

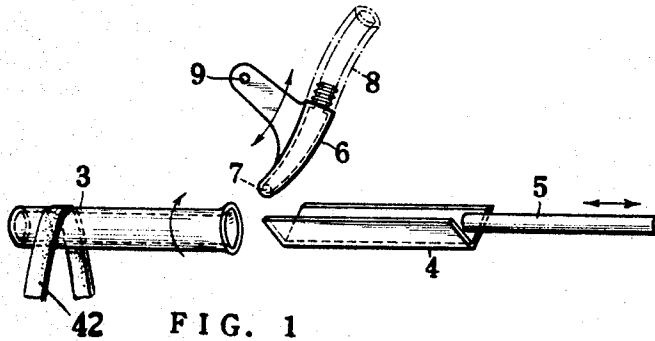
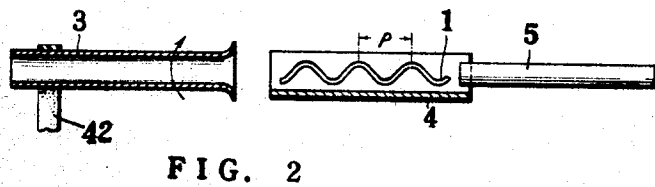
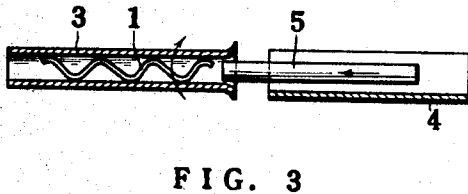
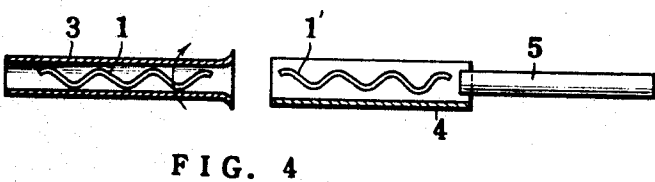
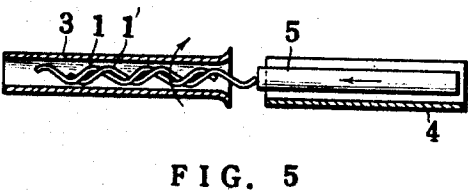
July 16, 1968

