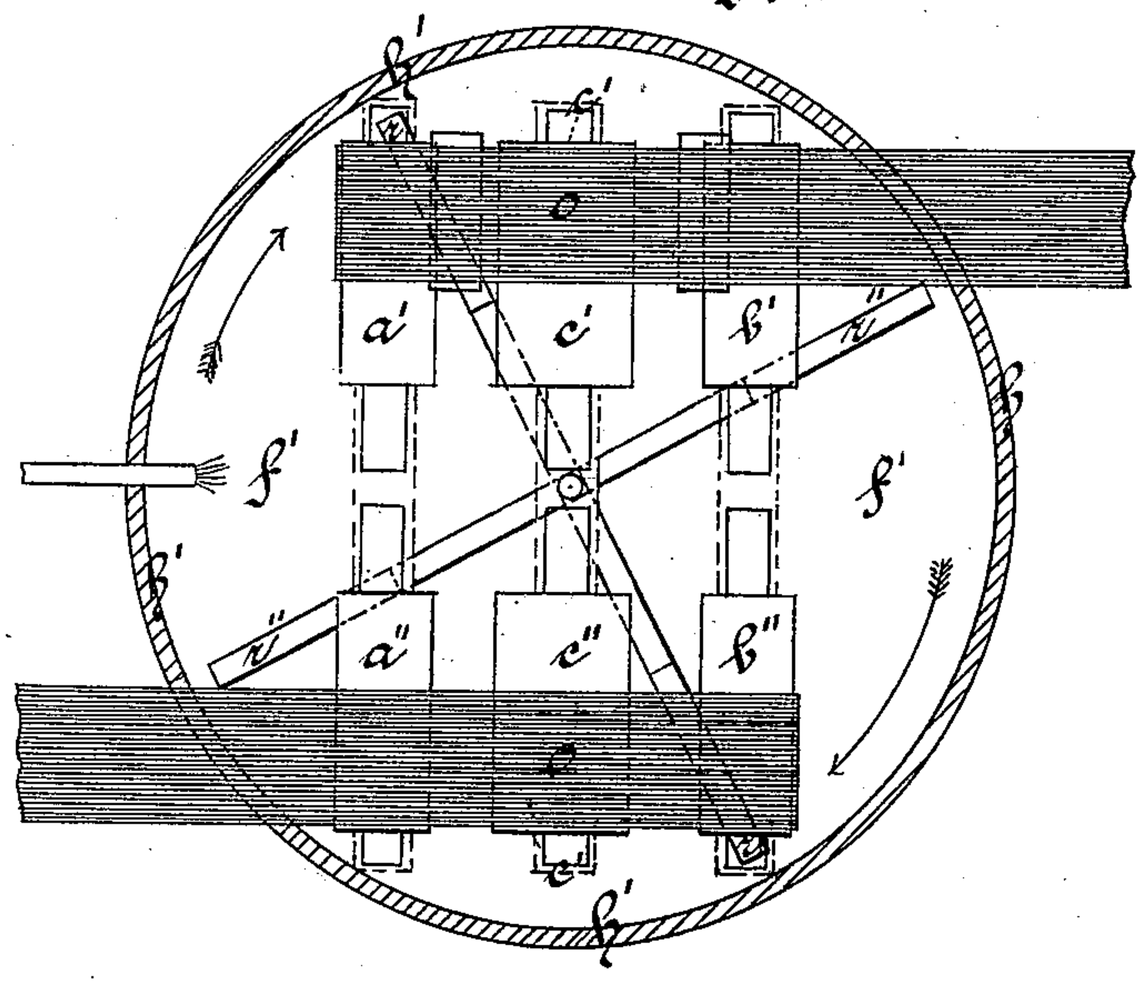


Fig. 8.

