May 31, 1949. F. A. GRUETJEN 2,471,485

MANDREL WITH MEANS FOR CLAMPING AND SPREADING TUBES

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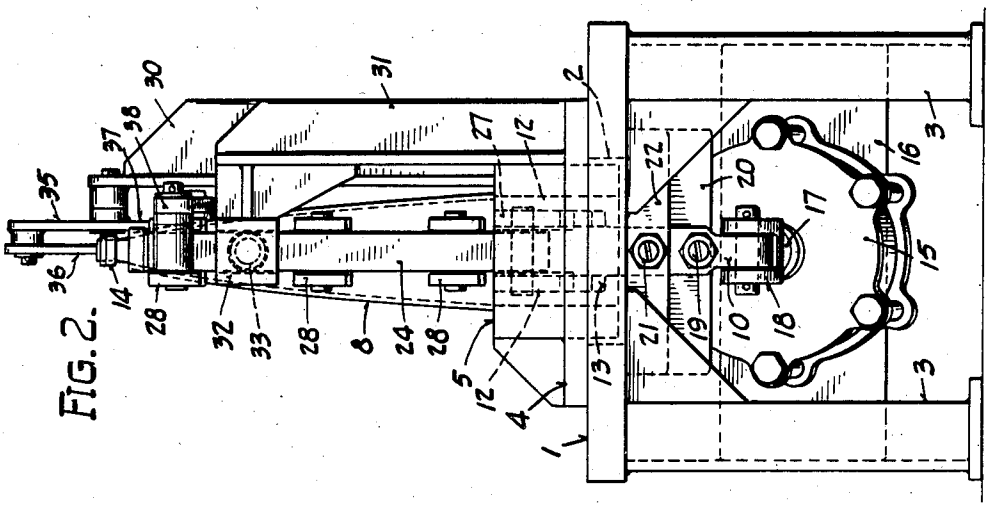

FIG. 2.

