July 10, 1956 P. D. BRADFIELD 2,753,918

METAL EXPANSION AND CONTRACTION MATERIAL AND METHOD AND APPARATUS FOR FORMING THE SAME

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Fig. 1

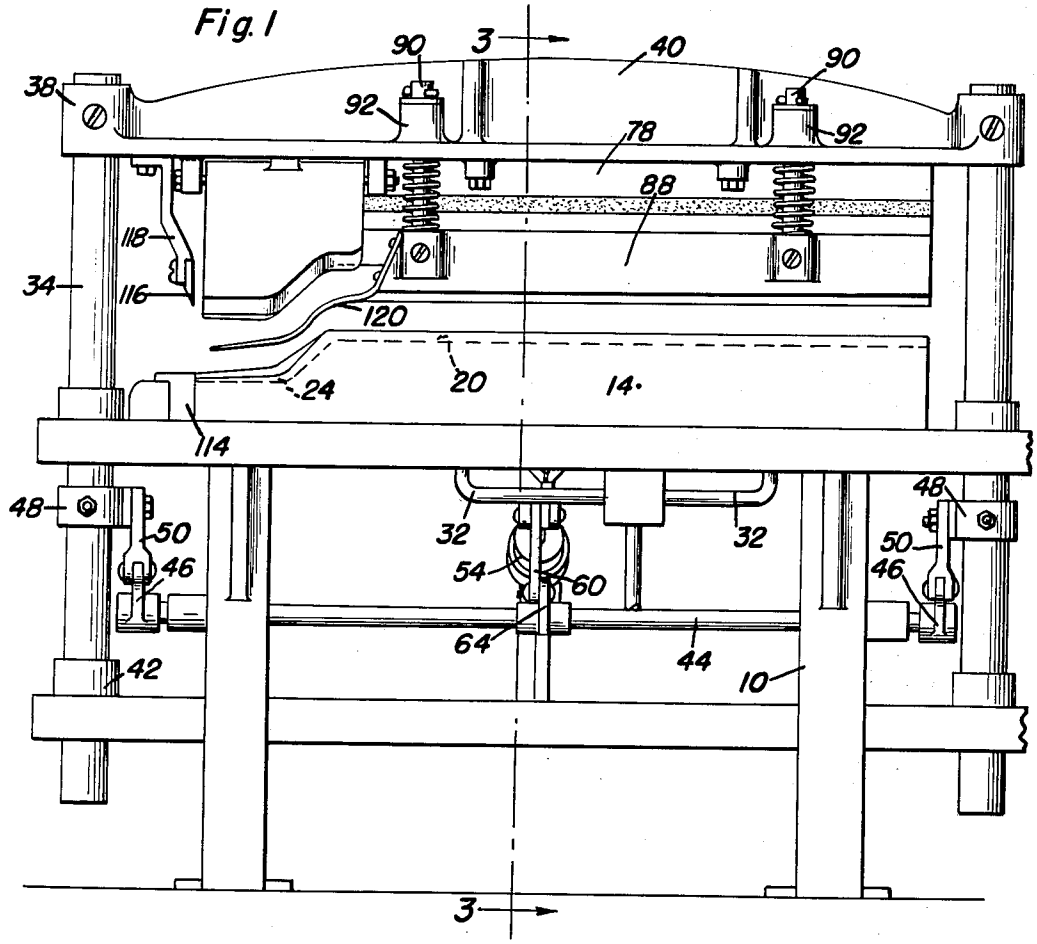
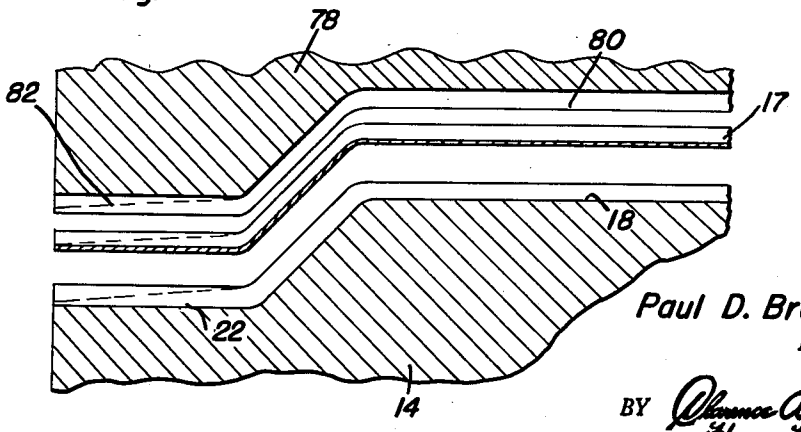