TATSUO TERAOKA
ARMOR ROD ASSEMBLY MACHINE

3,392,433

Filed June 15, 1966

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

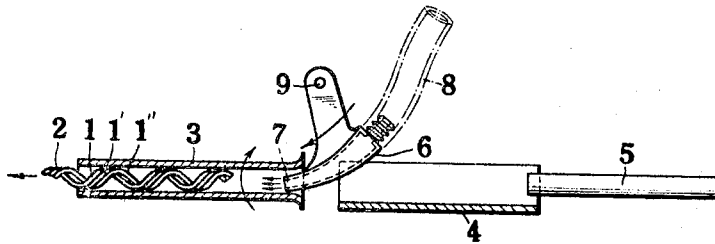


FIG. 6

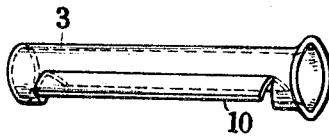


FIG. 7

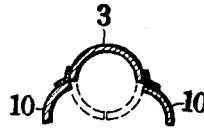


FIG. 8

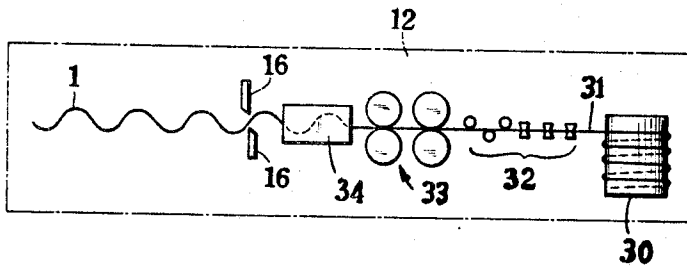


FIG. 9

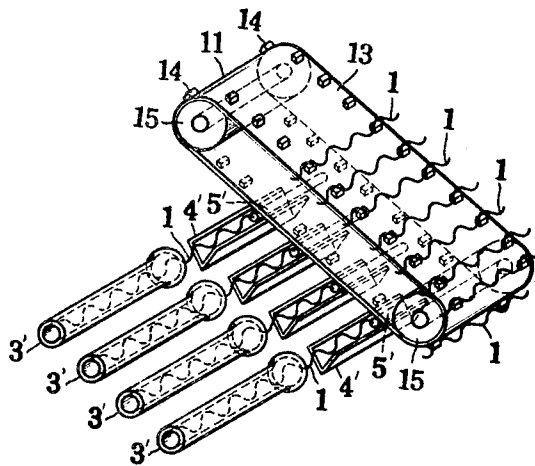


FIG. 10

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4 Sheets-Sheet 3

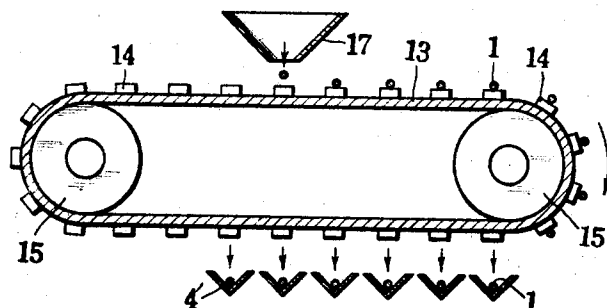


FIG. 11

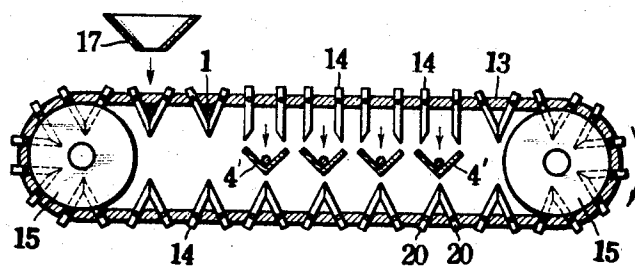


FIG. 12

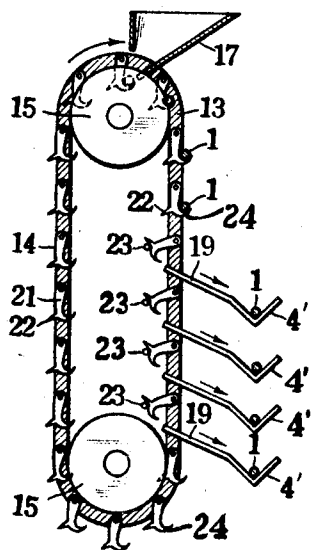


FIG. 13

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4 Sheets-Sheet 4

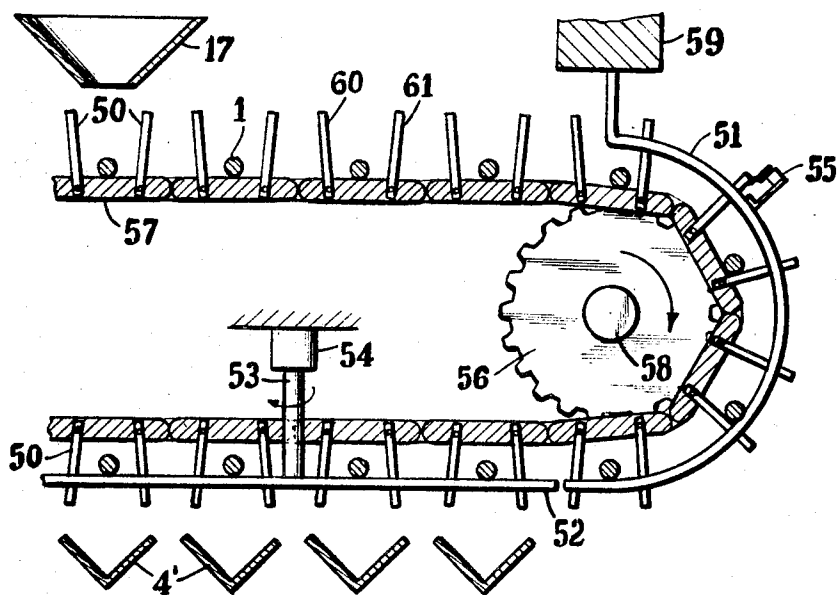


FIG. 14

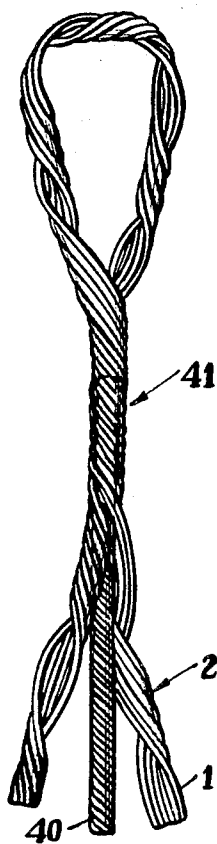


FIG. 15

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1

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ARMOR ROD ASSEMBLY MACHINE

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Claims priority, application Japan, July 23, 1965,

40/44,118

10 Claims. (Cl. 29—203)

The present invention relates to a device for inter-twisting pre-formed armor rods into a partial sheath for use with the anchoring of cables.

Armor rods are round rods or wire elements which are given a helical set. A plurality of such rods are laid together and interfit to form a hollow tube or a complete sheath having generally the appearance of wire rope. The internal diameter of the tube formed with such helical elements is generally slightly smaller than the outer diameter of the cable to which it is adapted, so that it firmly grips the cable. The gripping sheath may be used for forming dead ends or other tensioning or abrasion protecting devices. The cable may, for example, be an electrical cable or a guy wire. Such armor rods and their applications are discussed in United States Patent No. 2,671,732 to Peterson.

The technique of applying pre-formed helical armor rods to a cable, such as is disclosed in the above-mentioned Peterson patent, requires a line man to perform the wrapping by hand. A tool for performing this wrapping operation may also be used.

At the present time the individual armor rods are formed by giving a helical twist to a straight length of rod (thick wire) and cutting the rod to the correct length. The individual rods are intertwined and assembled by hand into groups of 4, 5 or 6 rods forming a partial sheath. The hand assembly of rods is expensive and time consuming. The groups of rods are then treated with a plastic adhesive which glues them together and keeps them correctly aligned. Two or more groups of rods, each forming a partial sheath, are twisted together around the cable to form the complete sheath (tube) to grip the cable.

