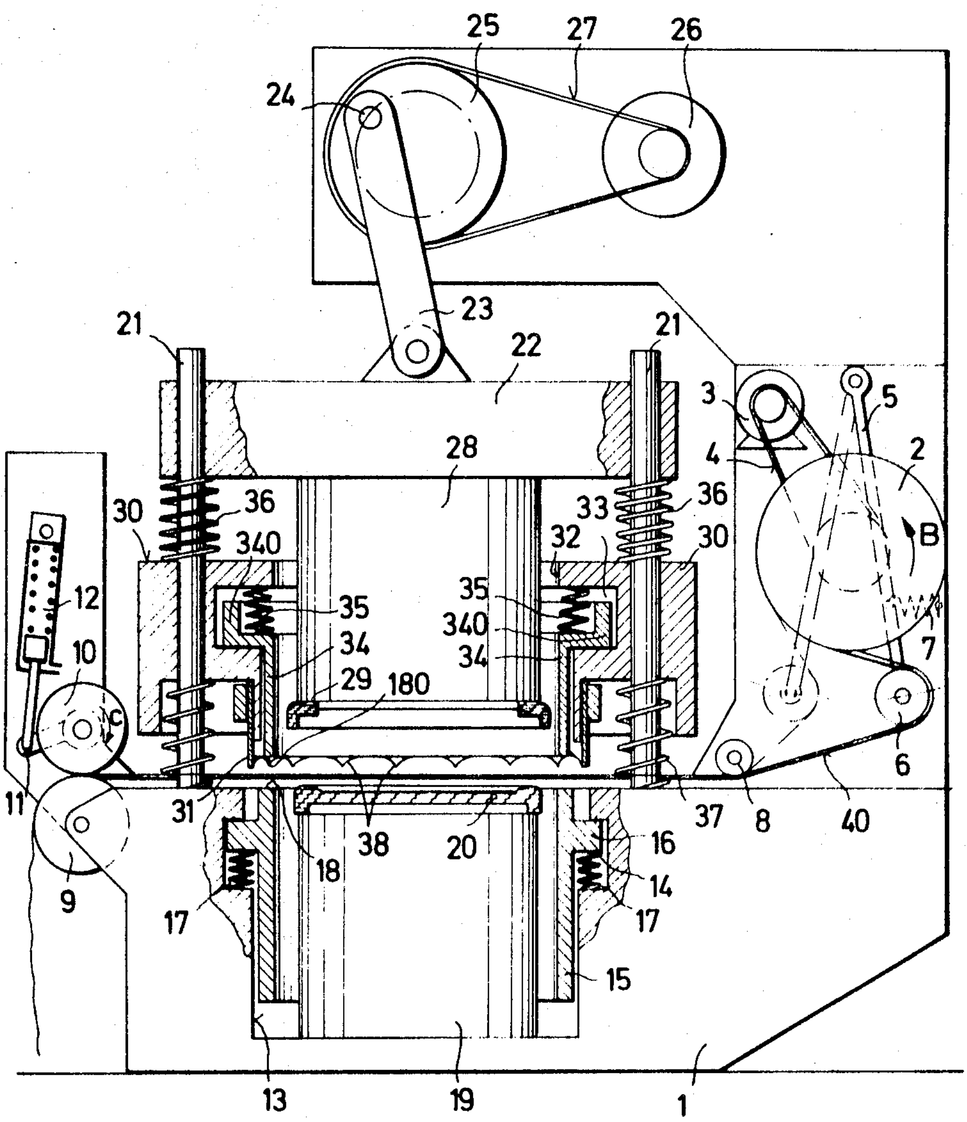

Fig. 1

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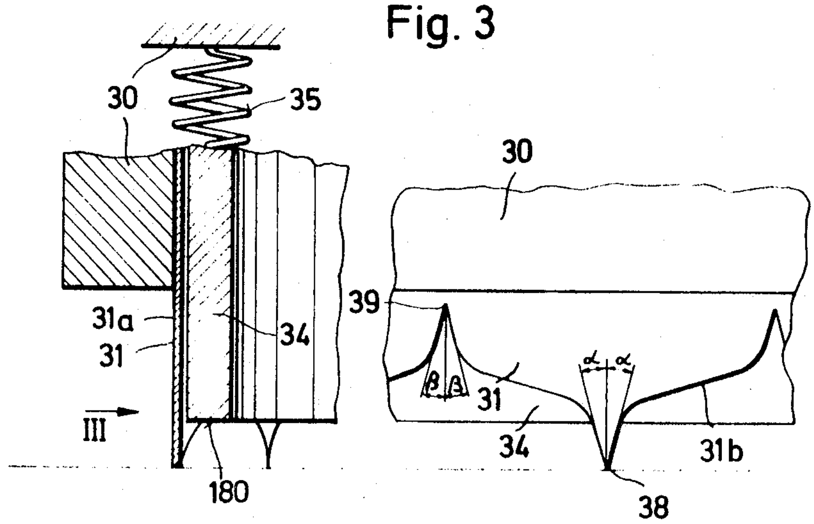
Nov. 30, 1971 G. ZUHLKE 3,623,211

METHOD OF FRAMING A FOIL PORTION

