

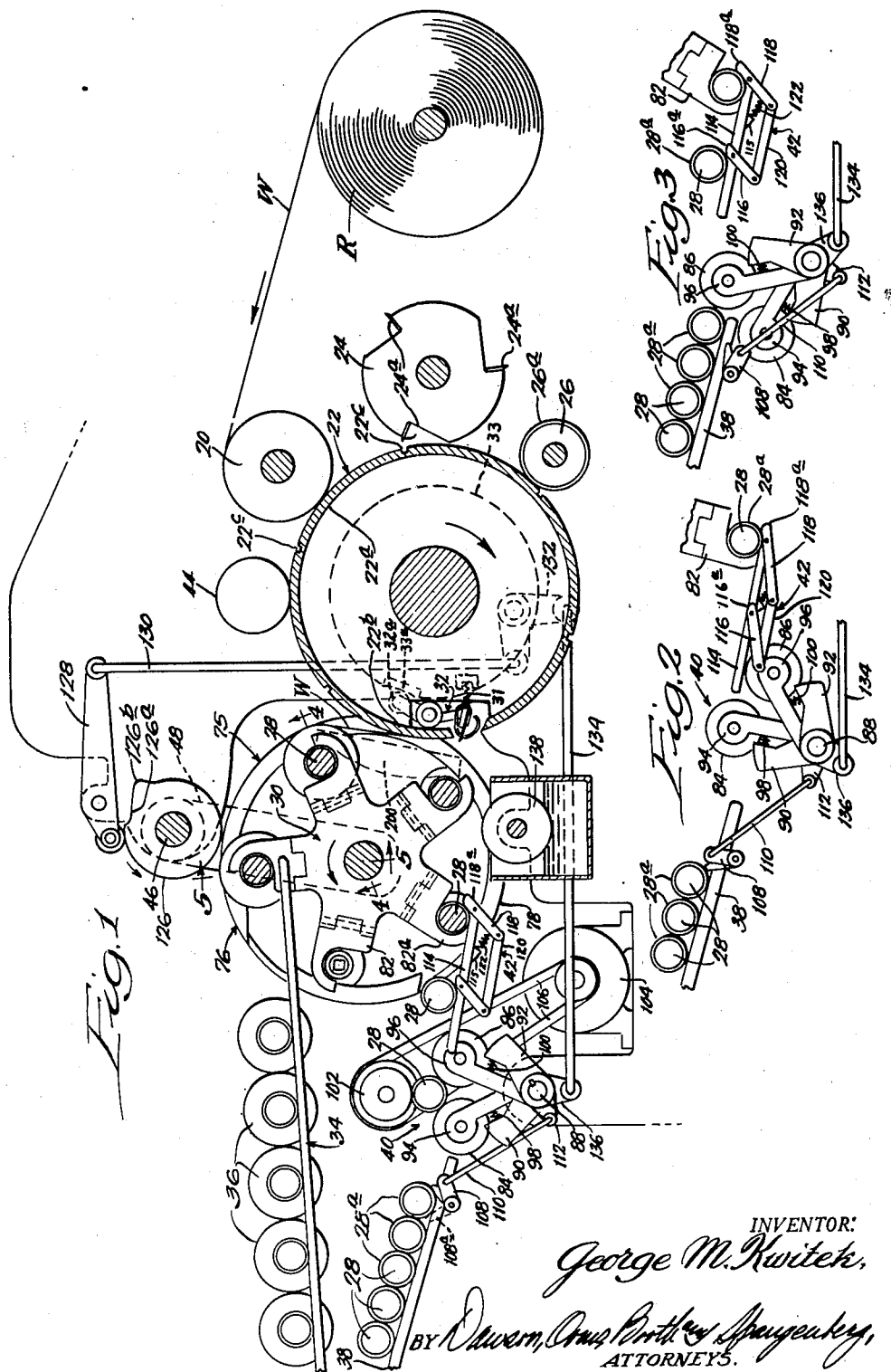
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MANDREL CORE CUTTING, LOADING,
AND EJECTING MECHANISM

