May 19, 1970 F. R. BENEDICT 3,512,441

ADJUSTABLE GANG SLITTER

Filed May 14, 1968 4 Sheets-Sheet 1

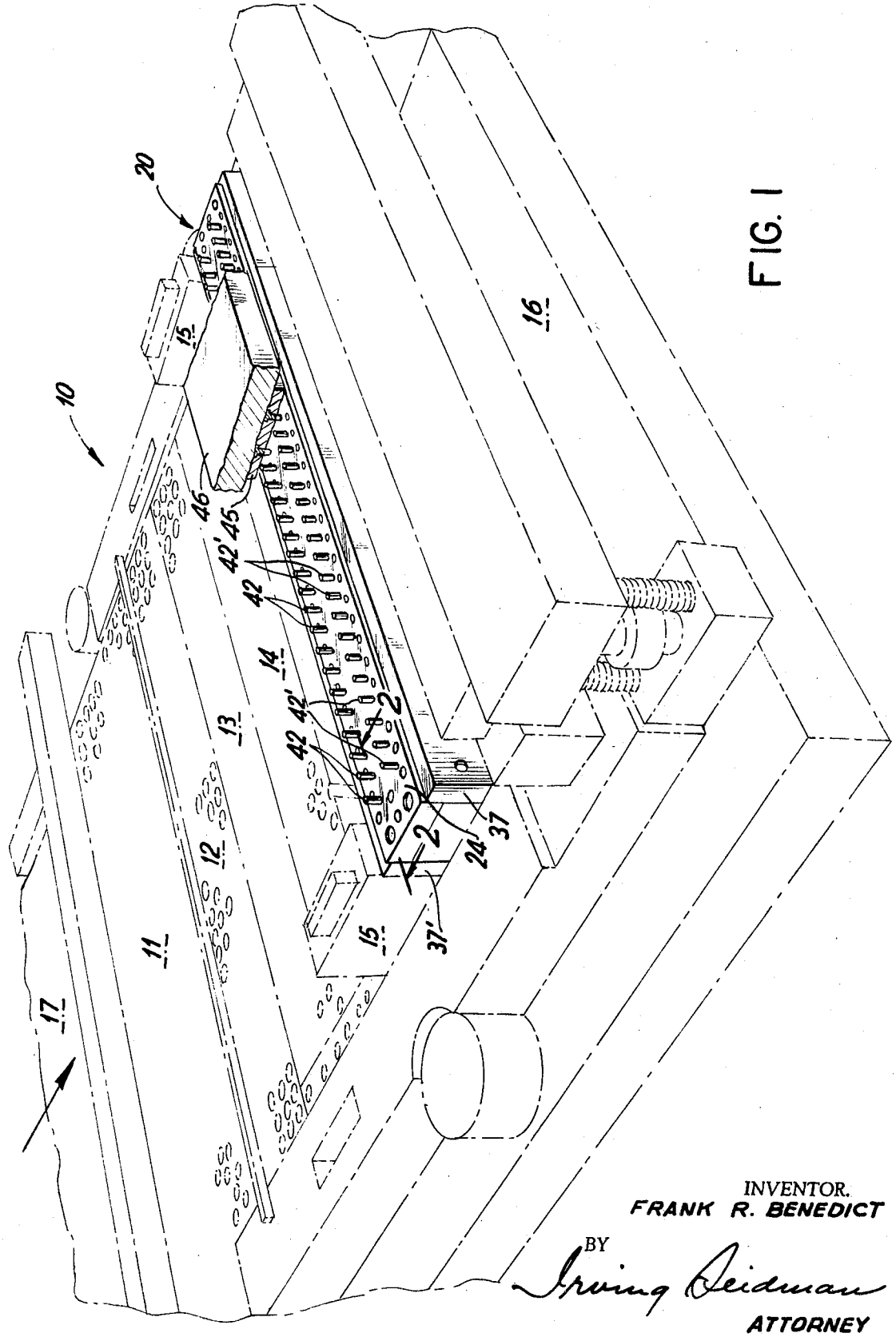


FIG. 1

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ADJUSTABLE GANG SLITTER

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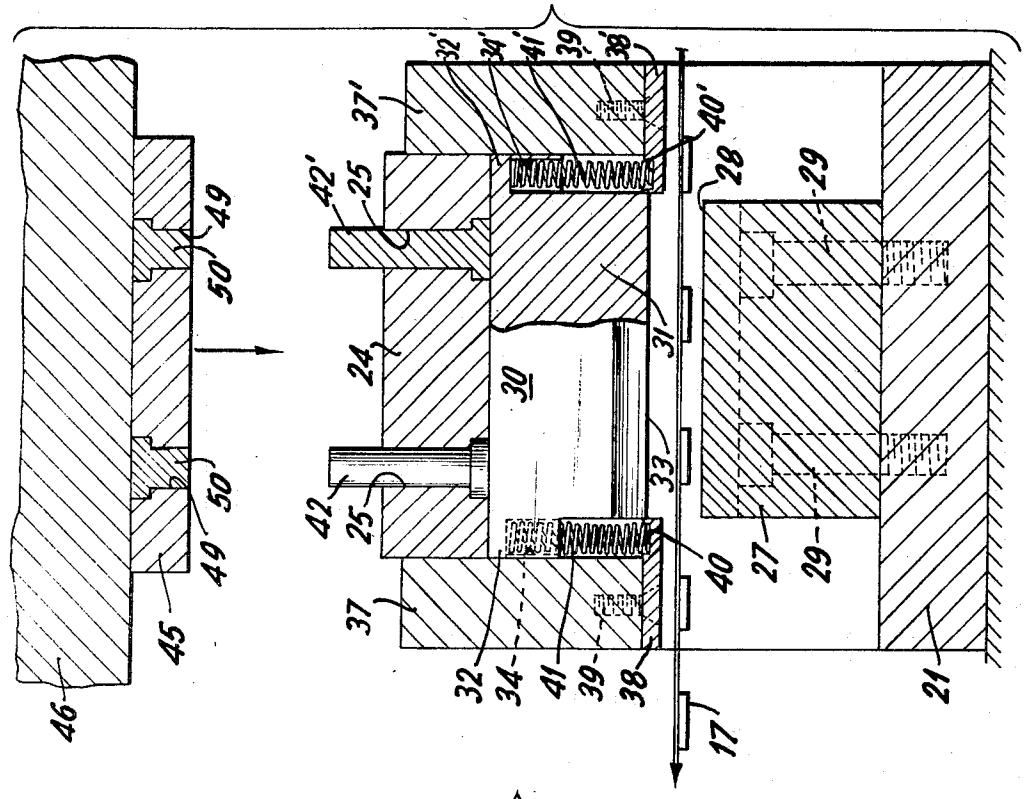