It is the objective of the present invention to provide a machine for the automatic assembly of individual armor rods into groups (partial sheaths) which machine is relatively simple so that it is not costly and may easily be repaired.

The manufacturing process for producing partial sheaths of armor rods includes apparatus which twists wire rods into the desired helical set. The pre-formed rods are cut to an appropriate length. The present invention provides a mechanism which assembles these lengths together by intertwisting them to form a partial spiral envelope composed of paralleled armor rods. The assembly apparatus includes a plurality of rotatable tubes each of which is slightly larger than the diameter of the helically set wire. A hopper delivers individual pre-formed rods into a conveyor belt or conveyor chain. The conveyor has gripping means to hold the rods and, at a pre-determined time, to release them. The rods are conveyed to above a group of V-shaped trays. A group of rods is simultaneously deposited in the trays. Each tray has associated with it a push bar to push the correct number of individual rods into the tube and means to eject the intertwined rods (the formed partial sheath) from the tube. The tube intertwists 4, 5 or 6 wires together. The intertwined wires are then adhered together. The group of rods comprising the partial sheath assembled by the apparatus of the present invention is suitable for wrapping about a cable by hand or using a tool.

2

Other objectives of the present invention will be apparent from the following detailed description of a preferred embodiment of the present invention taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic perspective view of the assembling apparatus of the present invention;

FIGS. 2-5 are cross-sectional views showings steps in the operation of the apparatus to assemble a plurality of pre-formed lengths of armor rods;

FIG. 6 is a cross-sectional view of one embodiment of the present invention for removing the assembled armor rods from the assembly device;

FIG. 7 is a perspective view of another embodiment of the assembling device adapted to remove the assembled armor rods;

FIG. 8 is a cross-sectional view of the embodiment of FIG. 7;

FIG. 9 is a schematic view of the pre-forming apparatus of the present invention;

FIG. 10 is a perspective view of an embodiment of the present invention having a plurality of assembling devices;

FIG. 11 is a cross-sectional view of the embodiment of FIG. 10 showing means to load a plurality of assembling devices;

FIG. 12 is a cross-sectional view of a further embodiment of the present invention for loading a plurality of assembling devices;

FIGS. 13 and 14 are cross-sectional views of still further embodiments of the present invention for loading a plurality of assembling devices; and

FIG. 15 shows the application of assembled armor rods to form a dead end for an electrical power line.

