No. 717,415. Patented Dec. 30, 1902.

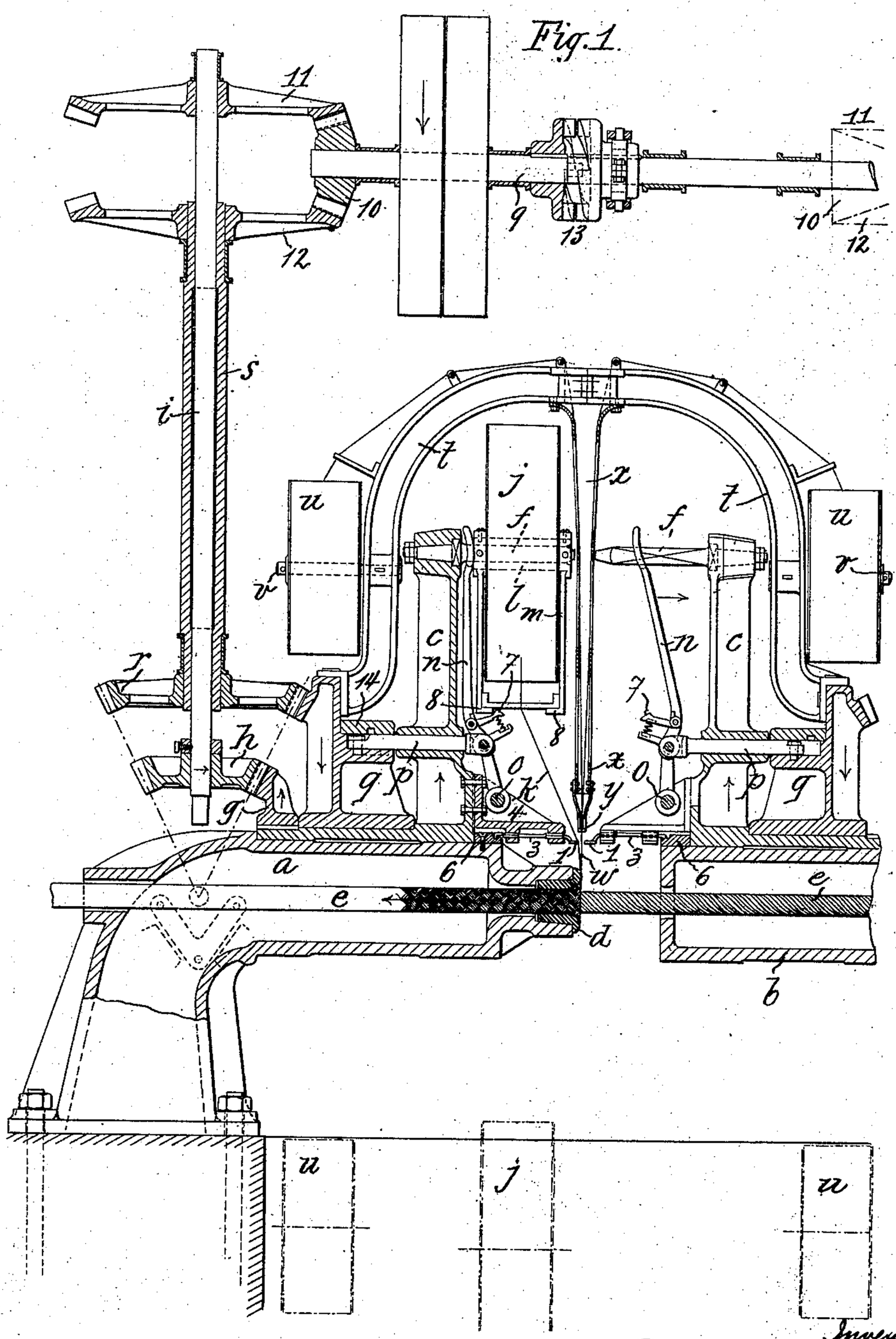
B. KIRSCH.

BRAIDING MACHINE.

(Application filed Nov. 9, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses:
B. Thon
B. H. Sommers

Inventor.
Bernhard Kirsch.
by Munn & Co.
Attys.