FIG. 3

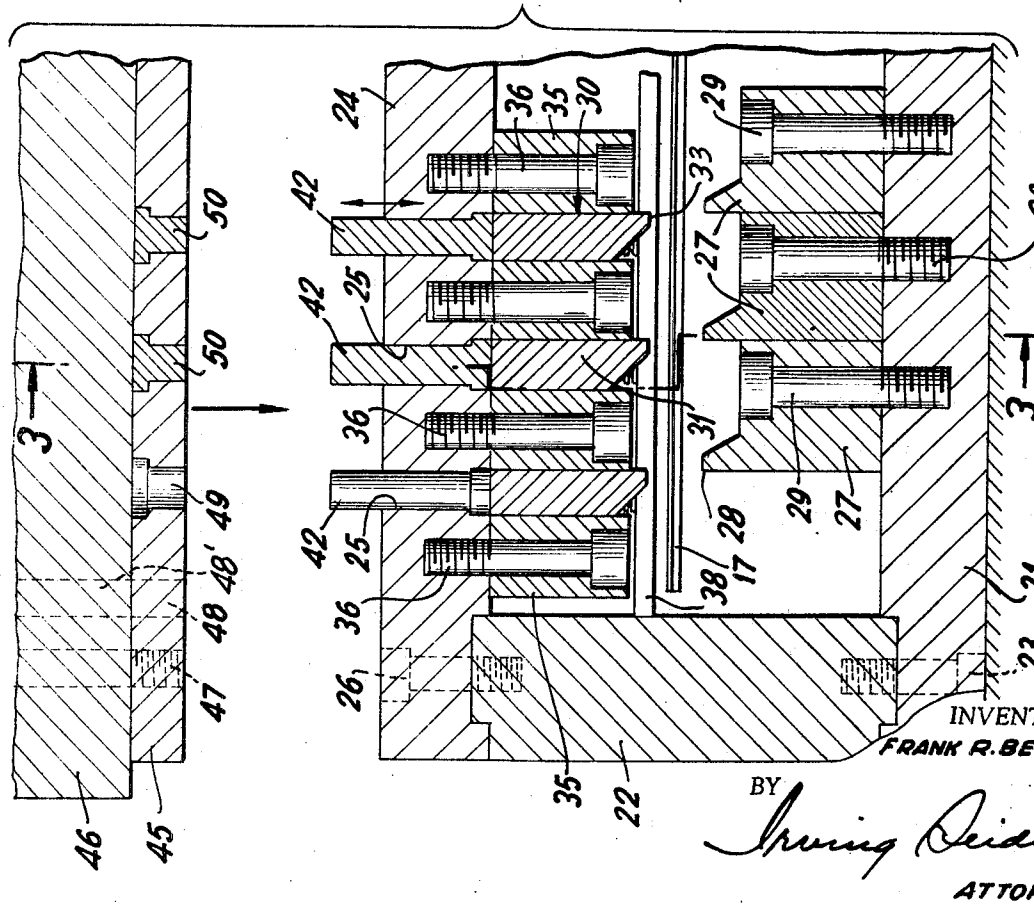


FIG. 2

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ADJUSTABLE GANG SLITTER

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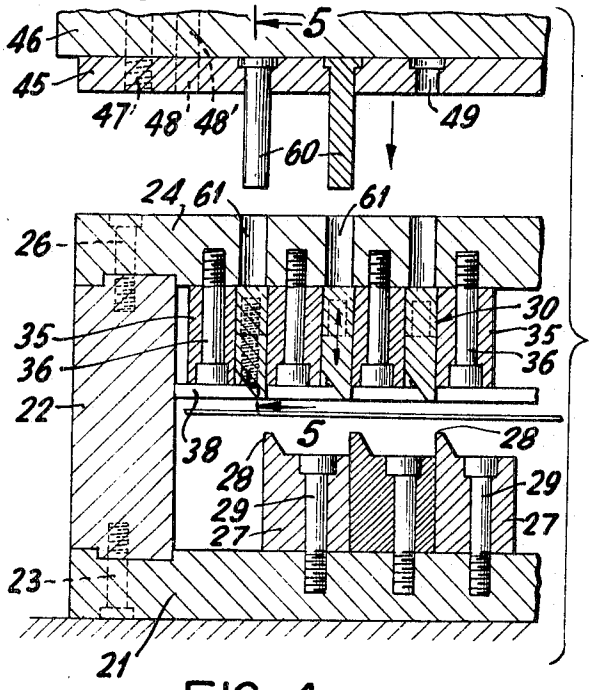