Fig. 9



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METAL EXPANSION AND CONTRACTION MATERIAL AND METHOD AND APPARATUS FOR FORMING THE SAME

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Fig. 2

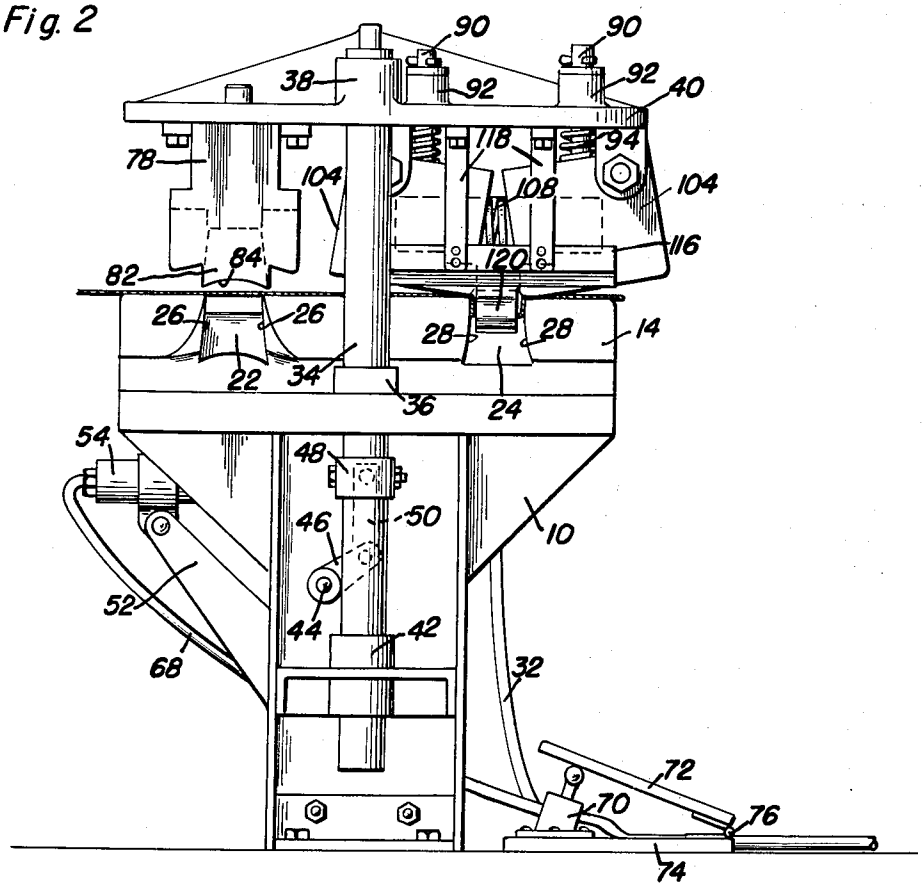
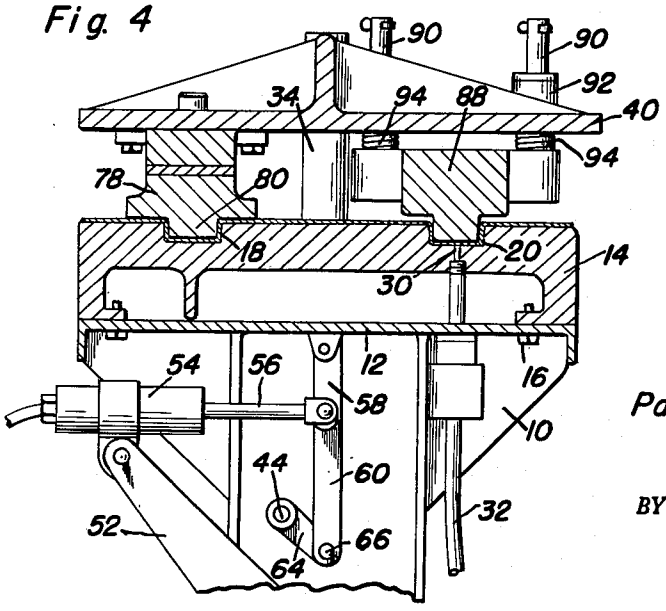