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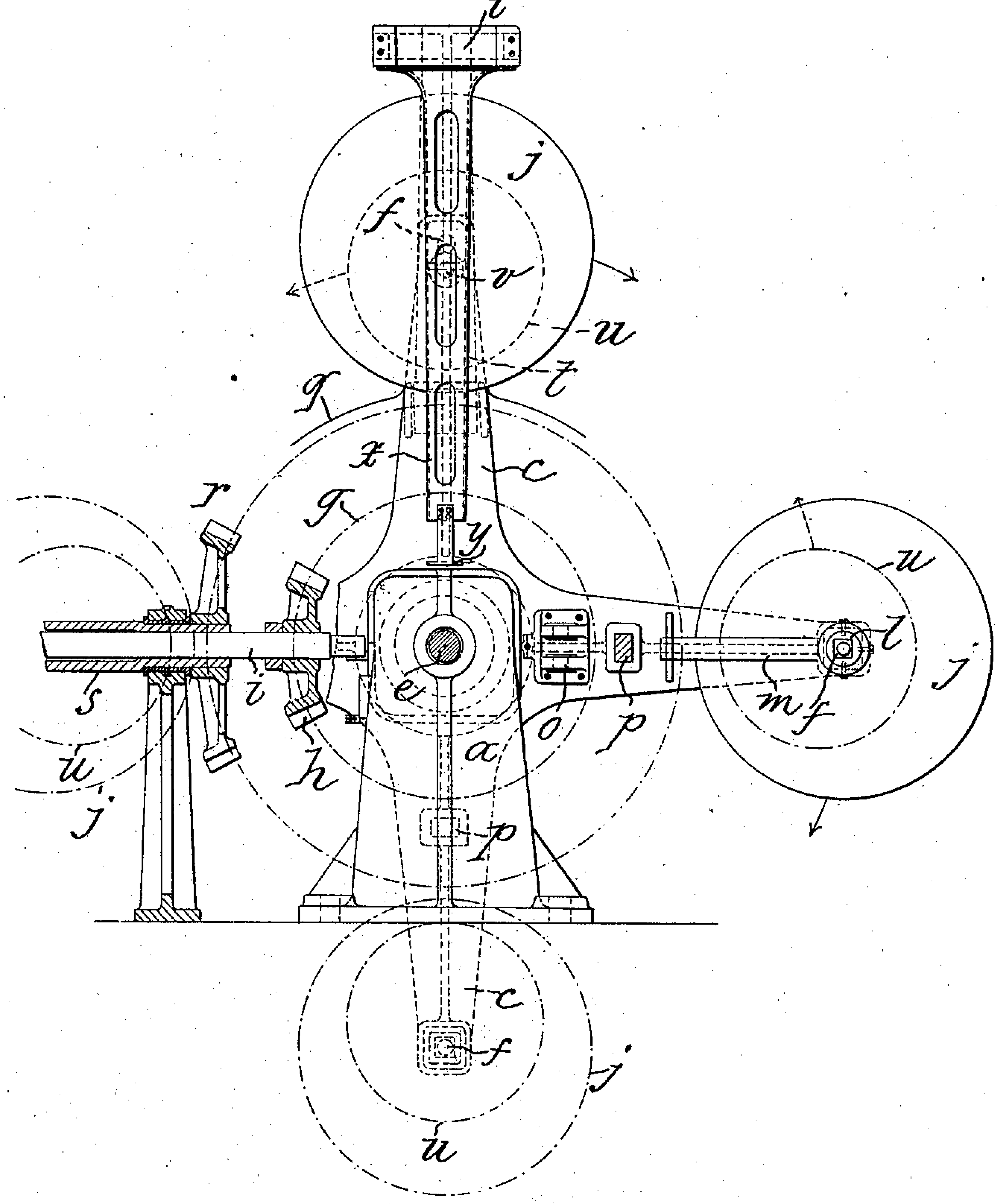
(No Model.) 3 Sheets—Sheet 2.

Fig. 2



Witnesses:
[signature]
B. H. Sommers

Inventor,
Bernhard Kirsch
by [signature]
Atty.

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

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(No Model.) 3 Sheets—Sheet 3.