FIG. 1 shows the relationship of the various parts of the basic assembling device of the apparatus of the present invention. The assembling tube 3 receives the helical pre-formed lengths of armor rods. Tube 3 is rotated in the direction shown by the arrow to intertwist the pre-formed lengths of armor rod to form the assembled sheath or envelope. The assembling tube 3 is selected so as to be slightly larger in diameter than the diameter of the helical set of the armor rods 1. If rods having a larger diameter are to be assembled, then a larger tube 3 must be utilized. The assembling tube 3 functions by its frictional action on the individual rods to twist them together. The pre-formed rods are cut to length and deposited in a receiving tray 4. The pusher rod 5, associated with the tray 4, moves the pre-formed lengths 1 from the receiving tray 4 into the assembling tube 3. Either 4, 5 or 6 individual rods are loaded into the tube 3 while the tube is being rotated. The number of individual rods used in a partial sheath depends upon the size of the rod and the application of the sheath.

A nozzle member 6 having an orifice 7 and an air supply hose 8 is pivoted about an axis at 9. This permits the orifice 7 of the nozzle to enter the flared end of the assembling tube 3. A blast of air from orifice 7 expels the assembled envelope of helical elements from the assembling tube 3. Other removal means, such as clamping fingers, may be used to extract the formed partial sheath from the tube 3.

FIG. 15 illustrates one use of the assembled partial sheath of armor rods. The assembled partial sheath (envelope) 2 is comprised of helical elements 1 sufficient in number to occupy a semi-circle, for example, 4, 5 or 6. The cable 40 is gripped by a complete sheath 41 which is formed when the envelope is twisted about the cable 40. The envelope 2 forms a complete 360° sheath 41 when properly laid by twisting about the cable 40 and securely grips the cable.

FIG. 2 shows the receiving tray 4 with a length of a

3

pre-formed helical armor rod 1. The pitch of the helix is indicated as the distance P. The assembling tube 3 is shown rotating in the direction of the arrow. The tube 3 is rotated by a motor (not shown) connected to a belt 42 which is positioned about the tube. The pushing element 5 is shown retracted to the right.

In FIG. 3 the pusher 5 has moved to its extreme position to the left carrying with it the pre-formed rod which has been inserted into the assembly tube 3.

FIG. 4 shows a second helical rod 1' positioned in the receiving tray 4 adjacent the assembling tube 3.

FIG. 5 shows the pusher 5 introducing the second rod 1' into the assembling tube. As the assembling tube rotates, the second rod is threaded into adjacency with the first rod 1 such that they lie side by side in close parallelism.

FIG. 6 shows the assembled envelope 2 of pre-formed helical rods including rods 1, 1', 1''. It is removed from the assembling tube 3 in the direction of the arrow by the blast of air from nozzle 6. Orifice 7 of the nozzle member 6 is introduced into one end of the assembling tube 3. The air supply from tube 8 provides a blast of air in the assembling tube 3 which carries the rods assembled into partial sheath 2 out of assembling tube 3.

FIGS. 7 and 8 show a modified form of the assembling tube 3. This form of the tube 3 has an openable section formed of two hinged door elements 10. The door elements 10 open, by means of a solenoid which is controlled by a timer, when an appropriate number of helical rods 1 have been assembled into a partial sheath 2. When open, the doors 10 permit the assembled partial sheath 2 to drop out of the tube 3.

FIG. 9 shows a schematic view of the pre-forming apparatus which is mounted on a base 12. A supply of wire of appropriate size and alloy is provided by a spool 30. The wire 31 is passed through a series of conventional wire straightening rollers 32 and is pulled by conventional wire driving capstan means 33. The straightened wire is then passed through a conventional helix forming means 34 to impart the desired helical twist to the wire to form an armor rod. When a predetermined length of pre-formed helix rod has been formed, knife blades 16 sever the helix rod from the wire supply.