Filed Oct. 6, 1969 3 Sheets-Sheet 2

Fig. 3



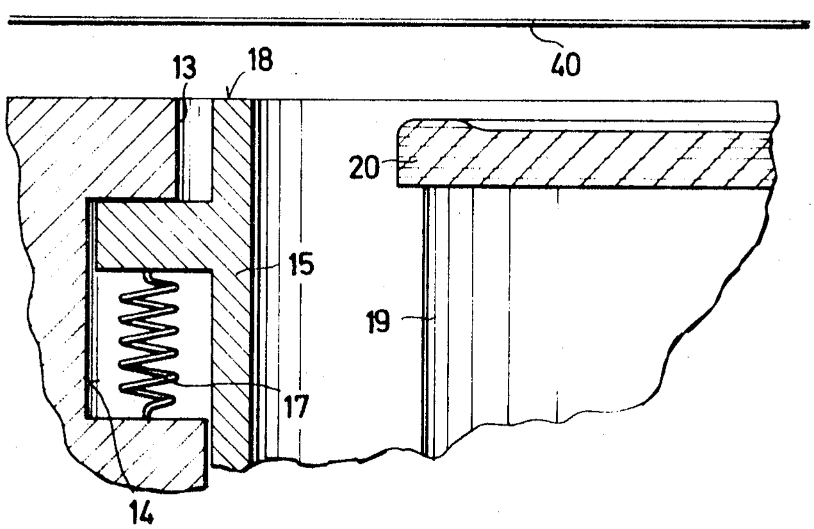


Fig. 2

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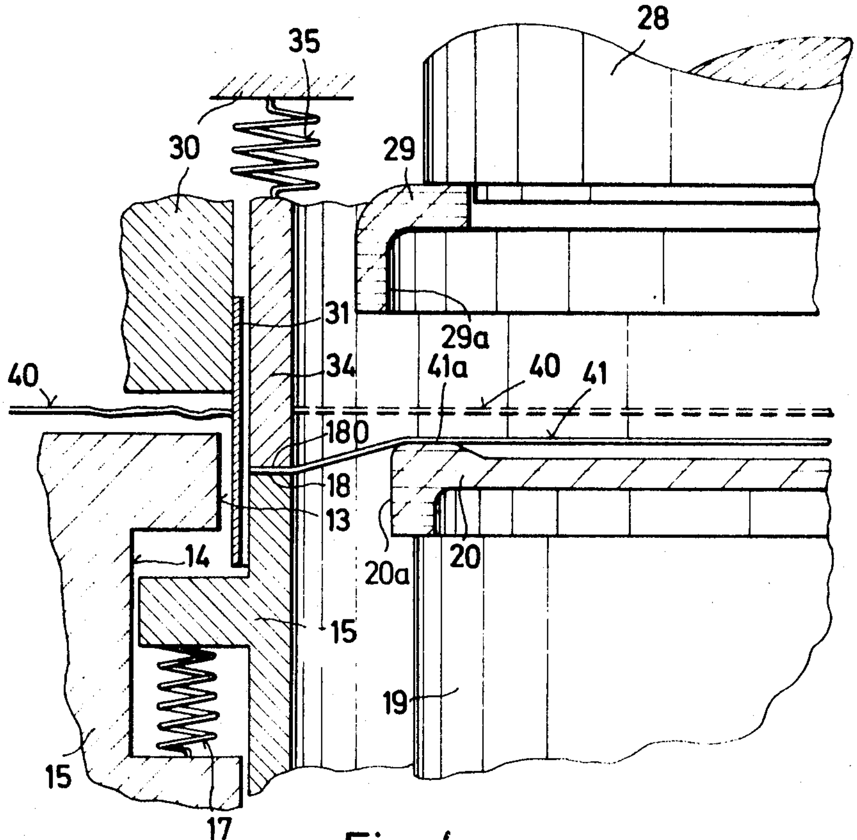