FIG. 4

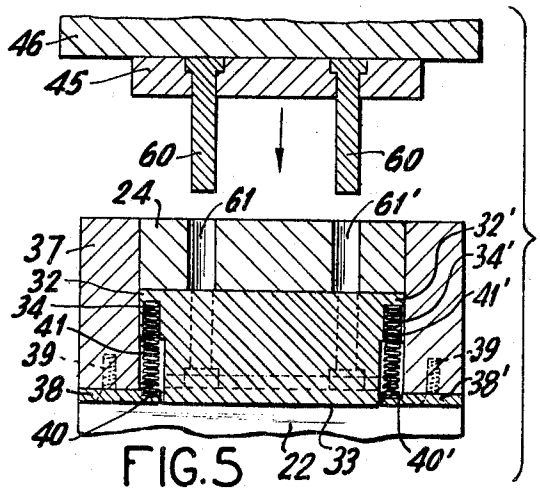


FIG. 5

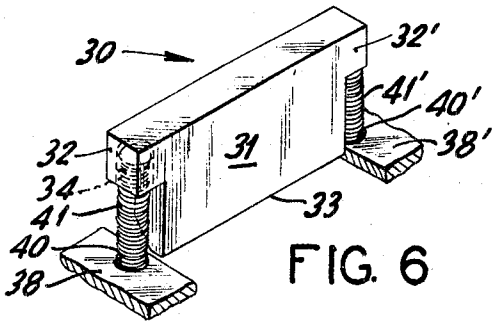


FIG. 6

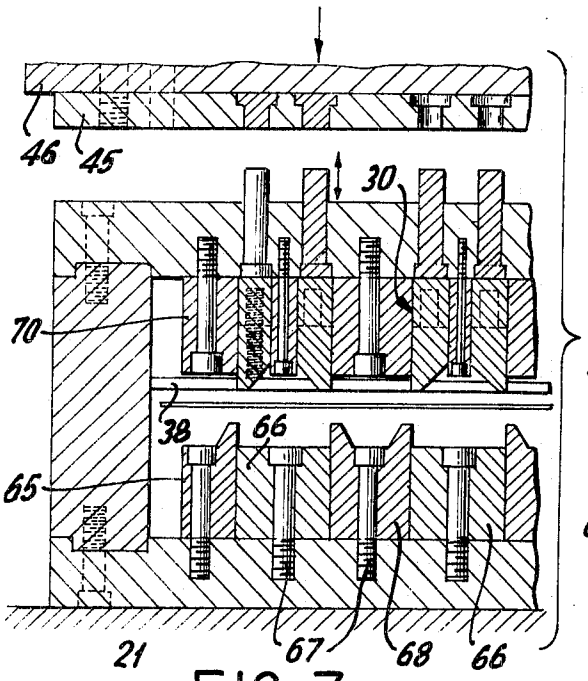


FIG. 7

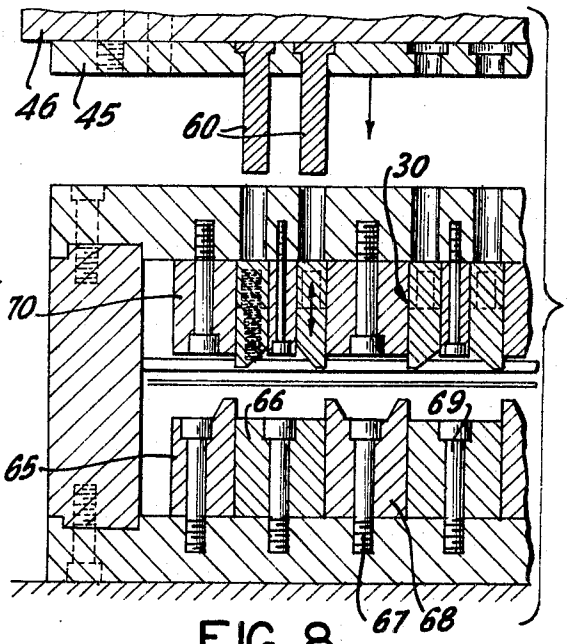


FIG. 8

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ADJUSTABLE GANG SLITTER

Filed May 14, 1968 4 Sheets-Sheet 4

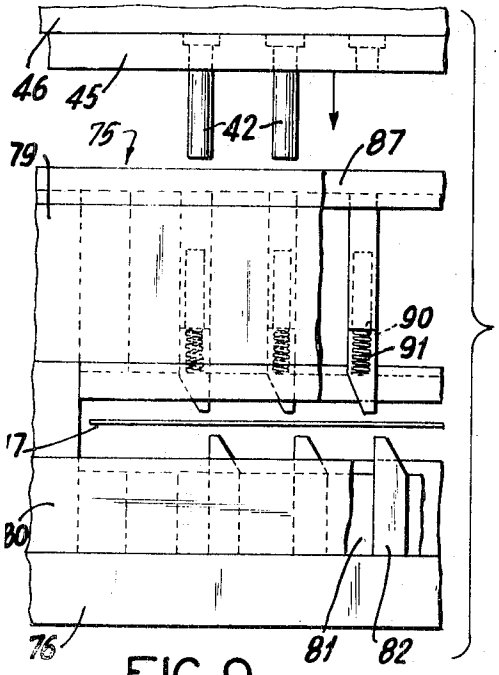


FIG. 9

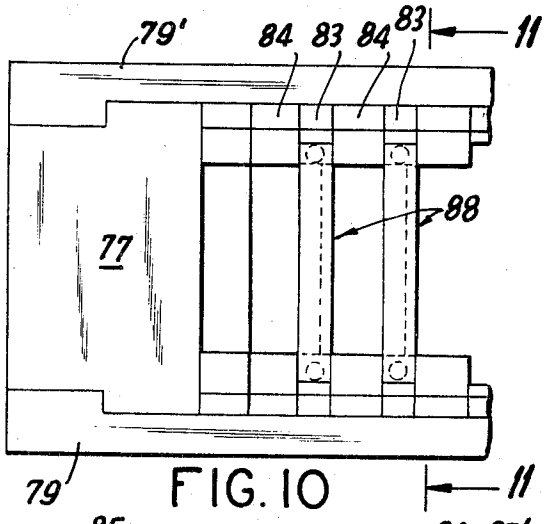


FIG. 10

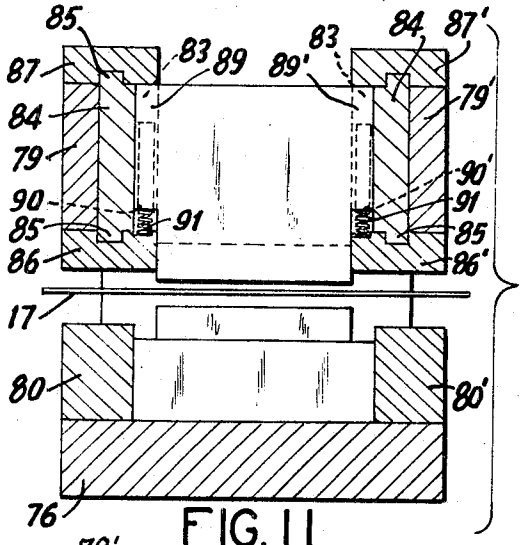


FIG. 11

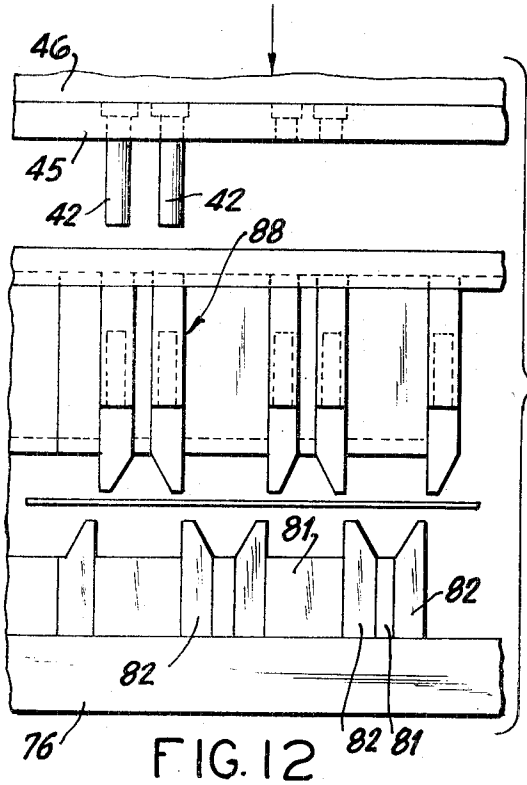


FIG. 12

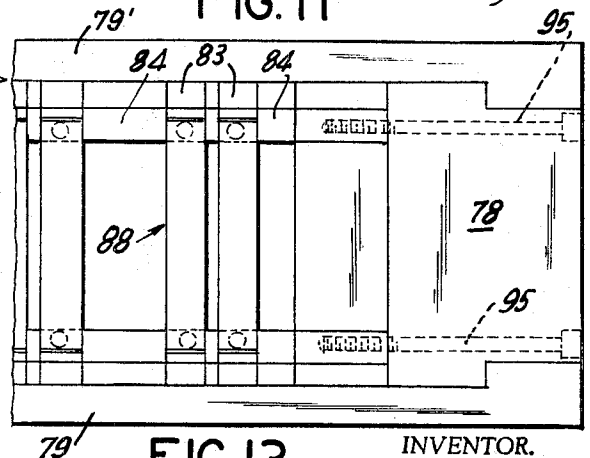


FIG. 13

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United States Patent Office 3,512,441 Patented May 19, 1970

3,512,441

ADJUSTABLE GANG SLITTER

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Filed May 14, 1968, Ser. No. 728,993
Int. Cl. B26d 5/08
U.S. Cl. 83—571 11 Claims

ABSTRACT OF THE DISCLOSURE

An adjustable gang slitter for slitting collared fin stock fabricated in a progressive air conditioning fin die provided with a plurality of lower stationary blades and a plurality of upper blades aligned with and mounted for vertical movement toward the lower blades for slitting fins passing therethrough. An interchangeable actuator plate, driven by a die ram is provided to activate selected slitter blades, said actuator plate being provided with means which enables a change in the selection of blades desired to be activated.

This invention relates to an adjustable gang slitter, and more particularly to an adjustable gang slitter used in a progressive air conditioning fin die for cutting thin materials to form air conditioner fins.