It is apparent that the time required for assembly of an envelope is determined by the number of helical elements which comprise the envelope and the speed at which the assembling tube rotates. To thread (intertwist) a helical rod into assembly with its neighbors requires a number of revolutions equal to the number of revolutions or pitches of the helix. The pusher 5 can feed the elements no faster than the rate at which they are threaded among their neighbors. Since there are practical limits to the speed of rotation of the assembling tube 3, economical production requires that there be a plurality of such assembling tubes. Such a plurality is shown in FIG. 10.

The plural assembling device of FIG. 10 is comprised of a plurality of assembling tubes 3' and a corresponding number of receiving trays 4' and pusher means 5'. The plural trays 4' are supplied with pre-formed and cut rods 1 by means of a conveyor belt 13 carried by rotated drums 15. The drums are rotated by an electric motor.

The rods 1 are held on the conveyor 13 by gripping means 14, such as clamps or electromagnets. A hopper 17, preferably a vibrating hopper, is used to provide gripping means 14 with rod elements 1, see FIG. 11. As the upper surface of the conveyor is loaded with rods 1, the conveyor 13 is caused to advance a distance equal to the spacing between the trays 4. Soon there are sufficient rods 1 held on the conveyor 13 to provide a rod over each of the receiving trays 4. There are four such trays shown in FIGS. 10-14, but more or less may be used. The grips are released and the rods 1 drop, all at the same time, into the trays 4'. As can be seen in FIG. 11, the elements are conveyed to their proper positions and then released to the receiving trays 4' at the same time. The four pusher bars 5' operate simultaneously and are operated by solenoids

4

controlled by a timer switch (not shown). In the case of the four trays of FIG. 10, four rods 1 drop simultaneously and are pushed into the four assembling tubes 3' at the same time. If each partial sheath is to be composed of five rods, then the belt 13 would bring five rods, in sequence, and drop five rods into each of the trays 4'. The rods do not enter the assembling tubes until the previous rod has been entirely twisted into position. That is, for example, if the helix has 10 turns, each assembling tube will rotate 10 times for each of the four rods inserted into it after the first rod is inserted. After the five rods are twisted together in each of the four assembly tubes, the assembled rods (forming a partial sheath) are ejected from the tubes. In this example the belt has carried 4×5 , or twenty, rods and each of the tubes have been rotated at least 4×10 , or forty, times for each complete cycle of operation.

FIG. 12 shows another embodiment of the conveyor 13. The embodiment of FIG. 12 provides a conveyor 13 having openable hoppers 14 instead of the gripping illustrated in FIGS. 10 and 11. These hoppers 14 are comprised of two hinged plates 20 which, when closed, form a trough for conveying the element 1 to positions over the receiving trays. When the closed hoppers 14 are in position over receiving trays 4', they are opened by allowing plates 20 to swing into parallel. Elements 1 drop from between plates 20 into the receiving trays 4'. Receiving trays 4' are shown as being within the area defined by the belt 13.

FIG. 13 shows a cross-section of a still further embodiment of the conveyor means. The conveyor belt 13 has pivotable hook-like retainer means 21 affixed to it. Retainer 21 has a rod receiving hook 24 which receives the pre-formed helix rod 1 from a supply hopper. When the hooks 21 bearing the rods have been advanced to a position adjacent their appropriate receiving trays 4', a movable series of projections 23 are caused to intercept second hooks 22 on the retainers 21 to cause the retainers 21 to rotate about their pivots, thereby releasing rods 1 to ramps 19 which lead to receiving trays 4'. In FIG. 13 four projections 23 are moved simultaneously to load four rods 1 into four trays 4'.