Fig. 4

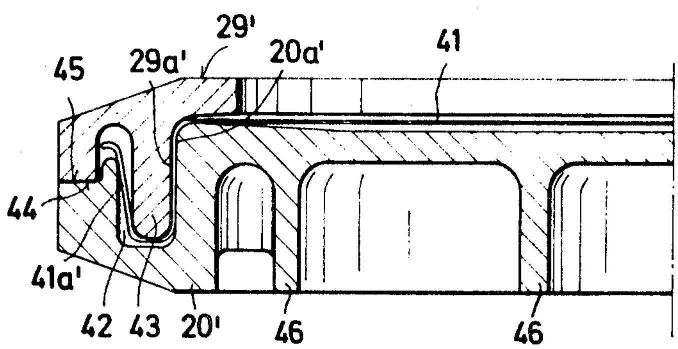

Fig. 5

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3,623,211

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3,623,211

METHOD OF FRAMING A FOIL PORTION

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Int. Cl. B23p *11/02*
U.S. Cl. 29—448 6 Claims

ABSTRACT OF THE DISCLOSURE

In order to frame a foil portion with a mirror surface, a foil is perforated along a circular line, a marginal zone of the foil is frictionally held within the endless line, the foil is cut along the endless line, and the marginal zone is firmly clamped and moved over a first frame part and tensioned, whereupon a second frame part is pressed against the first frame part and clamps the tensioned foil to the first frame part without any wrinkles or folds.

BACKGROUND OF THE INVENTION

It is known to frame mirror-reflecting foils onto large frames, and such mirrors are used for decorative purposes in store window displays. It is difficult to obtain a uniformly tensioned foil part surrounded by the frame, without folds or wrinkles adjacent the frame. When smaller frames are to be provided with a mirror-reflecting foil, for the purpose of making mirrors of average size which can be used as pocket mirrors and the like, folds and wrinkles in the region of the smaller frames cannot be avoided by the prior art. Consequently, foil mirrors have only been used in very large sizes.

SUMMARY OF THE INVENTION

It is one object of the invention to provide a method and apparatus by which glassless foil mirrors of average size can be manufactured in large series.

Another object of the invention is to provide a method and apparatus for framing a foil without folds or wrinkles.

Another object of the invention is to produce inexpensive framed mirrors without the use of glass.

In accordance with the invention, a mirror-reflecting foil which is much larger than the area of the mirror to be produced, is tensioned in a plane, and perforated along an endless annular line, whereupon a marginal zone within the line of perforation is frictionally held between a pair of clamping parts. The foil is then cut between the perforated holes, whereupon it is more firmly clamped by pressing the central foil part into engagement with a first frame part. Thereupon, a second frame part is pressed against the first frame part, clamping the foil between the two frame parts, while the marginal zone is pulled out of the clamping means.