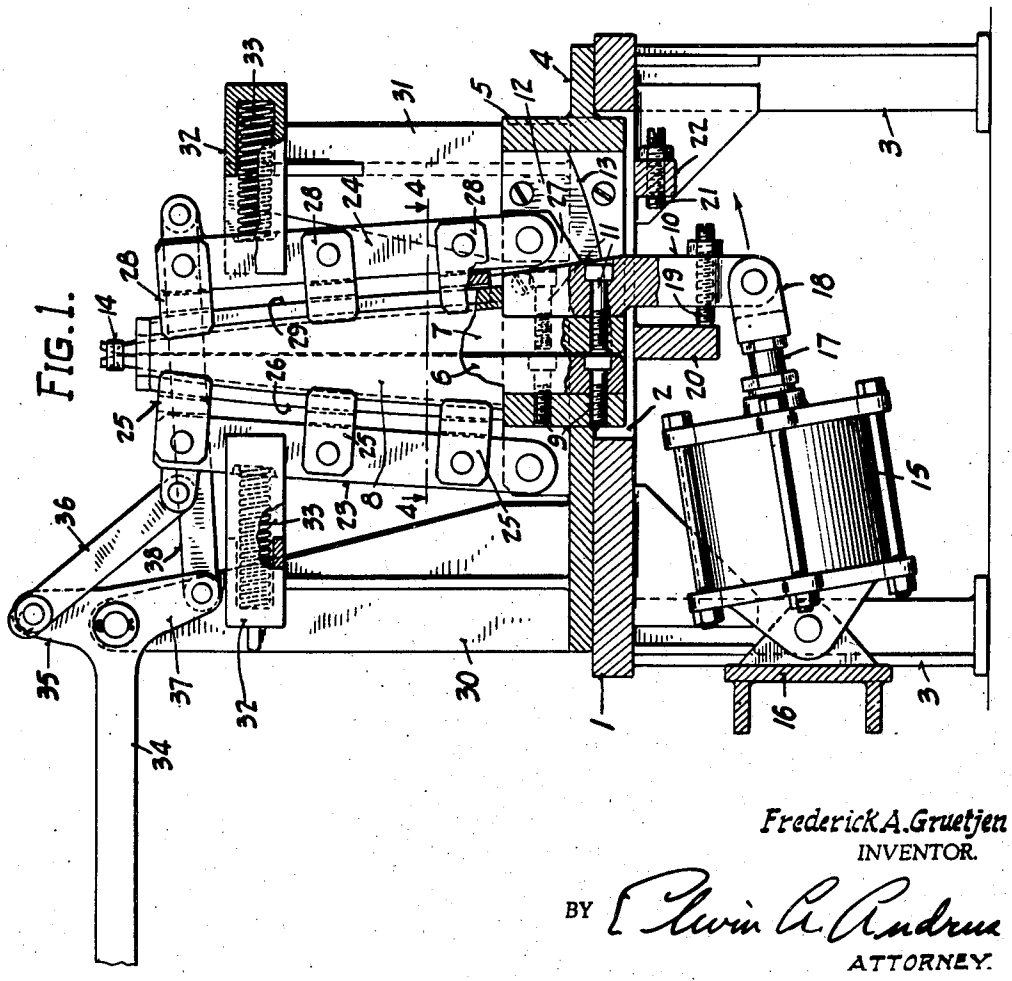

FIG. 1.

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FIG. 3.

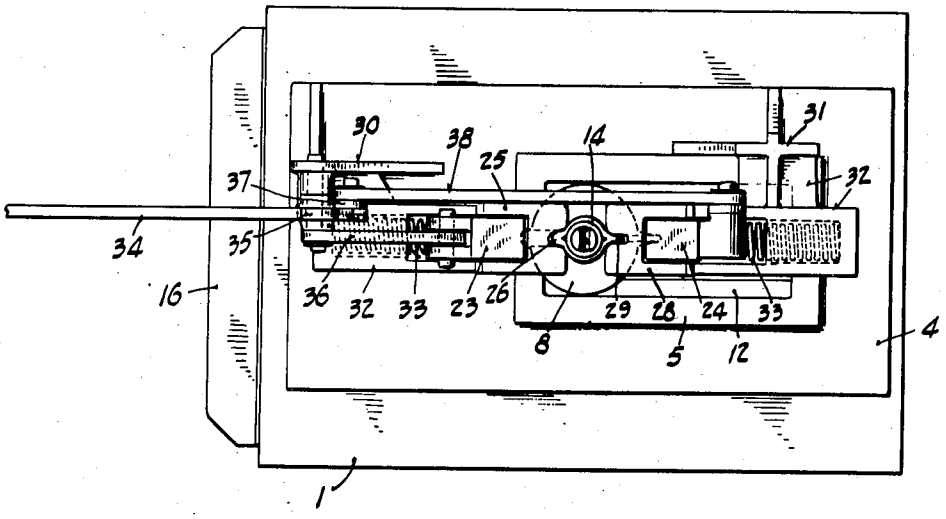


FIG. 4.

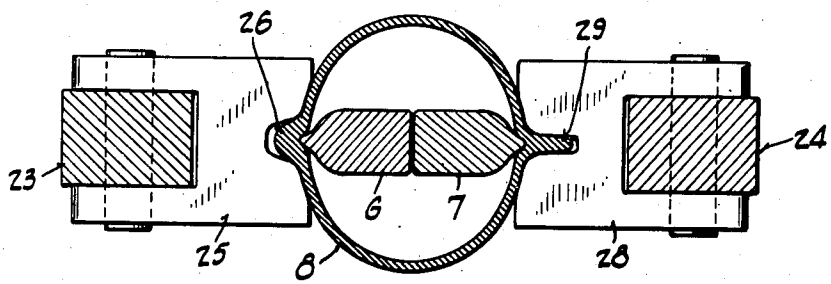
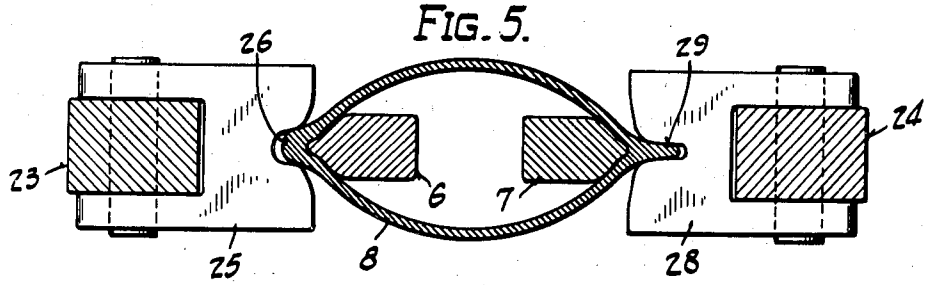


FIG. 5.