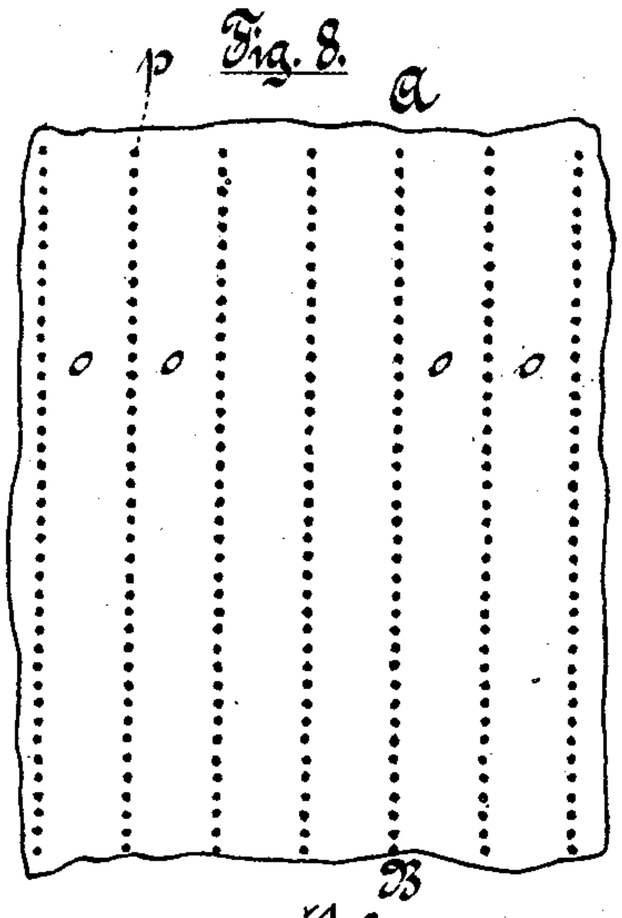
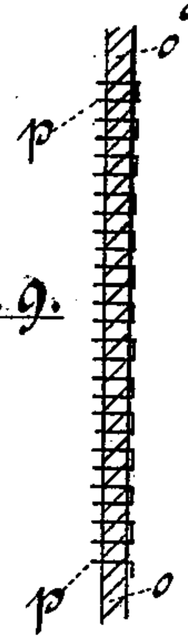


Fig. 9.



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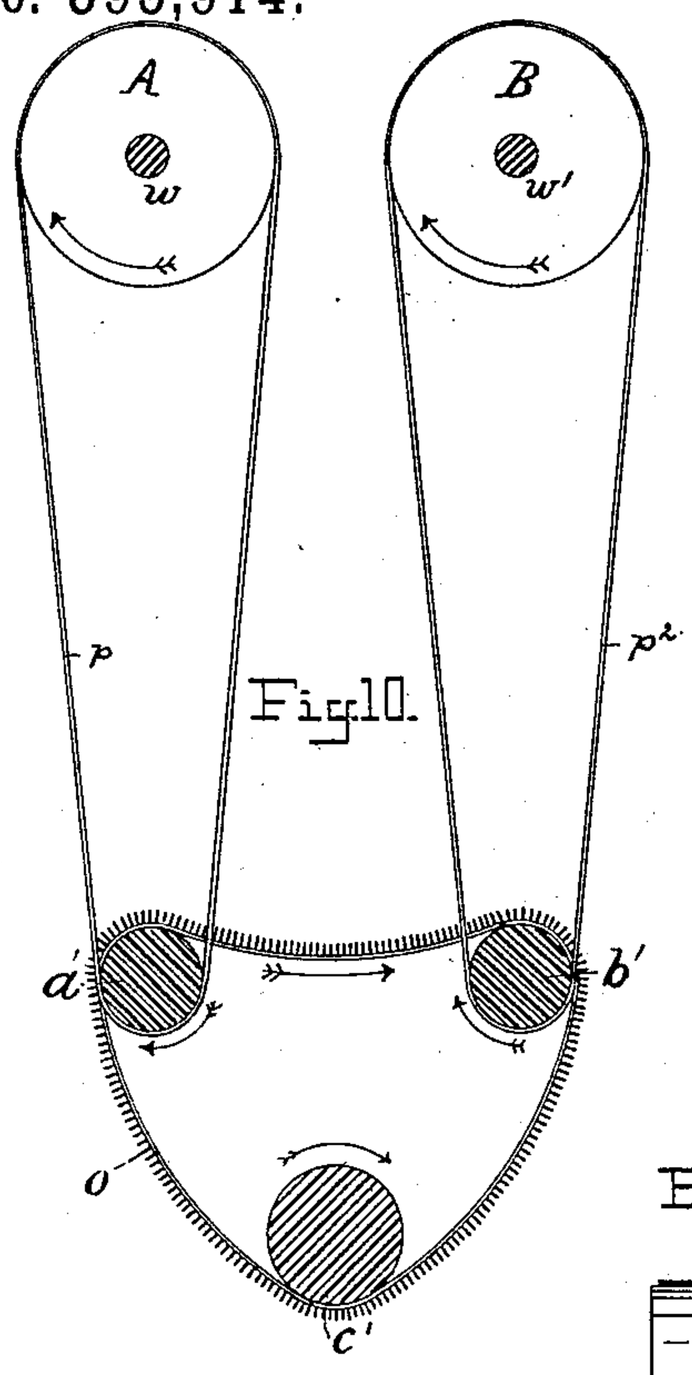