Fig. 4



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METAL EXPANSION AND CONTRACTION MATERIAL AND METHOD AND APPARATUS FOR FORMING THE SAME

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Fig. 3

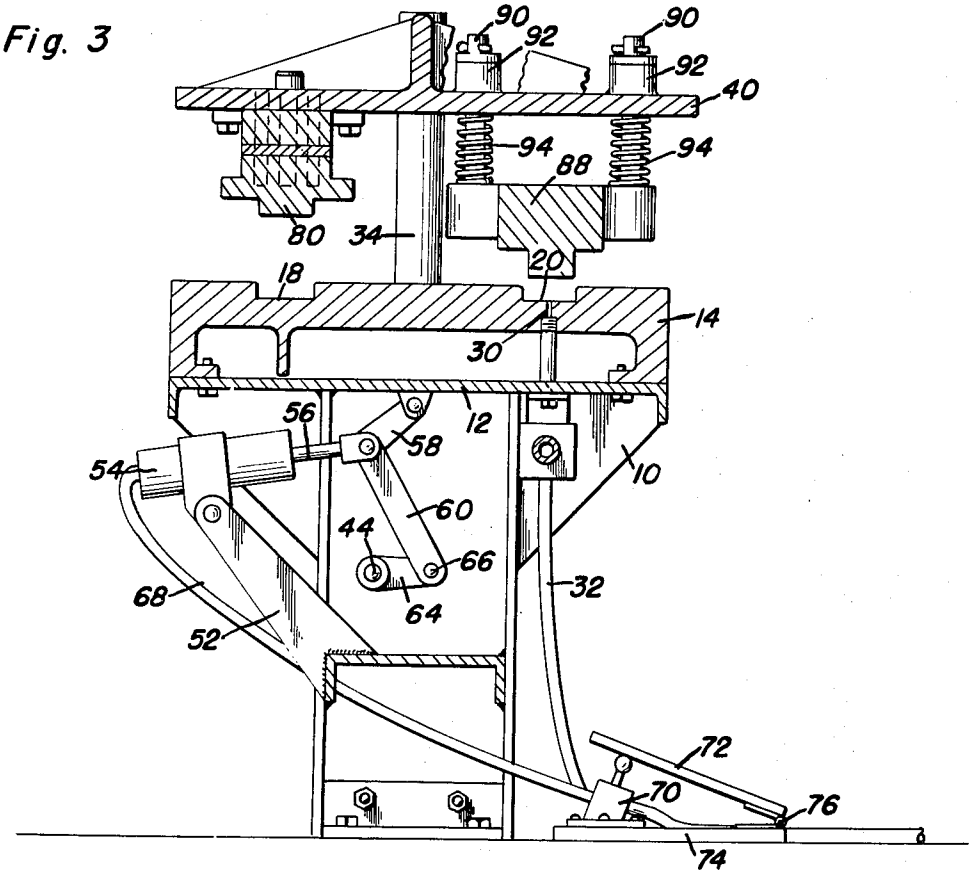

Fig. 10

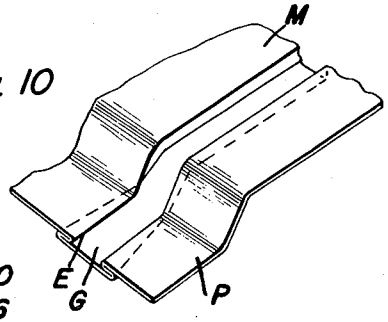

Fig. 5

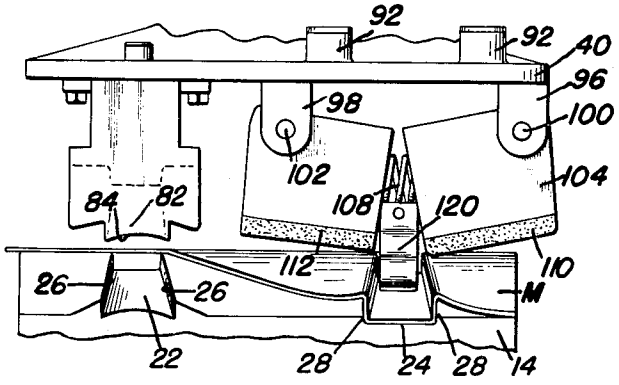

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Fig. 6

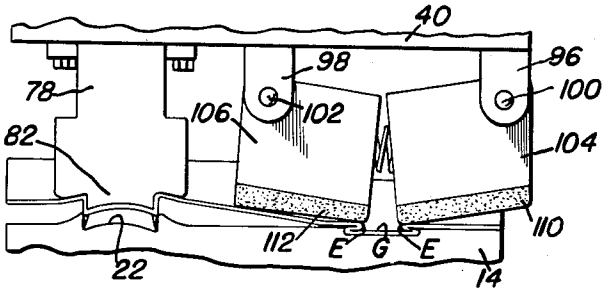


Fig. 7

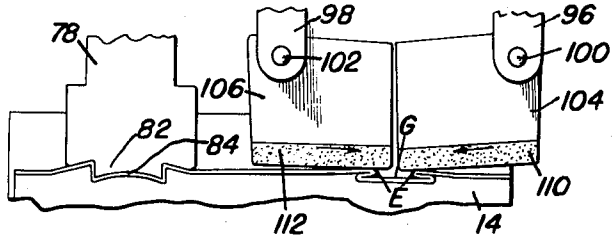
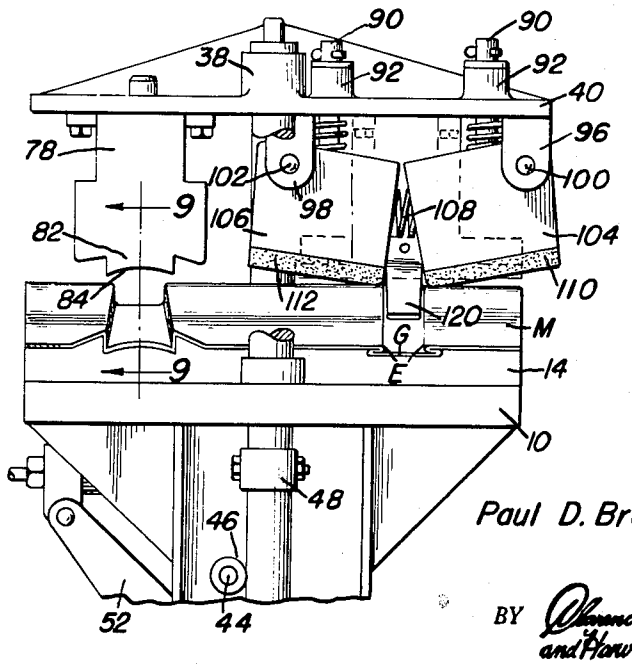


Fig. 8



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2,753,918

METAL EXPANSION AND CONTRACTION MATERIAL AND METHOD AND APPARATUS FOR FORMING THE SAME

Paul D. Bradfield, Santa Ana, Calif.

Application September 26, 1952, Serial No. 311,706

10 Claims. (Cl. 153—76)

The invention relates to new and useful improvements in die presses and the primary objects of the present invention are:

(*a*) To provide a fluted construction sheet that is yieldable to be used for expansion and contraction purposes.

(*b*) To provide a fluted construction sheet that is yieldable to be used for expansion and contraction purposes, the flutes being angled at their ends and made wider and shallower to permit free flow of air at said ends.

(*c*) To provide a machine for producing fluted sheets capable of being used as cooling blankets for jet engines.

Another important object of the present invention is to provide a metal expansion joint press and die for forming expansion channels in a metallic sheet which channels have specially shaped end portions for the purpose of permitting two sheets to be spot welded together.