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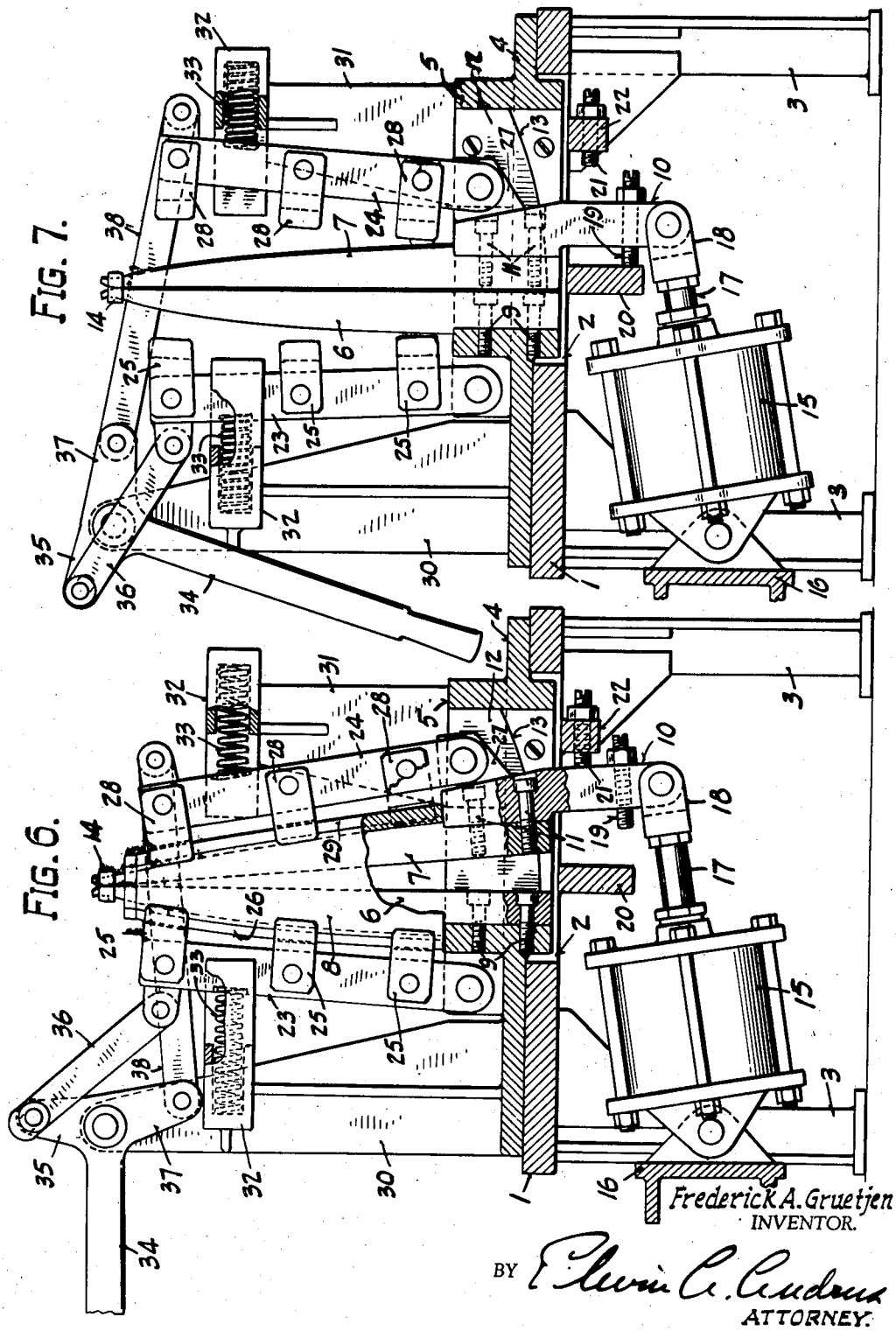

FIG. 7.

FIG. 6.

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MANDREL WITH MEANS FOR CLAMPING AND SPREADING TUBES

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Application October 23, 1943, Serial No. 507,365

8 Claims. (Cl. 153—39)

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This invention relates to forming apparatus adapted particularly to the spreading of a tubular member in the direction of its diameter, as in the forming of tip sections for propeller blades.

The principal object of the invention is to provide a simple and inexpensive apparatus which can be operated rapidly to provide for a large production capacity.

Another object is to provide an apparatus with definite adjustable limits of movement.

Another object is to provide for ready loading and unloading of the apparatus to thereby shorten the cycle of operation.

The accompanying drawing illustrates an embodiment of the invention as employed for the spreading of propeller tips.