A method, according to the invention, comprises the steps of tensioning a foil in a plane; making perforations in the foil along an endless line surrounding a foil part; frictionally holding an annular marginal zone of the foil part within the endless line; cutting the foil along the endless line; supporting first and second frame parts on opposite sides of the foil part inward of the frictionally

2

held marginal zone; moving the marginal zone beyond the first frame part so that a central foil portion of the foil part surrounded by the first frame part is tensioned; and moving the first frame part, and a second frame part matching the first frame part first into engagement with an annular framing zone of the foil between the marginal zone and the central foil portion, and then into clamping engagement with the first frame portion while pulling the marginal zone out of frictional engagement whereby the central foil portion is framed.

It is preferred to frictionally hold the marginal zone during the cutting of the foil, and to firmly clamp the marginal zone during the tensioning of the central foil portion.

An apparatus according to the invention comprises tensioning means for tensioning a foil in a plane, and being preferably part of transporting means for stepwise transporting a foil web; cutting means having an annular edge formed with circumferentially spaced cutting points, and including cutting edge portions between the cutting points; annular clamping means for frictionally holding or clamping an annular marginal zone of the foil inward of the annular cutting edge; first and second support means for supporting the first and second frame parts on opposite sides of the tensioned foil inward of the annular clamping means; and operating means for operating the cutting means, the clamping means and the support means in a timed sequence.

Preferably, the operating means first move the cutting means to a perforating position in which the points penetrate the foil, then move the clamping means to an operative position frictionally holding the annular marginal zone of the foil, then moves the cutting means to a cutting position in which the cutting edge portions cut out a foil part frictionally held by the clamping means, and then move the support means to a framing position in which the first and second frame parts clamp the cut-out foil part while the marginal zone is pulled out of the clamping means.

In the preferred embodiment, the cutting means includes an annular wall having an annular cutting edge in which the cutting points alternate with recesed cutting edge portions so that, when the cutting means is moved toward the foil, first the cutting points penetrate the foil and make holes through the same along the endless line, whereupon further movement of the cutting means effects complete cutting of the foil along the endless line.

In the preferred embodiment of the invention, the clamping means include first and second clamping parts. First spring means bias the first clamping part and second spring means bias the second clamping part, the first spring means being weaker than the second spring means so that the first clamping part compresses the first spring means and engages the second clamping part for frictionally holding the marginal zone, whereupon movement of the first clamping part with the second clamping part compresses the second stronger spring so that the marginal zone is firmly clamped and the foil part is tensioned in the framing position.

The foil preferably consists of polyester, and has a thickness between 5 micron and 20 micron. A mirror-reflecting layer of aluminum is vaporized onto one side of the foil. However, the invention is not limited to the framing of mirror-reflecting foils, and foils framed in accordance with the invention may be used for other purposes.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary schematic elevation, partially sectioned, illustrating an embodiment of the invention;

FIG. 2 is a fragmentary sectional view illustrating a detail of FIG. 1 on a larger scale;

FIG. 3 is a fragmentary elevation illustrating a portion of a cutting means viewed in the direction of the arrow III in FIG. 2;

FIG. 4 is a fragmentary sectional view corresponding to FIG. 2, but illustrating another operational position; and

FIG. 5 is a fragmentary sectional view illustrating a modified embodiment of a frame provided with a foil in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A foil supply reel **2** is rotatably mounted on a supporting frame **1** and is driven from a motor **3** by a V-belt **4** in the direction of the arrow B. A thin foil having a reflecting mirror surface is wound up on supply reel **2**, and is guided over a tensioning roller **6**, under a guide roller **8**, and between a pair of transporting rollers **9** and **10**, so that the section of the foil web **40** located between rollers **9**, **10** and **8**, is located in a plane, and tensioned by tensioning roller **6** which is mounted on a lever arm **5** pivotally supported at its upper end on the supporting frame **1**, and being biassed by a spring **7** to urge tensioning roller **6** towards the right as viewed in FIG. 1.