In manufacturing collared fin stock for an air conditioning heat transfer surface, high production requirements necessitate the use of very wide stock upon which a multiplicity of collared holes, in a progressive pattern, are formed. The patterned stock is then slit into collared hole fin strips by a single, or group of, unitized slitter units which are mounted in a conventional progressive air conditioning fin die, and actuated by an up and down motion of a press ram. The multiplicity of fin strips thus formed are cut off outside the die so that strips of a desired length for assembly are formed.

In order to change the slitting pattern of the conventional slitter, from one row to two rows, two rows to three rows, three rows to four rows, or combinations thereof, it becomes necessary to remove or replace the top slitter blades from the individual slitter units. Because of the extremely limited space available in the slitter area of the die, changing, removing and/or replacing blades is particularly difficult and especially time consuming. Additionally, when blades are changed or removed, the die cannot be operated and production must be temporarily halted. It is obvious therefore that "change time" of the slitter blades becomes an extremely important factor in achieving and maintaining high production efficiency.

Accordingly, an object of the present invention is the provision of an improved adjustable gang slitter in a progressive air conditioning fin die in which cutting patterns formed by a plurality of slitter blades can be changed without the necessity of removing and/or replacing individual blades in the die.

Another object of the present invention is the provision of an adjustable gang slitter in a progressive air conditioning fin die in which the pattern being cut can be effectively altered with a minimum of production time loss.

A further object of the present invention is the provision of an adjustable gang slitter in which a plurality of slitter blades may be installed or changed as a unit, obviating single blade handling.

Another object herein is the provision of an adjustable gang slitter which permits simple and quick removal of a single blade, or a plurality of blades for sharpening, or the like, without affecting cutting accuracy.

Still another object of this invention is the provision of an adjustable gang slitter in a progressive air conditioning fin die which permits simple, quick and accurate slitting pattern combination changes and the adjustment of slitting patterns to conform to varying stock widths.

A still further object herein is the provision of an adjustable gang slitter which is relatively simple to manufacture and which will effect lower per unit manufacturing costs of collared fin stock.

Another object of the present invention is to provide an adjustable gang slitter in a progressive air conditioning fin die which enhances the safety of the operator thereof.

In effecting the foregoing objects, the present invention utilizes a plurality of upper slitter blades, mounted for vertical movement, within an upper frame and aligned with a like number of stationary lower slitter blades. An interchangeable acutating plate affixed to, and driven by, a die ram is positioned above the upper slitter blades. Means are provided in the actuating plate for translation of the vertical ram movement to movement of a selected slitter blade, a set of slitter blades or any number or combination of slitter blades.

Other important objects, advantages and features of the present invention will be apparent to those versed in the art from the following description and accompanying drawings wherein like numbers identify like parts in the several views, and wherein:

FIG. 1 is a view of an adjustable gang slitter in accordance with the present invention shown utilized with a progressive air conditioning fin die.

FIG. 2 is a front view of the adjustable gang slitter taken on line 2—2 of FIG. 1;

FIG. 3 is an end view of the slitter taken on line 3—3 of FIG. 2;

FIG. 4 is a front view, in section, of a slitter gang showing an alternate actuating plate construction for translating ram movement to selected slitters;

FIG. 5 is an end view of the gang slitter taken on line 5—5 of FIG. 4;

FIG. 6 is a perspective view of a slitter blade;

FIG. 7 is a sectional view of an alternate arrangement of slitter blades;

FIG. 8 is a sectional view of a slitter gang as shown in FIG. 7 with an alternate actuating plate construction for translating ram movement to selected cutters;

FIG. 9 is a sectional view of a gang slitter showing an alternate construction thereof;

FIG. 10 is a top plan view of a gang slitter as shown in FIG. 9;

FIG. 11 is a view taken on line 11—11 of FIG. 10;

FIG. 12 is a sectional view of a gang slitter showing an alternate arrangement of slitter blades; and

FIG. 13 is a top plan view of gang slitter showing the opposite end of the slitter as illustrated in FIG. 10.

Referring now to the drawings, FIG. 1 illustrates a progressive air conditioning fin die **10**, showing an adjustable gang slitter **20** utilized therewith. In the manufacture of air conditioning fins, thin metallic stock **17** is fed into the die **10** in the direction indicated by the arrow shown in FIG. 1. Such stock is drawn in a cup forming section **11** of the die, providing the stock with a plurality of cup like structures thereupon. The stock traverses a piercing section **12**, extrusion section **13**, a curl section **14** and a side trimmer **15** to form a plurality of collared holes upon the face of the thin metallic sheet stock. Such stock is now fed into the adjustable gang slitter **20** for lengthwise slitting, forming strips having one or more rows of collared holes depending upon the gang slitter pattern selected. Such strips are cut across the width thereof by an end cutter **16** to form air conditioning heat transfer fins.

The adjustable gang slitter, in accordance with the present invention, fabricated of a hardened steel, comprises a bottom plate **21**, disposed across the width of the bed of the progressive air conditioning fin die **10**. At each end of said bottom plate **21**, and at right angles thereto, end blocks **22** (one shown) are secured to said plate **21** by screws **23**. A top plate **24** provided with a plurality of headed pin counterbores **25**, presently to be described, is disposed parallel to bottom plate **21** and is secured by screws **26** at both ends thereof to end blocks **22** to form a frame like structure.

A plurality of block like rectangular bottom slitter blades **27** having a cutting face **28** at the top thereof, are fixedly mounted by screws **29** or the like to bottom plate **21**, the height of said blades **26** being generally less than half the height of end blocks **22**.