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3 Sheets-Sheet 1



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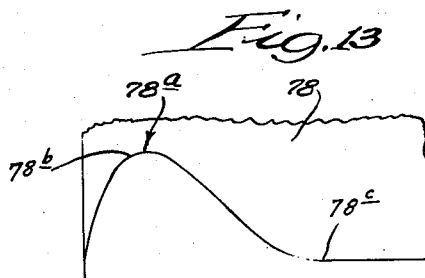
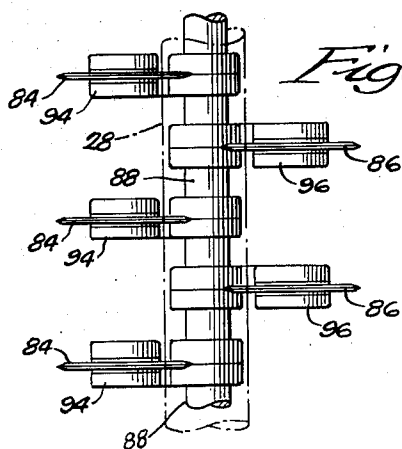
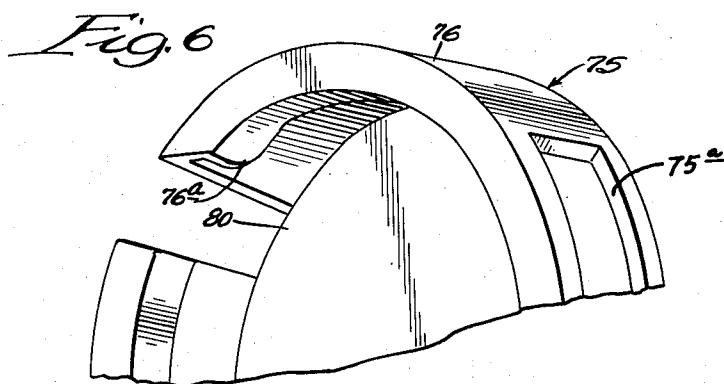
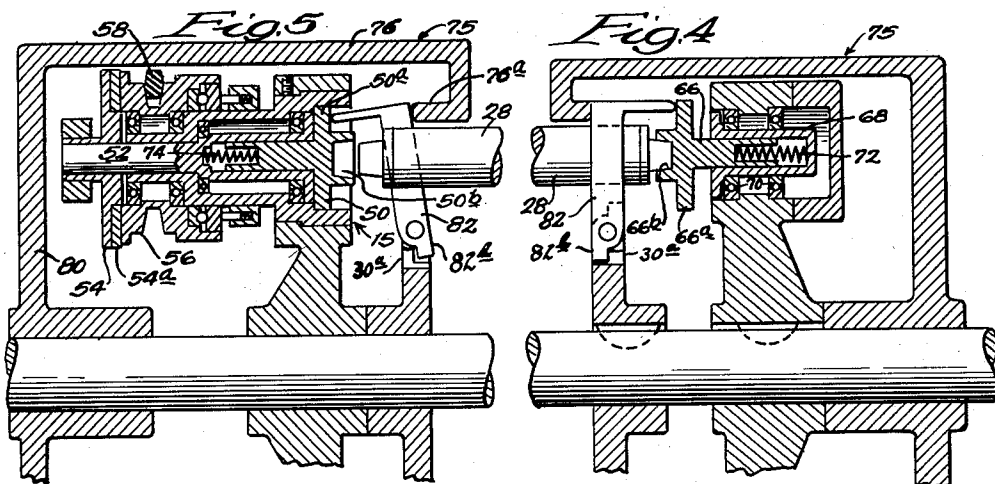
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3 Sheets-Sheet 2

2,553,052



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UNITED STATES PATENT OFFICE

2,553,052

MANDREL CORE CUTTING, LOADING, AND
EJECTING MECHANISM

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10 Claims. (Cl. 164—65)

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My invention relates to an improved mechanism adapted to receive a mandrel carrying a unitary paper tube and automatically operable to cut the tube and wind a plurality of webs of paper or the like thereon. This invention is an improvement upon my pending patent application S. N. 22,485, filed April 21, 1948, now Patent No. 2,512,900, granted June 27, 1950, and upon my patent No. 2,237,759 granted April 8, 1941.