Transporting roller **10** abuts transporting roller **9** under pressure, and is turned by means of a lever **11** by a drive motor **12** in the direction of the arrow C so that upon each stroke of motor **12**, foil web **40** is pulled off the supply reel **2**. The tensioned section of foil web **40** is located between a stationary support **19** carrying at its top end a first frame part **20**, and a movable support **28** carrying at its lower end a second frame part **29** which has a flange with an inner cylindrical face **29***a* matching the outer cylindrical face **20***a* of a flange of frame part **20**, as best seen in FIG. 4. In accordance with the apparatus and method of the invention, a substantially circular foil part is framed between frame parts **20** and **29** in the tensioned condition obtained by tensioning roller **6**. It will be noted that the tensioned section of the foil web **40** is substantially larger than the part thereof which can be framed by frame parts **20** and **29**.

The drive motor **12** serves only the purpose of stepwise transporting foil web **40**. During the forward movement of foil web **40**, tensioning roller **6** is turned against the action of spring **7** to the position illustrated in broken lines in FIG. 1, in which a switch, not shown, is actuated by tensioning means **5**, **6** to start motor **3** by which the foil web **40** is unwound from supply reel **2** until tensioning roller **6** assumes a position on the right illustrated in the full lines in FIG. 1. In this end position, the tensioning means **5**, **6** actuate another switch by which the circuit of motor **3** is interrupted.

Foil web **40** preferably consists of polyester, and has a thickness between 5 micron and 20 micron. The mirror coating on one side of the foil is preferably vaporized aluminum.

Supporting frame **1** has a base portion with a tubular wall having an inner cylindrical surface **13** provided with a circular groove **14** having rectangular cross-section. A tubular clamping part **15** is located within the cylindrical surface **13**, and has a circular outer flange **16** projecting into the annular groove **14**. The annular cup face of groove **14** serves as a stop abutment for flange **16** which is urged by springs **17** resting on the lower annular face of groove **14** to move upward to the illustrated end position of the tubular clamping part **15** in which the circular clamping face **18** is located slightly below the tensioned foil section. The annular clamping face **18** is located in a horizontal plane parallel to the plane of the tensioned foil section, and perpendicular to the vertical axis of the apparatus.

The base portion of supporting frame **2** carries a pair of upright guide posts **21** on which a yoke **22** is mounted for up-and-down movement. Yoke **22** is fixedly connected with support **28** which carries the upper frame part **29**, and is reciprocated by a link **23** pivotally connected thereto and also to a rotary member **25** carrying a pivot **24** on which the upper end of link **23** is mounted. Member **25** is driven by a pulley and drive belt **27** from a motor **26** so that during operation of the motor **26**, yoke **22** is reciprocated in up-and-down strokes.

The vertical posts **21** also support cutting means for vertical movement. The cutting means include an annular holder **30** guided by posts **21** and located between upper springs **36** abutting yoke **22**, and lower spring **37** abutting the top face of the base portion of support frame **1**. A circular knife or cutter **31** is secured to cutter holder **30**, movable with the same. Cutter holder **30** has an inner face **32** formed with an annular groove **33** having a rectangular cross-section. A circular clamping part **34** has an outer flange **340** located in groove **33** and abutting the lower annular face of the same due to the action of coil springs **34** which abut the upper face of groove **33**. The circular clamping face **180** of the upper clamping part **34** is located in a plane parallel to the plane of the tensioned foil, and opposite the clamping face **18** of clamping part **15**. The diameter of clamping part **34** is greater than the diameter of support **28** and frame part **29**, and smaller than the diameter of the circular cutting knife **31**. The upper and lower faces of grooves **33** limit the up-and-down movement of clamping part **34**.

The resilient spring force of springs **17** is greater than the force of springs **35**, and the spring force of springs **36** is greater than the spring force of springs **37**.