Top slitter blades **30**, at least one of which is utilized in the adjustable gang slitter **10**, is comprised of a substantially rectangular block like body **31** having flanges **32**, **32'** at both ends of the top thereof and a cutting face **33** at the bottom thereof. Said flanges **32**, **32'** are provided with recesses **34**, **34'** therein. A plurality of guide blocks **35** are secured to the undersurface of top plate **24** by screws **36** and are so arranged to form channels therebetween to receive blades **30** therein. The arrangement is thus one guide block **35**, followed by a top slitter blade **30** and another guide block and another blade. It is to be noted that the spacing of the guide blocks permit the blades to be slidable therebetween and the width of guide blocks **35** are such that the cutting faces **33** of the top slitter blades and the cutting faces **28** of the bottom slitter blades are in precise alignment, said blades making line-to-line contact.

A pair of side guides **37**, **37'** are secured to the sides of end blocks **22** along the upper portion thereof so that a clearance through the width of the gang slitter **20** is provided between the cutting faces of lower blades **28** and upper blades **33** to permit movement of the sheet metal stock **17** therebetween. A pair of spring reaction plates **38**, **38'** are secured by screws **39** to the bottom of side guides **37**, **37'** said plates having recess **40** therein to receive reaction springs **41**, **41'** lodged in and extending from recesses **34**, **34'** of flanges **32**, **32'** respectively.

As has heretofore been indicated, top plate **24** is provided with a plurality of headed pin counterbores **25**, generally two such counterbores for each slitter blade **30**. Said counterbores are aligned so that a pair of operating pins **42**, **42'**, when set within said counterbores **25** and extending upwardly through plate **24**, are slidably retained therein by the top of a slitter blade **30** under compression supplied thereto by reaction springs **41**, **41'**.

Disposed above said operating pins **42**, **42'**, there is provided an actuator plate **45** secured to the undersurface of a conventional die shoe **46** of the fin die **10**. Said actuator plate is provided with at least one attachment screw **47** for securement to die shoe **46**. Location apertures **48**, **48'** are provided in said actuator plate **45** and die shoe **46** respectively to receive therethrough a dowel or pin in order to align said actuator plate **45** with top plate **24**. Actuator plate **45** is further provided with pairs of counterbored gag button apertures **49** which are precisely aligned with operating pins **42**, **42'** and are adopted to receive therein gag buttons **50** of a height commensurate with the thickness of actuator plate **45**.

In the lengthwise slitting of stock **17**, the pattern desired will be determined by the placement of gag buttons **50** in actuator plate **45**. Thus, if it is desired to slit stock **17** between each of the collared holes provided therein, gag buttons are placed in each of the gag button apertures **49**. The conventional motion of die shoe **46** will produce contact between the pairs of gag buttons **50** and the operating pins **42**, **42'** thus forcing top slitter blades **30** downwardly upon stock **17** as it passes between top slitter blades **30** and bottom slitter blades **27**. If it is desired to change the slitting pattern to include, for example, a strip having one collared hole followed by a strip having two holes, a gag button **50** is placed in the first counterbored aperture **49** while the next two counterbores are left open, as illustrated in FIG. 2. In effecting changes of gag buttons so as to change the slitting pattern, actuator plate **45** is removed from the die shoe **46**. To insert or remove appropriate buttons **50**. In replacing actuator plate **45**, and in order to assure proper alignment thereof with the actuating pins **42**, **42'** a dowel or pin may be used through location apertures **48**, **48'** before attachment screw **47** secures the actuator plate in position.

Where standard cutting patterns are repeatedly used, a single actuator plate may be prepared for each slitting pattern by locating apertures over selected operating pins. Instead of removing and selectively placing gag buttons in a single plate, the prepatterned plate can be inserted into the die. Depending too on the size of the actuator plate **45**, more than a single location aperture **48**, **48'** may be required and more than a single attachment screw **47** will be needed.

It it to be noted that although the cutting faces **28** and **33** of the bottom and top slitter blades respectively are shown to have a straight cutting edge, such cutting edges may be provided with a corrugated, wavy or any like design.

In a further embodiment of the present invention, it has been found feasible to operate top slitter blades **30** by utilizing a pair of operating pins **60** mounted directly in actuator plate **45**, as illustrated in FIGS. 4 and 5. In such case, top plate **24** is provided with a plurality of bores **61** aligned above top slitter blades **30**. A pair of operating pins **60** are disposed within gag button apertures **49** of actuator plate **45**, and are of sufficient length to protrude therethrough and into bores **61**, **61'** of top plate **24** so as to contact top slitter blades **30** upon the downward thrust of die shoe **46**. The use of gag buttons **50** as well as the precise sliding fit heretofore required between operating pins **42**, **42'** and counterbores **25** are eliminated.

Where particularly narrow fins are required to be slit so that the distance between collared holes in the stock **17** is extremely close, or where stock to be slitted is particularly thin, the cutting action of adjacent blades as shown in FIGS. 2 and 3 tend to slightly twist the stock along its cut edge. In order to avoid the twisted cut edge, where the problem arises, an alternate blade arrangement to provide symmetrical cuts is illustrated in FIGS. 7 and 8.

The gang slitter shown in FIG. 7 is provided with a single faced bottom slitter blade **65** at one or both ends of bottom plate **21**, depending upon the number of blades placed thereupon. Following the first blade **65**, a spacer block **66** is secured by screws **67** to bottom plate **21** and is followed by a double faced bottom slitter blade **68** secured by screws **69** to plate **21**. This arrangement is repeated along the bottom plate.