In the operation of the machines described in the above application and patent, paper core sections are fed separately to a mandrel by the operator. The operator thereupon places the mandrel on the machine for winding. This is a time consuming and difficult manual operation because the mandrel with its paper core on it must be manually placed in the winding arbor.

It is a general object of the present invention to provide an improved paper winding mechanism capable of receiving a mandrel received in a unitary tube or core.

Another object of the present invention is to provide an improved mechanism to cut rolls of paper or like material.

Yet another object of the present invention is to provide an improved mechanism to feed mandrels automatically to a mandrel carrying spider.

It is further an object of the present invention to provide a core cutting, feeding, loading and discharging structure that may readily be interconnected with the operating elements of a paper winding machine.

It is yet another object of the present invention to provide an improved mechanism to pick up mandrels on a spider and to discharge the same therefrom.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation can best be understood by reference to the following description taken in connection with the accompanying drawing in which:

Figure 1 is a somewhat diagrammatic view of a complete paper winding machine incorporating the features of the present invention;

Figure 2 is a view of the core cutting portion of the mechanism of Figure 1 in the discharging position;

Figure 3 is a view of the core cutting portion of the mechanism of Figure 1 in the loading position;

Figures 4 and 5 are enlarged fragmentary views through axes 4—4 and 5—5, Figure 1, respectively;

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Figure 6 is a view in perspective of the cam track as seen from underneath and to one side;

Figure 7 is a fragmentary top plan view of the core cutting discs of Figure 1;

Figure 8 is a somewhat diagrammatic view of the mandrel drive mechanism of the machine of Figure 1;

Figures 9, 10, 11 and 12 are views of various mandrel and chuck end sections that may be used with the mechanism of Figure 1; and,

Figure 13 is a fragmentary developed view of cam track 78, Figure 1.

Referring now to Figure 1, the paper winding machine receives paper in a wide strip or web from the feed roll R. This roll is suitably supported by means not shown and is free to rotate to release its contents. The web W unrolling from roll R travels over the idler or guide roller 20 to be fed upon the bed roll 22. Roller 20 is held in snug engagement with bed roll 22 by means not shown to assure a positive drive of the web in accord with the rotations of bed roll 22.

The web W is wrapped around bed roll 22 from point 22a where it is received thereon to point 22b where it is released therefrom.

The bed roll 22 is provided with a plurality of longitudinal notches 22c spaced by the length of the sheets to be formed. Each notch is adapted to receive a knife 24a on perforating roller 24 to perforate web W as it rides on the bed roll 22. Roller 24 is driven in synchronism with the bed roll 22 to assure accurate indexing of the knives 24a and the notches 22c of bed roll 22.

After travelling past the perforator roller 24, web W is carried past longitudinal slit 26. This slit has a plurality of disk knives 26a which bear against the web and cut the same lengthwise to form strips of the width desired to be wound. In forming toilet tissue, for example, the knives 26a may be spaced about 4½ inches and the web W may be about 60 inches in length.

When the web W leaves bed roll 22 it travels to the mandrel 28 that is in the winding position on spider 30. This mandrel is driven by means described hereafter to wind the web to form the separate rolls of paper. As will be described hereafter, each mandrel receives a tube or core of cardboard that is cut to define sections to receive each strip of the web W and is in registry therewith.

When the mandrel 28 has received its full number of sheets of web, the knife 32 on bed roll 22 is extended and cuts the web. Thereafter the mandrel 28 and the rolls formed thereon are carried to the discharge or upper position of the

spider 30 and are released to roll down the discharge track 34. A plurality of mandrels carrying completely wound cores are shown on the discharge track at 36.

The spider 30 is carried by spaced arms 42 which are swingably supported from the shaft 46. The spider and arm assembly is rocked in accord with the spider rotations by the cam 200. Rollers (not shown) on the ends of the spider 30 at each mandrel receiving position ride on the cam 200 to impart this movement to the spider.