In the drawing:

Figure 1 is a side elevation of the apparatus with the base sectioned and showing a propeller tip in place for forming and partially broken away to show the spreading mandrels;

Fig. 2 is an end elevation of the apparatus;

Fig. 3 is a top plan view of the apparatus;

Fig. 4 is an enlarged horizontal section taken on line 4—4 of Fig. 1;

Fig. 5 is a view similar to Fig. 4 showing the mandrels in their extended positions;

Fig. 6 is a view similar to Figure 1 showing the mandrels in extended positions; and

Fig. 7 is a view similar to Figure 1 with the clamping means released and the mandrels retracted for loading the blank.

The apparatus comprises a table top 1 having a central opening 2 therethrough, and corner legs 3. A plate 4 is mounted on the table top and carries a frame 5 lying in the opening 2 for supporting the operating mechanism of the apparatus.

The spreading mandrels 6 and 7 are disposed vertically back-to-back and have their outer faces tapered and curved to substantially fit the wall of a tapered and bilged tubular tip section 8. One mandrel 6 is secured to one end of frame 5 by bolts 9 while the other mandrel 7 is secured to a movable depending yoke 10 by bolts 11. Wear plates 12 secured in the frame 5 on either side of yoke 10 and having curved shoulders 13 matching similar shoulders on the yoke serve to support the yoke so as to maintain the two mandrels 6 and 7 at the same height. A washer 14 encircles the upper small ends of the mandrels to hold them in alignment. The frame 5 provides a longitudinal slot in which the yoke 10 operates to spread the mandrels apart at the lower end.

The operation of the movable mandrel 7 is

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obtained by the air cylinder 15 pivoted to a bracket 16 on the legs 3 at one end of the table, and having its piston rod 17 connected to the lower end of yoke 10 by a clevis 18. An adjustable stop 19 is threaded through yoke 10 to engage a depending lug 20 on table top 1 and determine the movement of mandrel 7 toward mandrel 6. Similarly, an adjustable stop 21 is threaded through a depending lug 22 near the end of top 1 to be engaged by yoke 10 and determine its outward spreading movement which separates the lower ends of mandrels 6 and 7.

In operation, while the mandrels 6 and 7 are closed together a tapered tip section 8 is slipped onto them over the top end and then the mandrels are spread apart at the bottom by operation of air cylinder 15 to spread the blank from a circular section to an oblong section. Operation of the cylinder 15 to move its piston in the opposite direction returns the mandrel 7 to vertical position where the blank 8 can be readily removed vertically from the mandrels and a succeeding blank applied. In operation the mandrels 6 and 7 pivot or rock upon one another at their contacting upper ends, and the upper end of the blank is spread only a slight amount depending upon its location relative to the pivotal points involved.

Since the tip section of a propeller blade is tapered and bilged in diameter, it is sometimes found that there is a tendency for the blank to rise vertically on the mandrels during spreading. In addition to this, the blank is twisted to correspond with the final blade twist, and there is a tendency for the leading and trailing edges to tip sideways when the blank is spread. To prevent this, the apparatus has a pair of spring pressed holding bars 23 and 24.

Holding bar 23 is pivoted to frame 5 and extends upwardly adjacent the fixed mandrel 6 with three holding yokes or clamps 25 vertically spaced therealong to engage the outside of the leading edge 26 of blank 8 and hold the blank on the mandrel. Similarly, holding bar 24 is pivoted to a bracket 27 on yoke 10 and extends upwardly adjacent the movable mandrel 7 with three holding yokes or clamps 28 vertically spaced therealong to engage the outside of the trailing edge 29 of blank 8 and hold the blank on the mandrel.

Side posts 30 and 31 are provided extending upwardly from the respective ends of plate 4, and carry lateral brackets 32 for supporting springs 33 for biasing bars 23 and 24 toward the blank.

For the purpose of separating bars 23 and 24 at the top for quick loading and unloading of

blanks to be operated upon, a double bell crank hand lever **34** is pivoted to the upper end of post **30**. The upper arm **35** of lever **34** is connected by a link **36** to the upper end of bar **23**, while the lower arm **37** of lever **34** is connected by a link **38** to the upper end of bar **24**.

As illustrated in Figure 1, when the lever **34** is raised to horizontal position, the bars **23** and **24** are brought together at the top and held so by spring assemblies **33**. Fig. 6 shows the position of the parts with lever **34** in raised position and the mandrels spread apart. When the lever **34** is lowered from the position shown in Fig. 6, link **36** pulls bar **23** away from the blank and link **38** pushes bar **24** away from it, leaving the blank free to be removed. As shown in Fig. 7 the apparatus is in position for loading the blank with the mandrels retracted and lever **34** lowered to hold the clamps open. Operation of the lever **34** is rapid and does not add materially to the time cycle of operation of the apparatus.