Fig. 10.

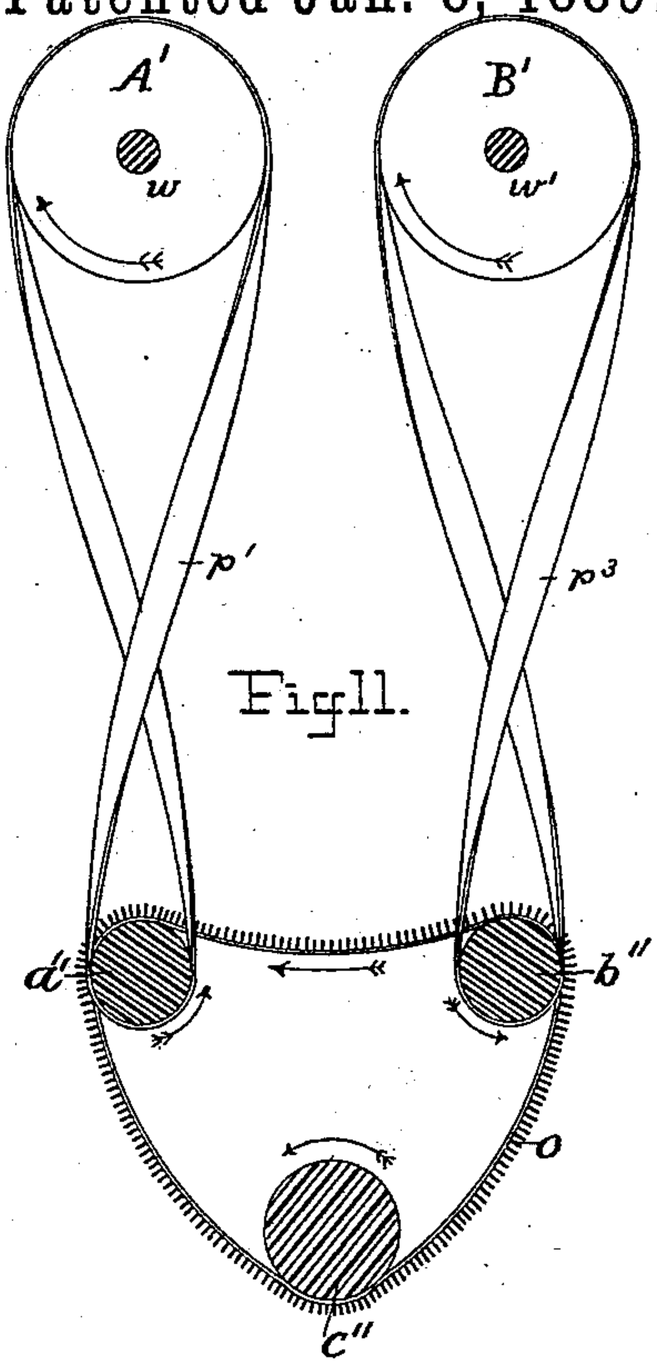