Mandrels 28 are fed to the spider 30 from the sloping feed track 38. The mandrels are each placed manually inside of a cardboard tube or core 28a before being placed on track 38. They are singly discharged from track 38 and are received in the core cutting mechanism indicated generally at 40. Thereafter, the mandrels are discharged to the parallelogram track-defining linkages 42 from which they are picked up by the spider 30.

The drive mechanism

The mechanical drive for the machine is taken from main drive shaft 44. This shaft is located above bed roll 22 and is driven by suitable means such as an electric motor (not shown).

The bed roll 22 is driven from shaft 44 by the pinion gear 45, Figure 8, which meshes with the teeth 23 formed on one side of the bed roll 22. Bed roll 22 is accordingly driven in fixed relation to the rotations of the main drive shaft 44.

The spider 30 is continuously rotated by drive shaft 44 through shaft 46, by means not shown. The shaft 46 is coincidental with the point of pivotal support of the hanger or arm 48 which carries the spider 30. Shaft 46 drives spider 30 by means of a belt or similar drive connection (not shown). Shaft 46 is in turn driven from drive shaft 44 by a drive connection having a suitable step down ratio so that spider 30 rotates one-fifth of a revolution while bed roll 22 releases the paper to be contained on each roll.

The driving connection between shaft 44 and spider 30 is so arranged that shaft 46 executes one revolution while bed roll 22 releases the paper desired to be contained on each roll. A 5 to 1 step down is provided in the drive connection between shaft 46 and spider 30.

The perforator roll 24 is driven from shaft 44 to have peripheral velocity equal to the peripheral velocity of that shaft.

The knife 32 is mounted on springs 31 to be biased outwardly and cut the web W. However, this knife is held in a retracted position against the spring bias by arm 32a which rides on a stationary cam 33 that normally holds the knife in the retracted position. The cam has a shiftable segment 33a that is shifted out of position when the quantity of paper desired to be rolled has been carried by bed roll 22. When this takes place, the knife 32 is released at approximately the point 22b to cut the web W.

Winding rotations are imparted to mandrel 28 by the drive chuck 50, Figure 5. This chuck is splined or otherwise attached to the shaft 52 which receives the clutch plate 54. Clutch plate 54 receives a felt-like facing material 54a which bears against the annular side face of the drive pulley 56.

A drive chuck 50 and the associated clutch mechanism and pulley is provided for each of the five mandrel receiving positions on the spider 30.

The drive arrangement for pulleys 56 can best be understood by reference to Figure 8 which

shows the spider 30 in the position where winding is about to be transferred from mandrel 28a to mandrel 28b. As shown, the main drive shaft 44 carries the drive pulley 44a that receives belt 58 having a V-shape on its opposite sides so that it can receive a V-pulley on either side. From pulley 44a, belt 58 traverses idler pulley 60 and then travels over the drive pulleys 56a and 56b for mandrels 28a and 28b, respectively. Thereafter, the belt 58 travels over idler pulleys 62 and 64 to return to the drive pulley 44a.

The size of pulleys 44a and 56a and 56b are so related that when the mandrels are unloaded the peripheral velocity of the core slightly exceeds the linear velocity of the web. This causes the web to wind tightly. As the roll builds up and the peripheral velocity of the roll tends to increase by reason of the constant angular velocity of the drive pulleys, the clutch facing 54a, Figure 5, slips relative to pulley 56 or to plate 54 to present breakage of the web W while maintaining it taut.

It will be observed that the mandrels are driven only when they are in the web-receiving position. At all other times they are free to rotate. If desired, however, brake means (not shown) may be provided to arrest rotation of the mandrels after they are loaded.

Mandrel pickup and release

Mandrels are automatically picked up and released as the spider 30 rotates. This is achieved by retracting the mandrel-receiving chucks in the regions adjacent the points of mandrel pickup and release.

The structure of the mandrel-holding chucks will be evident from the views of Figures 4 and 5. As shown, the chucks 50 and 66 have flanges 50a and 66a on their forward ends and have mandrel receiving notches 50b and 66b. The latter are in registry with each other to support a mandrel in axial alignment with the axis of rotation of the spider 30.