The clamps **25** and **28** confine the leading and trailing edges of the blank and hold the same in place during spreading of the mandrel. The shape and width of the mandrels is such that the sides of the blank immediately adjacent the leading and trailing edges quickly engage and form upon the mandrel surfaces, and the intermediate sides of the blank are free to stretch and flatten.

The invention may have various embodiments within the scope of the claims.

I claim:

1. In an apparatus for spreading metal articles of substantially circular section to an oblong section at one end, a pair of mandrels disposed back-to-back and adapted to pivot relative to one another at one end and move radially outwardly relative to one another at the other end, a fixed support for one of said mandrels at the outwardly movable end, a movable support for the other of said mandrels at the outwardly movable end, power means for operating said movable support to separate said mandrels and effect spreading of the article thereon, a clamp disposed adjacent each mandrel to prevent slippage of the article thereon during spreading, and means for rapidly separating said clamps to provide for unloading and loading of the apparatus.

2. In an apparatus for spreading metal articles of substantially circular section to an oblong section at one end, a pair of mandrels disposed back-to-back and adapted to pivot relative to one another at one end and move radially outwardly relative to one another at the other end, a fixed support for one of said mandrels at the outwardly movable end, a movable support for the other of said mandrels at the outwardly movable end, power means for operating said movable support to separate said mandrels and effect spreading of the article thereon, a clamp disposed adjacent each mandrel to prevent slippage of the article thereon during spreading, means for rapidly separating said clamps to provide for unloading and loading of the apparatus, and means normally biasing said clamps into engagement with the article being operated upon.

3. In apparatus of the class described, a pair of mandrels adapted to receive a tubular metal blank, relatively movable supports for said mandrels, a holding bar for each mandrel pivoted at one end to each of said supports and having clamping means for engaging a blank along substantially the length thereof to clamp the blank to the respective mandrels, and means for securing said holding bars in clamping position.

4. In apparatus of the class described, a pair of mandrels adapted to receive a tubular metal blank, relatively movable supports for said mandrels, a holding bar for each mandrel pivoted at one end to each of said supports and having clamping means for engaging a blank and clamping the same to the respective mandrels, means for securing said holding bars in clamping position, and means for separating the free ends of said holding bars to provide for loading a blank upon said mandrels.

5. In apparatus of the class described, a pair of mandrels adapted to receive a tubular metal blank, relatively movable supports for said mandrels, a holding bar for each mandrel pivoted at one end to each of said supports and having clamping means for engaging a blank and clamping the same to the respective mandrels, and a lever linked to the free ends of said holding bars to open and close the same upon the blank.

6. In an apparatus for spreading metal articles of substantial length and substantially circular section to an oblong section, a support, a pair of mandrels mounted on said support and disposed back-to-back and adapted to receive said article, said mandrels engaging and rocking on each other at one end and being adapted to move radially outwardly relative to each other at the other end, means securing said mandrels together at the engaging ends thereof to hold them in alignment during spreading, and motor operated power means mounted on said support connected to one of said mandrels at said outwardly movable end to rock the same upon the other mandrel at the opposite secured end and effect spreading of said article encircling the same.

7. In an apparatus for spreading metal articles of substantial length and substantially circular section to an oblong section, a support, a pair of mandrels mounted on said support and disposed back to back and adapted to receive said article, said mandrels engaging and rocking on each other at one end and being adapted to move radially outwardly relative to each other at the other end, means securing said mandrels together at the engaging ends thereof to hold them in alignment during spreading, motor operated power means mounted on said support and connected to one of said mandrels at said outwardly movable end to rock the same upon the other mandrel at the opposite secured end and effect spreading of said article encircling the same, and a resiliently backed clamp engaging the blank during expansion thereof to prevent slipping of the article on said mandrels during spreading.

8. Apparatus for spreading metal articles of substantially circular section to an oblong section, which comprises a frame, a pair of tapered mandrels disposed back-to-back within said frame and adapted to receive said article, means securing one of said mandrels to said frame with the other of said mandrels free to move and rock on the fixed mandrel at the inner end of the mandrels, means securing said mandrels together at their engaging inner ends to hold them in alignment during spreading, a hydraulic cylinder and piston rod pivoted to the outer end of the movable mandrel and to said frame to pivot the movable mandrel on the fixed mandrel at the inner end thereof and effect separation of the mandrels and spreading of the article en-

circling the same, a resiliently backed holding bar for each mandrel pivoted at one end to said frame, and a plurality of clamps on each bar for engaging the article and clamping the same to the respective mandrels to prevent slippage of the article thereon during spreading.

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