Fig. 3

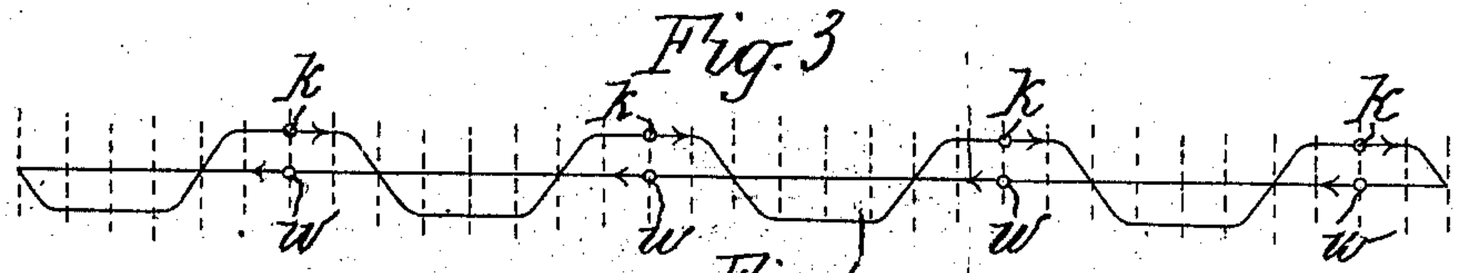


Fig. 4

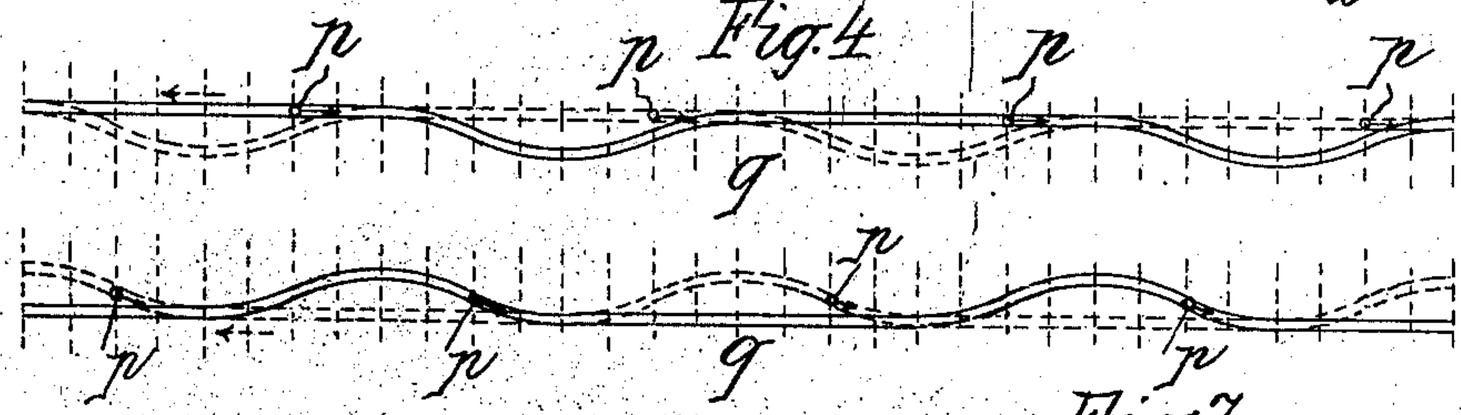


Fig. 5.

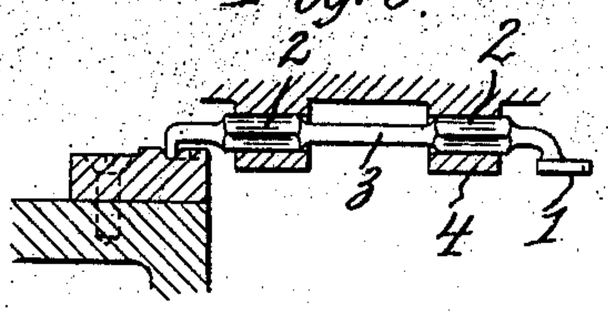


Fig. 6.