Chuck 65 is slidably received in the hollow shaft or cup 63 which is in turn supported on spaced bearings 70. A spring 72 is received in the recess of shaft 68 to bias chuck 66 to the extended or mandrel-engaging position. If desired, chuck 66 may be spined to shaft 68 to avoid any tendency to wind or unwind spring 72.

Chuck 50 is similarly received in the hollow end of a shaft 52. Spring 74 is received in the hollow end of shaft 52 and bottoms against that shaft and the chuck 50 to urge the latter to the extended or mandrel-engaging position.

When a mandrel 28 is received between chucks 66 and 50 and they are free to assume their extended positions, the mandrel is securely held in place on spider 30 and rotates in accord with the rotations imparted to chuck 50.

When the mandrels are picked up from track 42 chucks 66 and 50 are retracted against the bias of their respective springs to permit the chucks to swing to a position in registry with the incoming mandrel. This is accomplished by the cam track defining portions 76 and 78 of the cam track 75. Cam track 75 constitutes the cylindrical rim on the disk 80.

As seen best in Figures 5 and 6, the edge of cam track 75 is turned inwardly to overhang towards the center of spider 30 and to extend inwardly to engage the rockable pick-up hooks or hook-like arms 82. As shown in Figure 5, the returned portion 76a of the cam track 76 engages the rockable hooks 82 which in turn bottom against the flange portions 50a and 66a of

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the chucks 50 and 66 to overcome the bias of the springs 74 and 72 and retract the chucks.

Movements of the hooks 82 in response to the bias of springs 74 and 72 are limited by the stop members 82b and 30a.

The cam tracks 76 are positioned on opposite ends of the spider 30 in the region adjacent discharge track 34. The inturned portions of these tracks, 76a, Figure 6, are made of sufficient size to retract chucks 66 and 50 to spaced positions relative to the mandrel 28 and release the mandrel to track 34. The mandrel thereafter rolls down discharge track 34.

The cam tracks 78 are mounted on opposite sides of spider 30 adjacent parallelogram tracks 42. These tracks have inturned portions 78a, Figure 13, of sufficient size to retract chucks 66 and 50 to spaced positions relative to the mandrel 28 carried by track 42.

As the spider 30 rotates, the hook 82a adjacent track 42 engages the mandrel 28 on that track and pushes it forwardly. The cam track 78 then releases the chucks 50 and 66 to grasp the mandrel and thereafter carry the mandrel. Figure 13 is a developed view of cam track 78, Figure 1, showing how that track first retracts chucks 50 and 66 to travel to aligned positions relative to the mandrel without interference (portion 78b of the track) and then releases the chucks to engage the mandrel (portion 78c of the track).

Core cutting

The cutting mechanism 40 cuts the cores 28a on the mandrels 28 to form a plurality of sections therefrom. This mechanism comprises a pair of complementary cutters 84 and 86 defining staggered cutting disks or knives as shown in Figure 7. Cutters 84 and 86 are carried by a common rockable carriage defined by the shaft 88 and the cranks 90 and 92 pinned or keyed thereto.

Cutters 84 and 86 are mounted on the freely rockable arms 94 and 96, respectively. Springs 98 and 100 are interposed between arms 94 and 96 and the cranks 90 and 92 to cause the former to follow the rocking movements of shaft 88 while at the same time permitting relative closing movement of the cutters 84 and 86 as the cores 28a are cut.

A drive roll 102 is positioned in alignment with the cutters 84 and 86 when the carriage defined by shaft 88 is in the intermediate position shown in Figure 1. This roll is driven by motor 104 through belt 106.

Rockable trigger 108 is located on the end of track 38 as shown in Figure 1. This trigger defines member 108a which engages the mandrels 28 to hold the same against movement.

The trigger 108 is connected to the shaft 88 by the link 110 and the crank 112 to cause the trigger to partake of the rocking motions of the shaft 88 and the carriage defined thereby.