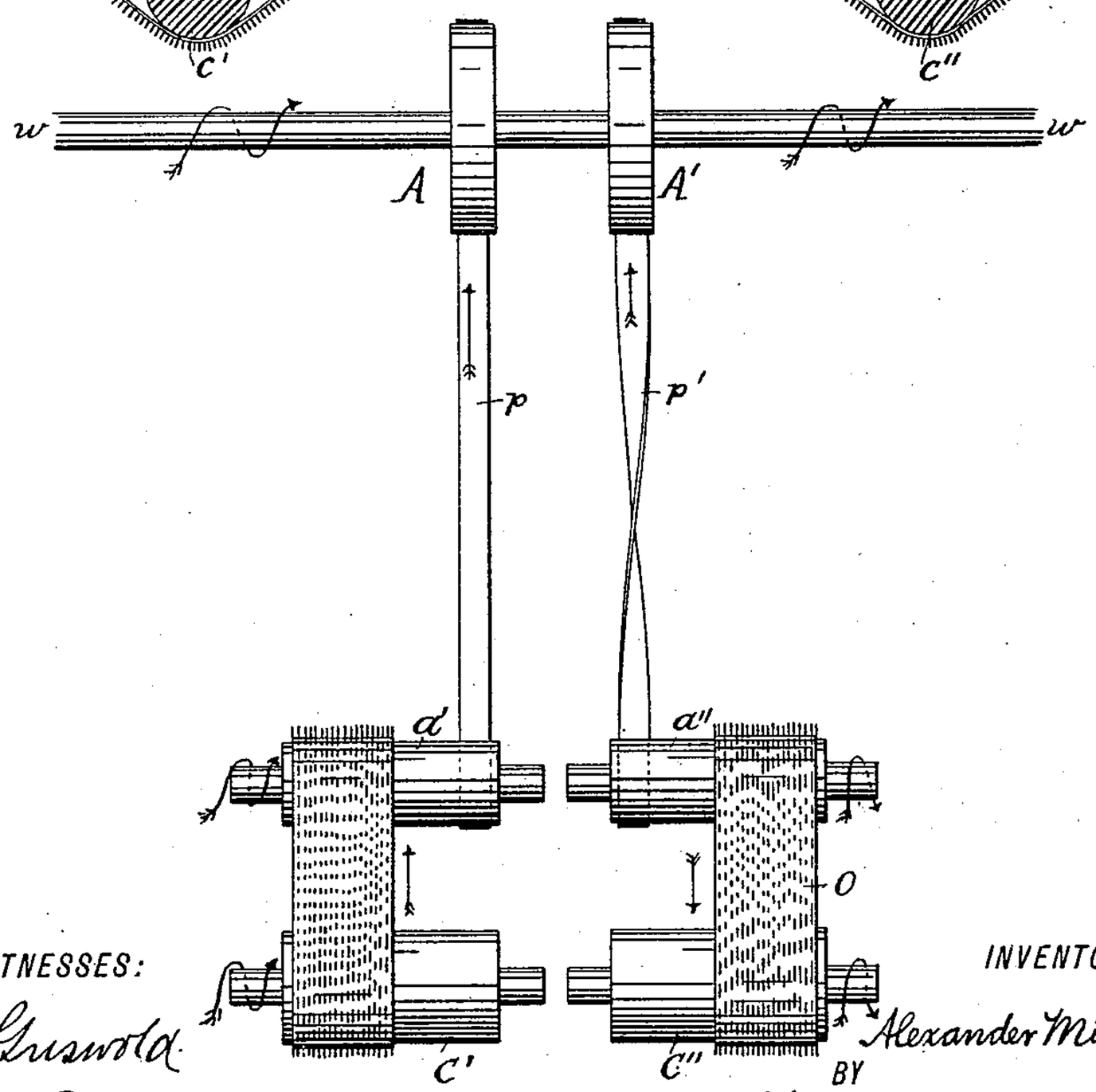