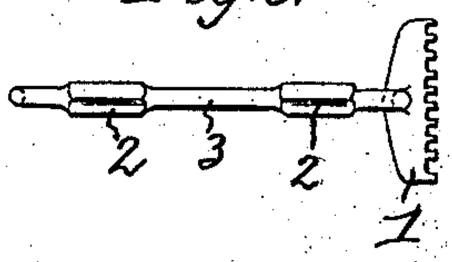


Fig. 7

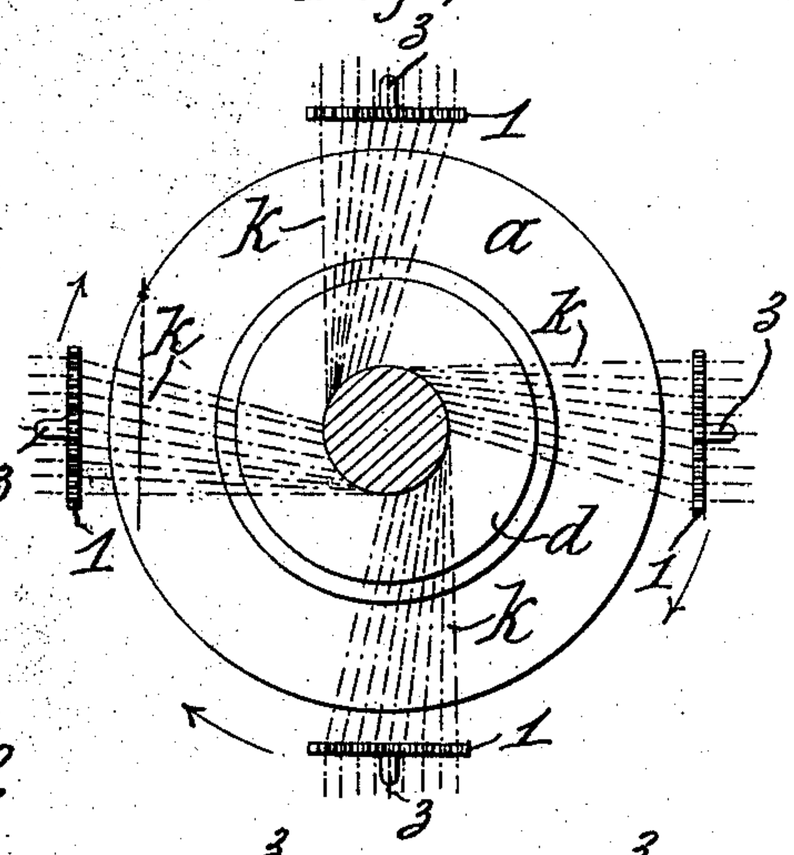


Fig. 8.

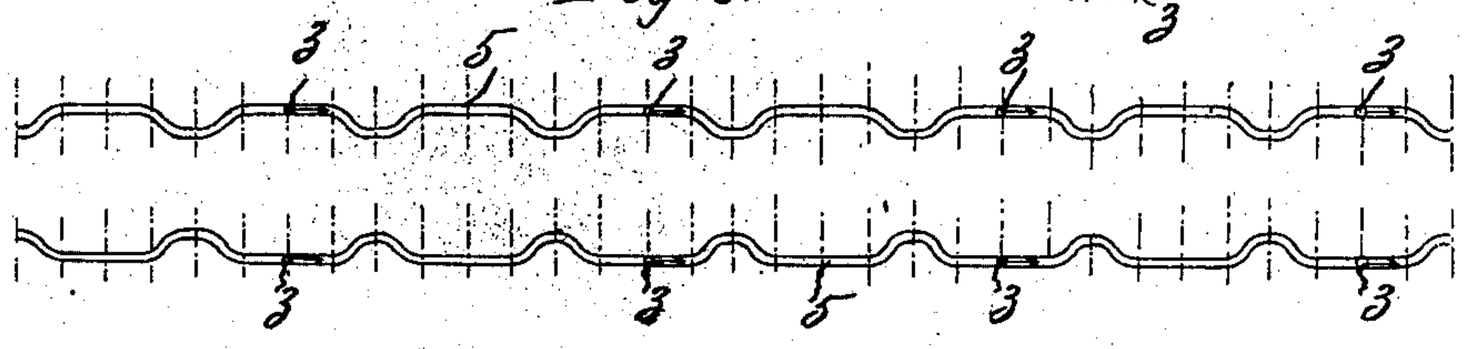


Fig. 9

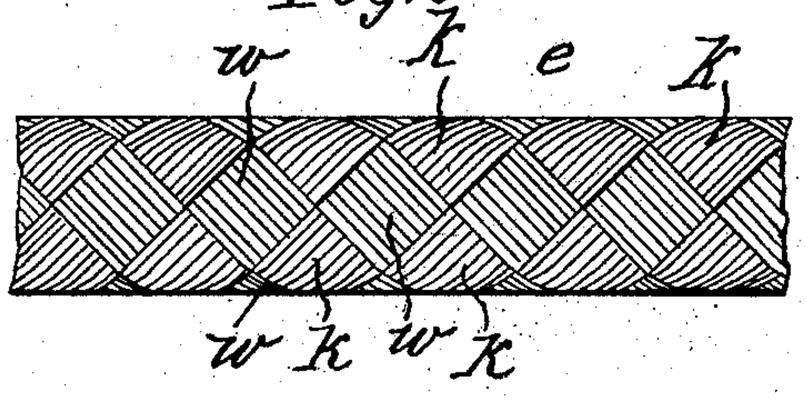
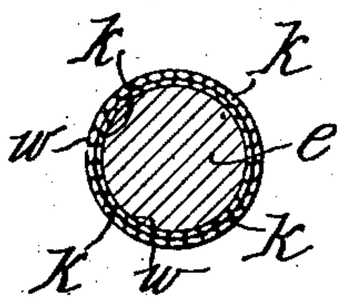


Fig. 10.