When the shaft 88 is rotated in the counterclockwise direction to cause cutters 84 and 86 to face track 38, the trigger 108 is rotated to the retracted position shown in Figure 3. This releases the last mandrel 28 and permits that mandrel to roll onto cutters 84 and 86. When the carriage defined by shaft 88 is subsequently restored to the intermediate position shown in Figure 1, the mandrel is carried in the nip between these cutters and the core 28a cut.

The mandrel 28 is discharged from cutter mechanism 40 by clockwise rocking movements of the carriage defined by shaft 88 as shown in Figure 2. This releases the mandrel to roll off

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on the track defined by parallelogram linkages 42.

The cutting mechanism is actuated in response to the needs of spider 30 by the linkage that can be traced from cam 126, through cam follower 5 and crank arm 128, link 130, crank 132, link 134, and crank 136 which is keyed to shaft 88. The cam 126 is affixed to shaft 46 and makes one rotation in the time period required to wind paper on a mandrel. Consequently, a new mandrel is to be fed for each rotation of that cam.

Cam 126 rotates in the counterclockwise direction. As it rotates from the position shown in Figure 1, the follower 128, which is spring biased downwardly, rides into dip 126a to rock the shaft 88 to the position of Figure 2 and release a mandrel to track 114 as shown. Thereafter, the cam follower 128 rides over projection 126b to rock the carriage defined by shaft 88 to the position of Figure 3 where a new mandrel is picked up. Thereafter the follower 128 rides on the intermediate portion of the cam 126 where it holds the carriage defined by shaft 88 in the intermediate position. The carriage dwells in this position for the remainder of the time available before a new mandrel is required by spider 30.

Mandrel feed

The parallelogram linkages 42 feed the mandrels singly to the spider 30. These linkages are located on opposite ends of the spider to define a track capable of receiving the mandrels.

The upper rails or links 114 of the parallelogram linkages 42 are fixedly supported and extend from the cutter mechanism 40 to the pickup point of spider 30. The links 116 and 118 are pinned to these rails and are connected at their lower ends by the lower link 120 to define a parallelogram. A compression spring 122 bottoms at its opposite ends against link 118 and projection 115 formed on link 114 to urge the parallelogram linkage to the rectangular shape.

The parallelogram linkage 42 normally assumes a nearly rectangular shape as shown in Figure 3. In this condition it restrains the mandrels 28 by reason of the extended portions 118a and 118a of the links 116 and 118, respectively. However, when the hooks 82 engage the mandrel held by link 118, the bias of spring 122 is overcome and the whole linkage collapsed as shown in Figure 2. This releases the mandrels to move on track 114, the first mandrel being picked up by the spider 30 and the other mandrels each advancing one position.

Each mandrel 28 travels over glue roller 132 to receive a spot of glue to grip the web W when that web is subsequently cut by knife 32.

As shown in Figures 9, 10, 11, and 12, the ends of the chucks and mandrels may be of square, octagonal, or other non-circular mating shapes. Figures 9 and 11 are fragmentary axial cross-sectional views of the chucks and Figures 10 and 12 are end elevational views of the corresponding mandrels, respectively.

It is desirable to use hollow mandrels 28 and to harden the portions thereof adjacent the points of contact of cutting knives 84 and 86 to achieve maximum mandrel life. This hardening may be accomplished by induction heating and appropriate quenching.

As shown in Figure 6, member 75 has a window 75a to receive the belt 58.

While I have shown and described a particular embodiment of my invention it will be understood that I do not wish to be limited thereto but intend by the appended claims to cover all modifications and alternative constructions fall-

ing within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A mechanism for use with a machine having a rotatable spider adapted to receive mandrels each carrying an array of cores, said spider being of the type adapted to receive an additional mandrel each time it is rotated a predetermined distance, said mechanism comprising means adapted to receive a plurality of mandrels each carrying a unitary core, trigger means interconnected with said spider and adapted to release one mandrel from said means each time said spider is rotated said distance, and means to feed said mandrel to said spider, said last means including elements adapted to cut the core on said mandrel to form an array of cores to be received on said spider.