Fig. 11.

Fig. 12.



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UNITED STATES PATENT OFFICE.

ALEXANDER MITSCHERLICH, OF FREIBURG, BADEN, GERMANY.

METHOD OF MANUFACTURING THREAD FROM SHORT FIBERS.

SPECIFICATION forming part of Letters Patent No. 395,914, dated January 8, 1889.

Application filed September 11, 1884. Serial No. 142,774. (No model.) Patented in England August 28, 1884, No. 11,746; in Austria-Hungary October 3, 1884, No. 30,411 and No. 44,982; in Italy October 18, 1884, XVIII, 17,401, and in France December 26, 1884, No. 163,787.

To all whom it may concern:

Be it known that I, ALEXANDER MITSCHERLICH, of Freiburg, Grand Duchy of Baden, Germany, and a subject of the Emperor of Germany, have invented certain Improvements in the Method of Manufacturing Thread from Short Fibers, (for which I have obtained British Letters Patent No. 11,746, dated August 28, 1884; Austro-Hungarian Patents No. 30,411 and No. 44,982, dated October 3, 1884; French Patent No. 163,787, dated December 26, 1884, and Italian Patent No. 17,401, dated October 18, 1884,) of which the following is a specification.

The object of my invention is the utilization, for the manufacture of thread, of very short fibers—such as sulphite cellulose, for instance, or soda cellulose, obtained by boiling wood or vegetable substance with a chemical agent. I attain this object by the method hereinafter described of treating the said fibers, whereby they may be readily spun into thread. In order to make the short fibers suitable for the manufacture of thread, they are mixed with water, so as to form a pulp. The fibers can then be treated by either the wet or dry process. By the wet process the pulp of fibers is allowed to flow in strips of suitable widths, which are then employed for the manufacture of thread. By the dry method a kind of felt or pasteboard is first made out of the fiber pulp, and after having obtained the desired thickness of the layer of the felt the latter is cut into strips of the width required. By then spinning these strips of felt or pasteboard obtained by either method new thread is manufactured, the strength of which depends upon the fact that the short fibers have a parallel position lengthwise in the felt or pasteboard strips.

In the accompanying drawings, Figure 1 represents a cross-section of a contrivance for obtaining the fiber strips from the felt by the dry method. Fig. 2 represents a face view thereof. Fig. 3 shows in side elevation a contrivance for obtaining the fiber strips by the wet process. Fig. 4 is a plan view thereof, and Fig. 5 is a partial sectional plan view of a part of the apparatus shown in Figs. 3 and 4, but drawn to a larger scale. Fig. 6 represents a vertical section of another contrivance for obtaining the fiber strips by the wet process. Fig. 7 is a sectional plan view thereof. Fig. 8 is a plan view, on an enlarged scale, of a fiber-collecting belt used in the apparatus shown in Figs. 6 and 7. Fig. 9 is a section through the belt on the line A B, Fig. 8. Figs. 10, 11, and 12 are views showing means for driving the rollers of the apparatus, Figs. 6 and 7.

For manufacturing thread, the short fibers are mixed with water, so as to form a pulp, by means of a suitable contrivance, which may be constructed in any convenient manner. The apparatus which is represented, for instance, in Figs. 6 and 7, and which is hereinafter described, may be used for the purpose. Should the fiber bundles be too thick, they must be separated before being turned into felt or pasteboard. As the fibers used in this new method are, as it is, very short, they should not be torn by the apparatus employed for obtaining the strips. The pulp is gradually distributed by mixing the same with water until it is suitable for making the fiber strips. An impregnating material similar to that which is used for making paper water-proof may also be added to the mixture. From this thin fiber pulp, produced in the above-described manner, fiber strips may be obtained in various ways, and these strips are then employed for the manufacture of thread. In the accompanying drawings, for instance, three contrivances are represented for the manufacture of these fiber strips.

Figs. 1 and 2 represent in a cross-section and in a side view a contrivance to obtain the felt or pasteboard strips from the felt by what I have termed the "dry process." The fiber pulp is caused to flow over traveling endless drain-sieves suitably about three and a half feet wide, through which the water passes away with a minimum loss of fiber, and after having been thus prepared for the felt it comes to a cylinder, *a*, such as is shown in Fig. 1. This cylinder may be made of cast-iron, and is suitably covered with common woolen felt. The cylinder *a* revolves in the direction of

the arrow, and the continuous sheet of pasteboard, *c*, coming from the drain-sieves, is taken up by the cylinder *a* and passes between the cylinder *a* and a second cylinder, *b*, provided with cutters *d*. The cylinder *b* revolves in a contrary direction and at a greater speed than cylinder *a*. The distance between the circular cutters of the cylinder *b* is regulated by the width of the fiber strips required. Ordinarily strips are cut of a width of one and a half to three millimeters. The strips which are cut from the felt by the cutters *d* are passed over and coiled up on the roller *e*, Figs. 1 and 2. In order to secure a good coiling up, this roller is fixed at a greater distance from the roller *b* than is shown in the drawings, for in the latter the roller *e* is shown far too near to the cylinder *b*, owing to the want of space. On the roller *e* there are sundry divisions (according to the number of cutters) made by the partitions *s*, and always between two of these partitions the cut strips are coiled up. The roller *e* is mounted on a spindle, *w*, and after having been filled with fiber strips the roller can be taken off. In order to prevent any stoppage, several such empty rollers should be ready for use. These rollers, now filled with fiber strips, can be taken to the spinning-machine for the strips to be spun.