Witnesses:
R. F. Hall
B. F. Sommers

Inventor,
Bernhard Kirsch.
by Jacob Wolf
Atty

UNITED STATES PATENT OFFICE.

BERNHARD KIRSCH, OF VIENNA, AUSTRIA-HUNGARY, ASSIGNOR OF ONE-HALF TO ADOLF PESSL, OF VIENNA, AUSTRIA-HUNGARY.

BRAIDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 717,415, dated December 30, 1902.

Application filed November 9, 1899. Serial No. 736,424. (No model.)

To all whom it may concern:

Be it known that I, BERNHARD KIRSCH, a subject of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Braiding-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

A machine according to this invention is specially adapted for covering ropes, cords, or cables with braid to form an outer covering therefor. Such a braiding-machine differs from the hitherto usual vertical braiding-machines by having a horizontal axis and is characterized by the fact that the bobbins corresponding to one group of braiding-strips are moved alternately to and fro on the spindles (which are located opposite to one another) of two disks or spiders (hereinafter called "spiders") which rotate in the same direction and at the same speed, so that the said bobbins travel along a wavy line on the cylindrical surface described by the spindles, while the other group of braiding-strips rotates between and in direction opposite to that of the two spiders, so that from the two groups of threads of the braiding-strips there is formed a braid that surrounds the rope or cable, which moves continuously through the hollow pivots of the spiders and a central bush. Each braiding-strip consists of a number of yarn-threads which must lie parallel to one another in the braid, so that they form what may be described as a "flat band" whose thickness does not exceed that of the single yarn. In order to attain this result, there are arranged, as near as possible to the bush that serves to compress the finished braiding, thread-guides which join in the rotary movement of the braiding-strips and prevent the yarn-threads of each strip from crossing one another, and thereby causing the braided rope to be jammed in the bush. For those braiding-strips whose bobbins are alternately moved over from the spindles of one spider to those of the other and which therefore travel in a wavy path these thread-guides consist of inwardly-opening forks which have a notch for each thread. These forks are located opposite to one another at a certain distance apart, so that the threads of the braiding-strips rotating in the central plane can pass between them, and they approach each other only for a short time during the transfer of the bobbins for the purpose of insuring the transfer of the braiding-strips from the right-hand forks to the left-hand forks, or vice versa. The transfer of the bobbins from one spider to the opposite one is caused by oscillating levers, and the bobbins are held in their position for the time being against the pull of the braiding-strips by spring-pawls, which are released as soon as the levers are set in motion. The accompanying drawings illustrate an example of such a braiding-machine in which eight braiding-strips are used.

Figure 1 shows a vertical section of the machine, symmetrical portions being shown only once and the horizontally-arranged transmission-shafts appearing turned up into the vertical plane. Fig. 2 is a sectional side elevation of the braiding-machine, in which for the sake of clearness certain parts are omitted. Fig. 3 is a development of the braiding-paths. Fig. 4 shows analogously the curved grooves that operate the levers. Fig. 5 is a side view, and Fig. 6 a plan, of a thread-guide. Fig. 7 is an inside view of the arrangement of the thread-guides relative to the bush. Fig. 8 is a development of the curved grooves by means of which the thread-guides are actuated. Fig. 9 is a side elevation, and Fig. 10 a cross-section, of the braided rope or cable.