The positioning of top slitter blades **30**, as heretofore described, are altered accordingly so that the cutting faces **33** thereof are aligned with the bottom blades **68**. Spacing between top slitter blades are provided by a plurality of guide blocks **70** of varying widths. It is to be noted that varying cutting patterns and combinations thereof are possible by the provision of varying cutting faces of the bottom slitter blade **68** and the proper spacing and the alignment of the top slitter blades therewith. With gag buttons **50** disposed in actuator plate **45** as illustrated in FIG. 7, the direction of the cut on each side of each one row of fin is the same.

FIG. 8 illustrates the use of the same arrangement of cutting faces as shown in FIG. 7, but relies upon the use of long operating pins **60**, as shown in FIG. 4, to drive top slitter blades **30**.

In the foregoing description of the construction of an adjustable gang slitter **10** as illustrated in FIGS. 2–5, 7

and 8, it is to be noted that the slitter parts are positioned by the use of screws and the like. This, of course, necessitates making provision for screw apertures before the parts are heat treated and ground, and at the final stage of assembly, the parts, such as blocks or slitters, cannot be interchanged. Further, there is a tendency to distort the frame members so as to require some compensation for such distortion during assembly. For example, in normal precision grinding where all of the parts of one size would be ground at once, a plus or minus error of 0.0001" is economically attainable. If thirty of these blocks were stacked, the overall error would be thirty times this, or 0.003 inch. If the grinding error was this amount on 30 top slitter blades and a similar negative error were the same for the bottom slitter parts, the total misalignment between blades would be such that the slitter would not cut material. This problem causes considerable additional work in assembly since it becomes necessary to "tailor make" each part.

Since the problem is one of stacking a multiplicity of top slitter blades with positioning and guide blocks and a multiplicity of bottom slitter blades with positioning blocks so that the distance from one cutting face to another is the same within close limits, the lapping procedures to obtain precise thicknesses is economical and can be used. In using precision blocks to fabricate precision measurement equipment, blocks are stacked and held together by compression members so that large stacks may be handled easily.

Recognizing the advantages of precision in the lapping principle to obtain high accuracy in assembly, an adjustable gang slitter built on this principle and using the precision block system is utilized in the embodiment shown in FIGS. 9–13.

As illustrated in FIGS. 9–11, the adjustable gang slitter **75** comprises a bottom frame plate **76**. At one end of said plate there is provided a reaction block **77** and at the other end thereof, a compression block **78**. A pair of top frame tension members **79, 79'** are secured at one end thereof to reaction block **77** and at the other end thereof to compression block **78** in the upper portion thereof by being eyed thereto. A pair of bottom tension members **80, 80'** are similarly secured to said reaction block **77** and compression block **78** in the lower portion thereof.

A plurality of bottom spacer and guide blocks **81** are alternately stocked in series with a plurality of bottom slitting blades **82**, as illustrated in FIG. 9 within frame structure defined by bottom tension members **80, 80'** and are secured by bottom compression screws **95**.

Turning now to the upper portion of the slitter, a series of small spacer blocks **83** and larger guide blocks **84** are alternately stacked in series between reaction block **77** and compression block **78** in the upper portion thereof, said spacer and guide blocks **83**, and **84** respectively, being provided with a flange **85** at the top and bottom thereof. Said flanges are adapted to fit a lower pair of guide cages **85, 85'** and a pair of upper guide cages **87, 87'**. Said assembly of spacer blocks **83** and guide blocks **84** form blade slots to slidably receive therein upper slitter blades **87**. Compression screws **95** serve to secure the stack of blocks and slitters within the upper portion of the frame as illustrated in FIGS. 9 and 10. Each upper slitter blade **88** is provided with a flanged portion **89, 89'** having a recess **90** therein to receive a retraction spring **91**, said retraction springs disposed upon the lower guide cage **86**.

It will be noted that the top of the slitter unit is open. In operating the actuator plate **45**, as heretofore described, such plate is moved down between the upper guide cages **87, 87'** so that the operating pins **42** may be shorter than heretofore indicated. Said pins **42** may also be made quite large in diameter due to the open space between each pair of blades and pins **42** may overlap said blades.

FIG. 12 illustrates a construction utilizing the compression principle of assembly wherein the upper and lower slitter blades **88** and **82** respectively, are arranged to give the same direction of cut on both sides of a one row fin. In this construction it will be noted that the spacer and guide blocks are of different sizes to provide proper blade spacing.

From the foregoing, it will be apparent that the use of the compression type of assembly eliminates the need for bores and mounting screws in the assembly of the slitter. Better alignment of the parts and finer control of the assembly is also achieved thereby. Using this principle, cutting widths can be narrower, and the blades can be precisely formed in a lapping machine to give accurate dimensions at low cost.

What is claimed is:

1. An adjustable gang slitter for slitting collared fin stock in a progressive air conditioning fin die comprising:

(a) a pair of end blocks;

(b) at least one top plate secured to said end blocks along the top portion thereof;

(c) a bottom plate secured to the end blocks along the bottom portion thereof, said bottom plate being substantially horizontal to the top plate;

(d) a plurality of rectangular block like bottom slitter blades, each of said blades having a cutting face thereupon, said blades being disposed on the bottom plate along the upper surface thereof;

(e) means for securing said bottom slitter blades to said bottom plate;

(f) a plurality of rectangular, block like top slitter blades, each of said blades having a cutting face thereupon;

(g) means for aligning the cutting faces of the top slitter blades and the cutting faces of the bottom slitter blades;

(h) compression means for slidably securing the top slitter blades to the top plate for vertical movement of the top slitter blades to permit contact thereof with the bottom slitter blades for slitting fin stock passing therebetween;

(i) a powered movable die shoe secured to said air conditioning fin die;

(j) an actuator plate removably mounted to said die shoe along the undersurface thereof;

(k) means in said actuator plate for transmitting movement of said die shoe to preselected top slitter blades whereby preselected top slitter blades will make contact with corresponding bottom slitter blades aligned therewith to cut said fin stock through preselected areas thereof.