The assembly device shown in FIG. 14 includes a vibratory hopper 17 to feed the armor rods 1 onto the belt 13. Preferably belt 13 in this embodiment consists of two chain belts 57 which are driven by two large geared wheels 56. The geared wheels are in parallel and are connected to shaft 58 driven by an electric motor. The belts 57 are positioned like the treads in a tank or tractor, i.e., in parallel. Each chain belt 57 has a plurality of up-standing prong members 50. Each prong member is attached to the chain belt at a slight angle to the vertical in relation to the belt. There are two prong members 60 and 61 forming a pair and associated together to carry a pre-formed armor rod 1 between them. A plurality of such pairs of prongs are arranged around the circumference of the chain belt 57. A holding arm 51 is fixed to the base 59. Arm 51 is positioned to keep the rods 1 within the prong members 50 against the tendency of the rods 1 to fall out due to the force of gravity. The holding arm 51 terminates and is proximate to a movable arm 52. The movable arm 52 is attached to a ram member 53 and the ram is operated by the air cylinder 54. The movable arm 52 is positioned to keep the rods 1 within the prongs 50 at the bottom of the chain belt 57. Upon a signal, the air cylinder 54 pivots ram 53 so that it rotates the holding arm 52 approximately vertical to the direction of movement of the chain, i.e., coming out from the paper. This permits the rods 1 which have been held by the holding arm 52 to fall into the receiving trays 4'. A similar set of a holding arm, a movable arm and a ram is associated with the other chain belt to hold the other end of the rods 1. The two movable arms 52 rotate simultaneously. As shown in FIG. 14 the holding arms 52 hold four armor rods 1 and let them drop simultaneously into four receiving trays 4'.

5

The timing of the device is by means of a microswitch 55 which is fixed relative to the moving chain 57. The microswitch 55 is connected to a counting device (not shown) which counts the number of prongs and consequently the number of rods moving past it. When 8 prongs have moved past the switch 55 (when 4 rods have moved past it) the counter signals the air cylinder 54 to release the holding bar 52. The counter is adjusted so that, should it be necessary, the holding bar 52 may be extended so that additional trays may be added. With that modification 5 or 6 rods may be simultaneously dropped into 5 or 6 trays. The counter also counts the total number of rods, for example, if there are five rods for each of the four tubes, the counter will count twenty rods and initiate the action of the removal device, in cooperation with a timer.

It is to be understood that any modifications may be made in the present invention within the subjoined claims. I claim:

1. Apparatus for the assembly of a plurality of pre-formed armor rods each rod having a helical set and a predetermined length into a partial sheath, which apparatus comprises
 a base;
 a plurality of assembly tubes rotatably mounted on the base, the diameter of each tube being larger than the diameter of the rods to which they are adapted to assemble;
 means mounted on the base to rotate the tubes, the number of rotations for each rod inserted into the tube being at least equal to the number of helical turns of that rod;
 conveyor means mounted on the base to position the rods at the tube openings;
 a plurality of releasable holding means affixed to the conveyor means to hold the rods until they are positioned near the tube openings; and
 means mounted on the base adjacent the tubes to advance the rods into the tubes.

2. Apparatus as claimed in claim 1, wherein the holding means are magnets.

6

3. Apparatus as claimed in claim 1, wherein the holding means are openable hoppers comprising relatively movable plates which in one position form hoppers and in another position permit the rods to discharge to said tubes.

4. Apparatus as claimed in claim 1, wherein the holding means are rotatable hooks which receive the rods and upon rotation discharge said rods to said tubes.

5. Apparatus as claimed in claim 1, wherein the conveyor means is a belt and the holding means is a plurality of rods attached to the belt and protruding therefrom which cooperate with a fixed guide rod.

6. Apparatus as claimed in claim 1, wherein the means to advance the rods includes a plurality of V-shaped open trays, a slidable push bar positioned within each tray and means to advance and retract the said push bars.

7. Apparatus as claimed in claim 1, wherein the conveyor means is a belt and the apparatus includes a vibratory hopper affixed to the base and positioned over the belt to feed rods to the belt.

8. Apparatus as claimed in claim 1, including removal means mounted on said base to remove the assembled rods from said assembly tubes.

9. Apparatus as claimed in claim 8, wherein the removal means is an air pressure nozzle adapted to blow the assembled lengths of armor rods from the tubes.

10. Apparatus as claimed in claim 8, wherein the removal means is an openable section of the said tubes.

References Cited

UNITED STATES PATENTS

2,311,326	2/1943	Birkin	29—227 X
3,007,243	11/1961	Peterson	29—419
3,110,094	11/1963	Freeman	29—240 X
3,248,789	5/1966	Seaman	29—421 X
3,310,865	3/1967	Schelling	29—240.5 X
3,319,316	5/1967	Geyer	29—203 X

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