FIGS. 2 to 4 illustrate the active parts of the apparatus on a larger scale. As best seen in FIGS. 2 and 3, a cutting means **31** has a circular wall **31***a* with a lower circular cutting edge **31***b* which is formed with circumferentially spaced cutting points **38** whose lateral cutting portions define the angle 2α. Intermediate the cutting points **38**, cutting recesses **39** are provided bounded by cutting edge portions defining the angle 2β, which is preferably equal to the angle 2α. Intermediate cutting recesses **39** and cutting point **38** less-slanted cutting portions are located.

When the cutting means **30**, **31** is moved downward, the cutting points **38** penetrate the tensioned foil section and form holes in the same along an endless circular line. When cutting means **30**, **31** is further moved down first, the cutting angle α is effective so that slits are formed in the foil without circumferentially stretching the foil. In the same manner, the foil is cut at the ends of the downward cutting stroke of the cutting means **30**, **31** by the cutting edge portions forming the recesses **39**, the cutting angle β being preferably equal to the cutting angle α and effecting cutting through the last rear end portions of the foil between the perforations formed by the points **38**. The intermediate less-slanted cutting edge portion effects the cutting between the effective periods of points **38** and recesses **39**, and it is sufficient to have a small cutting angle only at the beginning and at the end of the cutting stroke by which the tensioned foil section is first perforated and then cut along a circular line for cutting out a circular central foil part.

Due to the construction and shape of the cutting knife 30, a circular cut can be neatly effected during movement of the cutting knife in a direction perpendicular to the plane of the foil.

OPERATION

The foil web 40 is held in a tensioned planar position between guide roller 8 and transporting rollers 9 and 10. The foil section is tensioned by the action of spring 7 on lever 5 of tensioning roller 6 which is urged to the position shown in solid lines in FIG. 1.

The vertical axis of the machine is also the axis of supports 28, 19, frame parts 29 and 20, circular clamping parts 34 and 15, and of cutting knife 31.

At the beginning of the operation, frame part 20 is located under the tensioned foil portion, and frame part 29 is located above the same, spaced a greater distance and registering with the lower frame part 20. The annular clamping face 180 is located outside of frame part 29 above the tensioned foil portion, registering with clamping face 18 of clamping part 15 which is located under the tensioned foil portion. Springs 36 and 37 hold the cutting means in a position in which the cutting edge is located below the clamping face 180 and adjacent the top face of the tensioned foil section.

Operating motor 26 is started and drives operating member 22 with support 28 downward. The motion is also transmitted by a spring 36 to holder 30 of the cutting means, and by a spring 35 to the upper clamping part 34, and since these parts move simultaneously, the points 38 of cutting edge 31 first reach the tensioned foil and penetrate the same to form holes along a circular line surrounding a circular foil part whose diameter is greater than the diameter of the frame parts 20 and 29.

During further downward movement of operating member 22, clamping face 180 engages the tensioned foil portion of foil web 40 and presses the same against clamping face 18 of the lower clamping part 15. The flanks of the cutting points have somewhat deeper penetrated through the tensioned foil portion, and form spaced slits in the same.

Since springs 35 are weaker than springs 17, the pressure exerted on the foil section by clamping faces 180 and 18 corresponds only to the spring force of springs 35 so that a circular marginal portion of the foil section is frictionally held.

Further downward movement of operating member 22 lowers the cutting edge 31 far enough so that the cutting recesses 39 become effective to complete the circular cut connecting the initial perforations of the foil so that the cutout foil part is only frictionally held by the clamping faces 180 and 18. The downward movement of operating member 22 moves holder 30 of the cutting means to a position in which the upper face of the annular groove 33 abuts the upper edge of the flange 340 of clamping part 34 so that clamping part 34 is rigidly coupled with holder 30, and since springs 36 are stronger than springs 17, further downward movement of operating member 22 moves the lower clamping part 15 downward against the action of springs 17 which results in increased pressure exerted by the clamping faces 18 and 180 on the clamped annular marginal zone of the foil so that the same can not slip between clamping faces 18 and 180.