Figs. 3 and 4 represent a contrivance by which these fiber strips may be obtained directly by the wet process. The fiber pulp made in the manner before referred to arrives, by the aid of the conducting-channels *t* and *l*, in the form of thin streams, at the endless drain-sieves *n*. On the sieves channels are provided of elastic caoutchouc bands *k k*, Fig. 5, coinciding with the conducting-channels *t* and *l*, in order to prevent these thin streams of pulp from getting together again. These caoutchouc bands *k k*, fixed on the drain-sieves, are sufficiently elastic to be carried around the rollers *r'* and *r* for the endless sieves. The feed movement of the fiber pulp in the conducting-channels is obtained by inclining the trough or spout, and on the drain-sieves the fiber pulp, letting off the water at the same time, is being moved by the motion of the endless sieves, which are carried over the rollers *r* and *r'*. From the drain-sieves these fiber strips pass to the rollers for coiling up, which are not shown in Fig. 3, but which can be formed similar to those shown in Figs. 1 and 2. The conducting-channels *t* and *l*, also the channels formed by the caoutchouc bands *k*, are shown more distinctly in the enlarged sectional plan, Fig. 5.

In Figs. 6 and 7 an apparatus is represented which can be used for obtaining fiber strips by the wet method. By means of supply-pipe *z* the fiber pulp is fed into a tank, *h'*, in which, by means of a stirring apparatus, *r''* *r''*, worked by a pair of bevel gear-wheels, R and R', the fiber pulp is continually stirred up in order to prevent the fibers from sinking to the bottom of the tank and keep them equally mixed in the liquid. In this tank there also travels on three rollers, *a' b' c'*, a leather belt, *o*, which on its exterior side is provided with a number of pins, *p*, close together in rows. I prefer to use wire staples to form these pins, as shown in Figs. 8 and 9. A second belt, *o*, traveling over rollers *a'' b''* *c''* in the opposite direction, may also be used, as shown in the drawings. The distance between the pins and the rows of pins depends upon the length of the fibers treated. The shorter these fibers are, and the thinner the pulp is, the nearer may be the rows and the closer may be the pins in each row. Where the fibers are longer and the pulp is thicker, the rows and the pins therein may be farther apart. With an average thick pulp of sulphite cellulose—from coniferous trees, for instance—it is preferable to arrange the pins at one-sixteenth of an inch and the rows one-third of an inch apart from each other. When other materials are used for producing fiber strips, the distance between the several pins and rows will depend upon the length of the fibers, as already mentioned. The distances between the pins may be, for instance, the thirty-second part of an inch and the corresponding distance between the rows would then be the sixth part of an inch. These distances may be increased for the pins up to the eighth part of an inch and for the rows correspondingly up to two-thirds of an inch. I have found that these distances, which, of course, are cited only as examples, and may be increased or diminished according to necessity, give advantageous results.

When soda cellulose or sulphite cellulose made of shorter fibers than those of coniferous trees—such as fibers of beech-wood or other trees bearing foliage are employed—smaller distances, corresponding to the length of fibers, can be chosen. The size of the wire pins may, for instance, be as follows: The length of the projecting part one-sixteenth of an inch and the thickness of the wire one thirty-second of an inch. These dimensions may, however, be modified according to the circumstances. The above-mentioned dimensions may preferably be employed, because the fibers form then a large number of single strips placed side by side in the direction of pins *p*, whereby a parallel position of the fibers in the finished thread will be obtained. Each belt thus provided with pins *p p* is moved on its rollers in the direction of the arrow, as shown in the drawings, and dips into the fiber pulp in the tank *h*. It will thus be obvious that these pins are employed for the production of the strips of fiber and are necessary to cause the fibers contained in the pulp to adhere to the belt in parallel lines.