The parts *a* and *b* are two rigidly-fixed heads, which are located opposite to each other and are turned cylindrical at their inner ends and which form the pivots for the rotating spiders *c*. One head *a* has at its inner end a cavity for the bush *d*, which serves to compress the braiding, while both heads are bored out for the passage of the rope or cable *e*. The spiders *c*, each of which carries four spindles *f* of square cross-section, are rotated at the same speed and in the same direction by means of bevel-wheels *g*, which are mounted on their hubs and which engage the bevel-wheels *h* of

the shafts *i*, so that the spindles *f* of the one spider are always located opposite to those of the other spider. The four bobbins *j*, on which the threads of the braiding-strips *k* of the one group are wound, can therefore be moved during their rotation around the axis of the machine from the right-hand spindles *f* to the left-hand ones, and vice versa. Each bobbin *j* is rotatably mounted on a sleeve *l*, which fits the square spindle *f* and is rigidly fixed to a frame *m*, that carries a tension device. (Not shown in the drawings.) The bobbins *j* are moved from spindle to spindle by single-arm levers *n*, which are pivoted at *o* on the hubs of the spiders *c* and embrace the spindles *f* with their forked ends and which are oscillated by means of sliding rods *p*, that engage the curved grooves of disks *q*. Each disk *q* is loosely mounted on the hub of the corresponding spider *c* and is driven at the same speed as the spiders *c*, but in the direction opposite to that of the spiders, by a bevel-wheel *r* of a hollow shaft *s*, that surrounds the corresponding shaft *i*. On each of the disks *q* there are fixed four arms *t*, on which are mounted spindles *v*, which are circular in cross-section and are adapted to carry the bobbins *u*, that contain the yarn-threads that form the four braiding-strips *w* of the second group. In the present case the yarn of each braiding-strip *w* is distributed on two bobbins *u*, which can therefore be much smaller than the bobbins *j*, while containing the same length of yarn. From the bobbins *u* the yarn passes over the ends (which are bent inwardly and screwed together) of the arms *t* and join together to form a braiding-strip *w* in each of the four radial sheath-like thread-guides *x*, which are attached to the arms *t* and carry at their inner ends perforated thread-guide plates *y*. The threads of the braiding-strips *k*, proceeding from the bobbins *j*, are led near to the bush *d* through thread-guide forks *l*, Figs. 5 and 6, which are turned with their openings inward—*i. e.*, the openings or notches of each fork *l* are turned toward those of the fork *l* opposite to it. These forks are mounted on stems 3, which carry square bosses 2 and are horizontally movable in supports 4, fixed to the spiders *c*, while by their inwardly-bent inner ends they engage in curved grooves 5 of rings 6, which are fixed rigidly to the heads *a* and *b*, respectively.

In order to prevent the bobbins *j* from being drawn inward by the tension of the braiding-strips *k* proceeding toward the bush *d*, there is mounted on each lever *n* a spring-pawl 7, which as soon as the bobbin arrives from the opposite side snaps in behind the projection 8 of the bobbin-frame *m*, and thereby holds the bobbin fast. This pawl is disengaged when the lever *n* begins to push the bobbin *j* inward.

The driving of the machine is effected by the main driving-shafting 9, which carries at each end a bevel-wheel 10, that forms a reversing motion in combination with a bevel-wheel 11, fixed on the shaft *i*, and a bevel-wheel 12, keyed on the hollow shaft *s*. The shafts *i* and *s* therefore rotate in opposite directions, but at the same speed.

For the purpose of facilitating the changing of the bobbins *j* the bevel-wheels *h* are held in position to gear with their respective gears *g* by a sleeve secured to its shaft *i* by a lock-screw, Fig. 1, so that by loosening the latter the said bevel-gear *h* can be moved along the shaft out of gear with *g*, thus permitting the rotation of one spider *c* independently of the other.

When working, the bobbins *j* are carried in a circle around the rope *e* to be braided and are at the same time pushed across by the levers *n* alternately toward the one side and the other. The braiding-strips *k*, which must follow the movement of the bobbins, travel along the wavy line shown in Fig. 3, while the braiding-strips *w* move continuously in the central plane of the machine. In this manner there is formed in the present case an eight-stranded braid in which each strip of the one group crosses each strip of the second group.

Fig. 4 is a development of the curved grooves which are arranged in the disk *q* and which set the levers *n* in motion by means of the sliding rods *p*. In each disk there are two sliding rods which are located on lines radiating at an angle of one hundred and eighty degrees from each other and engage in the groove indicated by full lines, which is arranged in the flange of the disk itself, and also two other sliding rods, which are likewise located on lines radiating at an angle of one hundred and eighty degrees from each other, but engage in the groove indicated by broken lines, which is located on the inner surface of a bipartite ring 14, screwed to the disk. Each lever *n* pushes the bobbin *j*, located in front of it, upon the spindle *f* of the opposite spider *c* and thereupon returns at once to its normal position, so that it avoids the thread-guide sheaths *x*, which pass between the ends of the spindles *f*. The perforated thread-guide plates *y* hold the several threads of the strips *w* beside one another, and the threads of each braiding-strip *k* are led through the notches of the thread-guide forks *l*, which follow the movement of the braiding-strips.