As best seen in FIG. 4, the clamped marginal portion moves downward with clamping means 34, 15 to a position located below the top face of frame part 20 so that an annular framing zone 41*a* surrounding the central mirror portion 41 is engaged by the peripheral part of frame 20 and tensions the central nip foil portion 41. As shown in FIG. 4, the outer part of the foil section of foil web 40 remains in initial position surrounding cutting knife 31.

During further downward movement of the operating member 22, frame part 29 engages the annular portion of the foil surrounding the frame part 20, and clamps the same by contact of inner surface 29*a* against outer surface 20*a* of frame part 20.

The central mirror foil part 41 is now framed by frame parts 20, 29 in a tensioned condition without any folds or wrinkles. Two frame parts 29 and 20 may now be secured to each other in any desired manner.

During the last part of the downward movement of the operating member 22, the marginal zone of the cut-out foil part is pulled out from the clamping end faces 180 and 18, and the outermost part thereof projecting from the gap between the faces 29*a* and 20*a*, may be cut off.

Due to rotation of member 25, operating member 22 is again raised so that the finished and framed mirror can be removed from stationary support 19 on which it rests. New frame parts 29 and 20 are mounted on support 19 and 28, and motor 12 is operated to move the foil web 40 a step so that another tensioned foil section is located between the new frame parts 20 and 28.

Springs 17 move clamping part 19 back to its normal higher position shown in FIG. 1, and the springs 37 move the cutting means 30, 31 upward, while clamping part 28 assumes its lower position under the action of springs 35.

FIG. 5 illustrates a modified frame consisting of a frame part 20′ and upper frame part 29′. In addition to clamping faces 20*a*′ and 29*a*′, an annular groove 42 is formed in frame part 20′ into which a rib 43 of frame part 29′ projects. The outer margin 41′ of the central foil part 41 is laid about rib 43. Reinforcing ribs 46 are provided in the interior of frame part 20′ so that its rigidity is increased. Frame parts 29′ and 20′ have abutting faces 45, 44 which are preferably welded by ultrasonic vibrations so that the mirror foil is permanently held in the frame 29′, 20′.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of apparatus for framing a foil differing from the types described above.

While the invention has been illustrated and described as embodied in method and apparatus for mass-producing framed mirror reflecting foils, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the sprit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. Method of framing a foil portion comprising the steps of tensioning a foil in a plane; making perforations in said foil along an endless line surroundng a foil part; frictionally holding an annular marginal zone of said foil part within said endless line; cutting said foil along said endless line; supporting first and second frame parts on opposite sides of said foil part inward of said frictionally held marginal zone; moving said marginal zone beyond said first frame part so that a central foil portion of said foil part surrounded by said first frame part is tensioned; and moving said first frame part and a second frame part matching said first frame part first into engagement with an annular framing zone of said foil between said marginal zone and said central foil portion, and then into clamping engagement with said first frame portion while pulling said marginal zone out of frictional engagement whereby said central foil portion is framed.

2. The method of claim 1, comprising placing said first and second frame parts on opposite sides of said foil before cutting said foil along said endless line.

3. The method of claim 2, comprising placing said first and second frame parts on opposite sides of said foil after cutting said foil along said endless line.

4. The method of claim 1, wherein said first and second frame parts engage said annular framing zone of said foil before the step of cutting said foil along said endless line.

5. The method of claim 1, wherein said first and second frame parts engage said annular framing zone after the step of cutting said foil along said endless line.

6. The method of claim 1, comprising frictionally holding said marginal zone during cutting of said foil, and firmly clamping said marginal zone during tensioning of said central foil portion; and wherein the tensioned area of the foil is substantially greater than said central foil portion.

References Cited

UNITED STATES PATENTS

173,720	2/1876	Guerin.	
2,961,759	11/1960	Weissfloch	29—452
3,180,220	4/1965	Jeffree	160—378
3,243,042	3/1966	Moulton	209—403
3,286,338	11/1966	Bohr	29—446
3,291,164	12/1966	Swallow	29—449 X

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U.S. Cl. X.R.

160—378