Means for imparting motion to the two belts are shown in Figs. 10, 11, and 12. The roller *a'* is driven by a belt, *p*, passing over a pulley, A, on a shaft, *w'*, while the roller *a''* is driven from the same shaft, but in the opposite direction, by a crossed belt, *p'*, passing over a pulley, A', on the shaft. Similarly the roller *b'* is driven by a belt, p^2, passing over

a pulley, B, on a second driving-shaft, w', while the roller b'' is driven in the opposite direction by a crossed belt, p^3, passing over a pulley, B', on the said shaft. The rollers c' and c'' are moved each by the friction of its own belt.

As shown in plan view, Fig. 7, the fiber pulp is pushed against each belt o in a slanting direction. The pulp is pushed against each belt in a slanting or oblique direction, owing to the circular motion imparted to it by the revolving stirring apparatus, (see the arrows in Fig. 7,) and it lifts the fibers in parallel positions out of the pulp flowing against the belt. To explain more clearly the term "slanting direction," I may point out that it is a slanting direction in a double sense, in which the pulp pushes against the belt, according as the apparatus is looked at in elevation (see Fig. 6) or from above. (See Fig. 7.) When the angle at which the flowing mass strikes against the bent belt is seen, as in Fig. 6, it would vary between twenty degrees and sixty degrees. The plan view of Fig. 7 shows an angle from thirty degrees to sixty degrees between the fibers horizontally swimming in a circle and the surface of the belt provided with wire pins. By the guidance of the belts and the movement of the pulp continually and regularly the fibers will be deposited on these pins on the belts and by the continuous motion of the belts by the time the latter leave the liquid the strips of felt will have thus been formed and may be taken off the bands. In proportion as the fibers are thus taken out of the tank new fiber pulp must be added by the supply-pipe mentioned before. As a means for taking these strips off each belt, the following may be used: The belt with the pins is covered with an endless large meshed fabric, g' g', through which the wire pins sufficiently project. This fabric passes over the cylinders c', d', and e'. As soon as the belt leaves the pulp the fabric rises from the belt and carries with it the strips of fiber over the rollers d' e'. On this large meshed fabric the fiber strips remain together, and after leaving the fabric at the roller e' pass onto the drain-sieves n, Fig. 5, and from there arrive at last at the rollers for coiling up, as described before. Before the leather belt dips into the pulp the said fabric g' passes back onto the belt, and the operation described before is repeated over again.

By the method described felt strips are obtained in which, for the greater part, the fibers lie parallel together, and thread manufactured out of such strips will naturally resist the strain of tearing twice as well as thread manufactured where this parallel laying of fibers has not been brought about. The felt strips thus obtained in any of the different ways described, and which will mostly tear by the slightest tension, are now spun, and may be subjected to pressing either beforehand or afterward.

The further working of the fiber strips in order to produce thread therefrom is carried on in the usual way, the peculiar properties of the strips being, however, taken into consideration. I do not claim in this case the finished article, as that forms the subject of a separate application for a patent filed by me November 3, 1886, Serial No. 217,897.

I am aware that it has been proposed to use paper for the manufacture of thread or yarns; but in such processes a finished paper was used—that is, a very thin material made of fibers ground in the rag-engine, and in consequence considerably shortened and not arranged parallel with each other, and owing to the more or less high pressure to which the material was subjected and owing to the presence in it of sizing it was of considerable firmness and always offered more or less resistance against tearing. In my process, on the other hand, I employ only naturally short fibers which are not otherwise reduced and are not capable of being spun—that is to say, fibers from which a pulp is prepared, and from this pulp strips are produced either by the wet or dry process already described.

The material which I have termed "pasteboard" is a substance similar to paper, but which is not finished and not pressed. It is a thick and proportionately loose material, which can be easily torn apart, and which, for its mass, is not either as firm or tough as paper.

I claim as my invention—

1. The method herein described of manufacturing thread from short fibers, (such as sulphite cellulose or soda cellulose,) said method consisting in forming these short fibers into a pulp, arranging the fibers substantially parallel to each other, producing fiber strips therefrom, and spinning the strips thus formed, substantially as described.

2. The method herein described of manufacturing thread from short fibers, (such as sulphite cellulose or soda cellulose,) said method consisting in first forming these short fibers into an aqueous pulp, producing directly from this pulp strips of pasteboard with the fibers parallel to each other, and spinning these strips into thread, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALEXANDER MITSCHERLICH.

Witnesses:
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J. GRUND.