In Fig. 8 there is shown a development of the curved grooves 5 of the abutment-collars 6, in which the outer ends of the fork-stems 3 engage. As soon as a bobbin *j* is pushed over the fork *l*, guiding the corresponding braiding-strip *k*, and the fork located opposite to it move inwardly toward each other, so that these forks almost touch while the threads are being transferred from the one fork into the other. Thereupon the two forks separate again in order to provide room for the passage of the braiding-strip *w*, so that while the one fork is empty the other holds the braiding-strip, which by reason of its tension lies close in the notches of the fork.

A braiding-machine of the kind described possesses the advantage that the rope or cable to be braided can be drawn through the braiding-machine and be braided in a horizontal direction while maintaining the tension at which it comes out of the rope-spinning apparatus.

Braiding-machines according to this invention can of course be constructed for braidings with a different number of strips of that of the machine hereinbefore described.

I claim—

1. Machine for braiding thread on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier, a second set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of said carriers; in combination with means for shifting the bobbins alternately from one carrier of the second set to an opposite carrier of the second set, means for guiding the threads from the bobbins of the first set so as to be crossed by the threads from the bobbins of the second set whenever a bobbin of the latter set is shifted from one carrier to an opposite carrier, and means for revolving the two sets of carriers in opposite directions about a core adapted to move in a straight line, for the purpose set forth.

2. Machine for braiding thread on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier, a second set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of said carriers; in combination with means for shifting the bobbins alternately from one carrier of the second set to an opposite carrier of the second set, means for guiding the thread from the bobbins of the first set so as to be crossed by the threads from the bobbins of the second set whenever a bobbin of the latter set is shifted from one carrier to an opposite carrier, and means for revolving the two sets of carriers in opposite directions about a core adapted to move in a horizontal line, for the purposes set forth.

3. Machine for braiding thread on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier, a second set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of said carriers; in combination with means for shifting the bobbins alternately from one carrier of the second set to an opposite carrier of the second set, means for guiding the threads from the bobbins of the first set so as to be crossed by the threads from the bobbins of the second set whenever a bobbin of the latter set is shifted from one carrier to an opposite carrier and means for revolving the two sets of carriers at the same speed in opposite directions about a core adapted to move in a straight line, for the purposes set forth.

4. Machine for braiding on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier of the set, a second corresponding set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of such, having a plurality of threads wound thereon, means for alternately shifting the latter bobbins from one carrier to an opposite carrier, means for guiding the threads from said bobbins parallel to each other to the core, means for simultaneously guiding the threads from the first set of bobbins so as to be crossed by the threads from the second set of bobbins by the to-and-fro shifting of the latter, and means for revolving the carriers at the same speed in opposite directions about a core adapted to move in a straight line, for the purposes set forth.

5. Machine for braiding on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier of the set, a second corresponding set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of such, having a plurality of threads wound thereon, means for alternately shifting the latter bobbins from one carrier to an opposite carrier, means for guiding the threads from said bobbins parallel to each other to the core, means for simultaneously guiding the threads from the first set of bobbins so as to be crossed by the threads from the second set of bobbins by the to-and-fro shifting of the latter and means for revolving the carriers at the same speed in opposite directions about a core adapted to move in a horizontal plane, for the purpose set forth.

6. Machine for braiding on a core, comprising a set of bobbin-carriers composed of two series of oppositely-arranged carriers, a bobbin revolubly mounted on each carrier of the set, a second corresponding set of bobbin-carriers also composed of two series of oppositely-arranged carriers and bobbins for only one series of such, having a plurality of threads wound thereon, means for alternately shifting the latter bobbins from one carrier to an opposite carrier, means for guiding the threads from said bobbins parallel to each other to the core, means for simultaneously guiding the threads from the first set of bobbins so as to be crossed by the threads from the second set of bobbins by the to-and-fro shifting of the latter, means for compressing the braiding on the core, and means for revolving the carriers at the same speed in opposite directions about a core adapted to move in a straight line, for the purposes set forth.