2. A mechanism for use with a machine having a rotatable spider adapted to receive mandrels each carrying an array of cores, said spider being of the type adapted to receive an additional mandrel each time it is rotated a predetermined distance, said mechanism comprising means adapted to receive a plurality of mandrels each carrying a unitary core, trigger means interconnected with said spider adapted to release one mandrel from said means each time said spider is rotated said distance, and means operable in synchronism with said spider adapted to receive said mandrels as they are released and cut the cores on the same to form an array of cores to be received by said spider, and feeding means operable in sequence with said last means to transfer the cut cores to said spider.

3. A cutting mechanism adapted to cut a core of paper or the like to form a plurality of sections, said mechanism comprising complementary cutting disks mounted on a rockable carriage, spring means interposed between each of said disks and said carriage and operable to urge said disks towards each other, and a drive roller in alignment with said cutting disks when said carriage is in an intermediate position and adapted to bear against the core on said disks to urge it against said cutting disks.

4. A cutting mechanism adapted to cut cores of paper or the like to form a plurality of sections, said mechanism comprising complementary cutting disks mounted on a rockable carriage, a drive roller in alignment with said cutting disks when said carriage is in an intermediate position and adapted to bear against the mandrel on said disks, a track extending to proximity with said carriage, and trigger elements operable to release cores singly to said cutting disks when said carriage is tilted towards said track.

5. A cutting mechanism adapted to cut cores of paper or the like to form a plurality of sections, said mechanism comprising a pair of complementary cutting disks mounted on a rockable carriage, a drive roller in alignment with said cutting disks when said carriage is in an intermediate position and adapted to bear against the core on said rollers, tracks extending to proximity with said carriage on opposite sides thereof, and trigger elements operable to release cores singly to said cutting disks when said carriage is tilted towards one of said tracks.

6. A mechanism to cut cores of paper or the like and discharge them to a predetermined point, said mechanism comprising a pair of complementary cutting disks mounted on a rockable carriage, tracks sloping downwardly to-

wards and away from said carriage and on opposite sides thereof, a drive roller mounted in registry with said cutting disks when said carriage is in intermediate position, a trigger on the track sloping towards said carriage adapted to restrain movement of said cores from said track to said carriage, and elements interconnecting said carriage and said trigger to actuate said trigger when said carriage is rocked to tilt towards said track.

7. A mechanism to cut cores of paper or the like and discharge them to a predetermined point, said mechanism comprising a pair of complementary cutting disks mounted on a rockable carriage, tracks sloping downwardly towards and away from said carriage and on opposite sides thereof, a drive roller mounted in registry with said cutting disks when said carriage is in intermediate position, a trigger on the track sloping towards said carriage adapted to restrain movement of said cores from said track to said carriage, and elements interconnecting said carriage and said trigger to actuate said trigger when said carriage is rocked to tilt towards said track, and means operable in sequence to tilt said carriage towards said track sloping towards said carriage, rock said carriage to said intermediate position, and tilt said carriage towards the other of said tracks.

8. A guide track and trigger mechanism to release mandrels singly to a rotatable spider comprising a pair of spaced parallelogram linkages having their upper links oriented to define rails extending to the mandrel pickup point of said spider, the transverse links extending above said upper links to define triggers, and means operable to collapse said links as the mandrel-receiving point on said spider passes said links.

9. A guide track and trigger mechanism to release mandrels singly to a rotatable spider mounted on a swingable arm of the type that executes a full swing each cycle of operation, comprising a pair of spaced parallelogram linkages having their upper links oriented to define rails extending to the mandrel pickup point of said spider, the transverse links extending above said upper links to define triggers, said upper links being pivotally connected to said arms, and spring means operable to urge said linkages towards a rectangular configuration.

10. In a mandrel-receiving spider, a plurality of hook-like mandrel pickup arms adapted to pick up mandrels in the loading position and to release mandrels in the unloading position, said arms being swingably mounted relative to said spider for movements about axes lying in a plane transverse to the axis of rotation of said spider, retractable chuck elements in registry with said arms and adapted to carry mandrels, said elements being engageable by said arms, and stationary cams operable to engage said arms to rock said arms in direction to retract said chuck elements to receive or discharge mandrels.

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