2. An adjustable gang slitter according to claim **1**, wherein said means for securing the bottom slitter blades to the bottom plate is a screw.

3. An adjustable gang slitter according to claim **1** wherein said means for aligning the top slitter blades and the bottom slitter blades comprise a plurality of spacer blocks interspersed between said top slitter blades, said spacer blocks being fixedly secured to the upper plate upon the undersurface thereof, said spacer blocks being of a width sufficient to align the cutting faces of the top slitter blades with the cutting faces of the bottom slitter blades.

4. An adjustable gang cutter according to claim **1** wherein the top slitter blades are provided with a flange outwardly disposed from each side of the top thereof, said flanges being provided with a recess therein, said compression means for slidably securing the top slitter blades to the top plate comprising a reaction plate extending below each of said flanges generally above the cutting face of the top slitter blades, and a reaction spring disposed within said recesses and held under compression by said reaction plates.

5. An adjustable gang slitter according to claim **1** wherein said actuator plate and said die shoe is provided

with at least one locator aperture, and a locator pin adapted to extend through said aperture for aligning the actuator plate and die shoe.

6. An adjustable gang slitter according to claim 1 wherein said top plate is provided with a plurality of apertures, at least one of said apertures being aligned with one of the top slitter blades, and wherein said means in said actuator plate for transmitting movement of the die shoe to preselected top slitter blades comprise an actuator plate having a plurality of counterbored apertures disposed therein, said counterbored apertures being aligned with the apertures in the top plate; a plurality of counterhead operating pins disposed within said actuator plate apertures, said pins disposed to extend through said apertures in the top plate to contact the top slitter blades along the top thereof.

7. An adjustable gang slitter according to claim 1 wherein said top plate is provided with a plurality of undersurface counterbored apertures, at least one of said operating pins disposed within said counterbored aperture, the heads of said operating pins being disposed upon the top slitter blades and extending upwardly through said counterbored apertures, said actuator plate having a plurality of counterbored apertures aligned with the operating pins to receive said pins therein, and a plurality of counterheaded gag buttons disposed within selected actuator plate counterbored apertures to limit ingress of said operating pins.

8. An adjustable gang slitter for slitting collared fin stock in a progressive air conditioning fin die comprising:

(a) a bottom frame plate;

(b) a reaction block secured to said bottom frame plate at one end thereof, and a compression block secured to said bottom frame plate at the other end thereof;

(c) a pair of top frame tension members, each of said members being anchored at one end thereof to said reaction block in the upper portion thereof, and at the other end thereof to said compression block in the upper portion thereof;

(d) a pair of bottom frame tension members, each of said members being anchored at one end thereof to said reaction block in the lower portion thereof and at the other end thereof to said compression block in the lower portion thereof;

(e) a plurality of bottom slitter blades disposed upon said bottom frame plate, and a plurality of spacer blocks interposed between each of said blades, said slitter blades and said blocks disposed between the compression and reaction blocks, and a compression screw disposed within said compression block for supplying pressure to secure said spacer and slitter blades against movement;

(f) a plurality of rectangular top slitter blades, each of said blades having a cutting face thereupon;

(g) means for aligning the cutting faces of the top slitter blades and the bottom slitter blades;

(h) compression means for slidably securing the top slitter blades to permit vertical movement thereof and contact with the bottom slitter blades for slitting fin stock passing therebetween;

(i) a powered moveable die shoe secured to said air conditioning fin die;

(j) an actuator plate removably mounted to said die shoe along the undersurface thereof;

(k) means in said actuator plate for transmitting movement of said die shoe to preselected top slitter blades whereby preselected top slitter blades will make contact with corresponding bottom slitter blades aligned therewith to cut said fin stock through preselected areas thereof.

9. An adjustable gang slitter according to claim 8 wherein said actuator plate is provided with a plurality of counterbored apertures along the top surface thereof, a plurality of counterheaded operating pins removably disposed within said apertures, said operating pins extending downwardly to contact the top slitter blades for transmission of movement of the die shoe to said top slitter blades to enable said blades to make cutting contact with the bottom slitter blades for cutting fin stock passing therebetween.

10. An adjustable gang slitter according to claim 8 wherein said means for aligning said top slitter blades and said bottom slitter blades comprise a plurality of larger spacer blocks and a plurality of smaller guide blocks, said spacer and guide blocks alternately stacked along the length of said top frame tension members between said reaction block and compression block, said spacer and guide blocks forming channels therebetween for slidably receiving therein said top slitter blades, said spacer and guide blocks provided with top and bottom flanges, a paid of lower and upper guide cage members, said members being keyed to fit said top and bottom flanges, and at least one compression screw disposed within said compression block for supplying pressure to secure said blocks and said guides in stacked arrangement.

11. An adjustable gang slitter according to claim 10 wherein the top slitter blades are provided with outwardly disposed flanges from each side of the top thereof, said flanges provided with a recess therein, compression means for slidably securing the top slitter blades to the top frame tension members comprising a reaction spring disposed within said recesses, said reaction spring being held under compression by said lower guide cage.

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