7. In a machine for braiding on a core, the combination of alined and spaced tubular horizontal bearings *a* and *b* and guides for guid-

ing a core therethrough, a pair of bobbin-carriers mounted to revolve on said bearing on opposite sides of the space between said bearings, each carrier having a plurality of oppositely-arranged radial arms carrying a bobbin-spindle, bobbins for one set of said spindles, and thread-guides for guiding the threads from said bobbins to the core, means for shifting said bobbins periodically from one spindle to the spindle opposite thereto; with a second pair of carriers mounted to revolve on said bearing on opposite sides of the first pair, said second pair of carriers having a corresponding number of oppositely-arranged radial arms carrying spindles, and a bobbin on each, each pair of radial arms connected and carrying a thread-guide extending radially toward the axis of rotation of the carriers to a point proximate thereto, and mechanism for revolving each pair of carriers synchronously at the same speed but in opposite directions, for the purposes set forth.

8. The combination with the spiders *c*, the squared spindles *f* thereon, the cylindrical bobbin-sleeves *l* constructed to conform to said spindles, and the frame or yoke *m* having shoulders 8 secured to opposite ends of the sleeves, the disks *q* provided with irregular grooves, and the bearings *a*, *b* on which said spiders and disks are revolubly mounted; of the rods *p* having a pin projecting into said grooves for periodically moving said rods to and fro, a lever *n* pivotally connected to each of said rods, the free end of a lever straddling a spindle *f* behind the aforesaid bobbin-sleeve *l* thereon, and a spring-controlled pawl 7 mounted on each lever and adapted to engage a shoulder 8 on the frame *m* carried by sleeve *l* on the spindle straddled by such lever, and means for revolving the spiders *c* and disks *q* in opposite directions, for the purpose set forth.

9. Machine for braiding thread on a core moving in a straight line, comprising two sets of bobbin-carriers, means for revolving one set in one direction and the other set in an opposite direction about said core, thread-guides for the bobbin-threads of one set of carriers extending radially between the carriers of the other set to a point proximate to the core, and thread-guides guiding the bobbin-threads of the other set of carriers to said core and means for shifting the bobbins carried by the last-named set of carriers from one carrier to its companion carrier for the purpose set forth.

10. Machine for braiding thread on a core moving in a straight line, comprising two outer and two intermediate bobbin-carriers, bobbin-spindles thereon, the last-named carriers having their bobbin-spindles alined and facing each other, means for revolving the outer carriers in one direction and the intermediate carriers in an opposite direction, means for shifting the bobbins from the spindles of one of the intermediate carriers onto the spindles of its companion carrier, thread-guides for each bobbin carried by said intermediate carriers for guiding their threads to the core, means for reciprocally shifting a pair of thread-guides when a bobbin is shifted from one carrier to the other, and thread-guides for the threads from the bobbins of the outer carriers, said guides extending radially between the inner guides to a point proximate to the core, for the purpose set forth.

11. Machine for braiding thread on a core moving in a straight line, comprising two outer and two intermediate bobbin-carriers, means for revolving the outer and intermediate carriers in opposite directions, the latter having their bobbin-spindles alined and facing each other, bobbins mounted on the spindles of one of said intermediate carriers to move freely lengthwise thereof and to rotate about them, forked levers straddling said spindles in rear of their respective bobbins, means for periodically actuating said levers to throw the bobbins off the spindles of one intermediate carrier onto the spindles of its companion carrier, a thread-guide for each bobbin-spindle for guiding the thread therefrom to the core, means for periodically and reciprocally moving two oppositely-arranged thread-guides, and thread-guides for the bobbin-threads of the outer carriers extending radially between the intermediate carriers to a point proximate to the core, for the purpose set forth.

12. Machine for braiding thread on a core moving in a straight line, comprising two outer and two intermediate bobbin-carriers, bearings on which both pairs of carriers are loosely mounted, gearing for revolving the outer carriers in one direction and the intermediate carriers in an opposite direction and means for disconnecting one or the other of the intermediate carriers from their driving-gears, for the purpose set forth.

13. Machine for braiding thread on a core moving in a straight line, comprising a tubular core-passage provided with means for tightening the braid on the core, in combination with two outer and two intermediate bobbin-carriers, means for revolving the outer carriers in one direction and the inner carriers in an opposite direction, means for shifting the bobbins from one of the inner carriers to the other, thread-guides for guiding the bobbin-threads of the inner carriers to the core, and thread-guides for the bobbin-threads of the outer carriers extending radially between the inner guides to a point proximate to the core, for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

BERNHARD KIRSCH.

Witnesses:
ALVESTO S. HOGUE,
AUGUST FUGGER.