A further object of the present invention is to provide a meal expansion joint press and die including coacting male and female dies that will form an elongated channel shaped groove in a sheet of metal and coacting female die and pressure jaws that will depress one end portion of the groove to form a wide exit of reduced depth.

A still further aim of the present invention is to provide an apparatus of the aforementioned character that is extremely small and compact in structure, strong and reliable in use, efficient and durable in operation, inexpensive to produce, service and maintain, and otherwise well adapted for the purpose for which the same is intended.

Other objects and advantages reside in the details of construction and operations as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, in which:

Figure 1 is a side elevational view of the present invention and showing the head member raised;

Figure 2 is a front elevational view of Figure 1;

Figure 3 is a vertical sectional view taken substantially on the plane of section line 3—3 of Figure 1;

Figure 4 is a fragmentary view of Figure 3 and showing the head member lowered;

Figure 5 is an enlarged fragmentary view of Figure 2 and showing a sheet of metal being processed by the invention and with the cutter blades removed;

Figure 6 is a view similar to Figure 5 but showing the pressure jaws partially lowered;

Figure 7 is a view similar to Figures 5 and 6 but showing the pressure jaws completely lowered;

Figure 8 is a view similar to Figure 2 but showing a sheet of metal after it has been processed by the invention;

Figure 9 is an enlarged vertical sectional view taken substantially on the plane of section line 9—9 of Figure 8; and,

Figure 10 is a fragmentary perspective view of a sheet of metal having a channel shaped groove formed therein by the present invention.

Referring now to the drawings in detail wherein for the purpose of illustration, there is disclosed a preferred embodiment of the present invention, the numeral **10** represents a table structure including a bed plate **12** to which a female die member **14** is removably secured as by fasteners **16**.

The upper face of the die member **14** is formed with two, side by side, channel shaped grooves **18** and **20** having downwardly offset forward end portions **22** and **24**. The side edges **26** of end portion **22** diverge as they extend forwardly and the bottom wall of end portion **22** is convexed as shown best in Figure 2. The side edges **28** are substantially half the depth of the side edges of the major portion of groove **18**.

The side edges **28** of end portion **24** diverge relative to each other as they extend forwardly. End portion **24** is of a depth less than the depth of the major portion of groove **20** for a purpose presently to be described.

Vertical passages **30** are provided in the female die member **14** and extend upwardly into the groove **20**. The lower internally threaded ends of the passages **30** receivably engage air supply lines or conduits **32** that extend to a suitable source of air pressure, whereby air under pressure may be directly upwardly through the passages for the purpose of lifting a sheet of metal **17** after the same has been flutted by the machine.

A suitable number of guide posts or rods **34** are fixed to and extend upwardly through guide sleeves **36** in the table structure **10** and into holding sockets or sleeves **38** formed with a horizontally disposed rigid head member **40**. The upper ends of the rods **34** are suitably held within the sockets **38** and the lower ends of the rods **34** are slidably received in holding sleeves **42** that are fixed to the table structure **10**.

Means is provided for selectively raising and lowering the head member **40**. This means comprises a horizontal rock shaft **44** that is journaled in simple bearings on the table structure **10** and to whose ends links **46** are suitable fixed. The outer ends of links **46** are connected to collars **48**, secured about the rods **34**, by pitman **50** so that as the shaft **44** is rotated to swing the links **46** downwardly, the links or pitman **50** will pull downwardly on the collars **48**, and as the collars **48** are fixed to the rods **34**, the rods **34** will be forced downwardly and with them the head member **40**.

A rigid arm **52** attached to the table structure **10** swingably supports a hydraulic cylinder **54** having a piston rod **56** that is pivoted to the adjacent ends of upper and lower pitman links **58** and **60**. The upper end of link **58** is pivoted to the bed plate **12**, as at **62**, and the lower end of link **60** is pivoted to a rigid arm **64** at the center of the shaft **44** by a pivot **66**.

A conduit **68** extends from cylinder **54** to a suitable source of liquid or fluid under pressure, whereby the piston rod **56** may be selectively extended from or retracted into its cylinder **54**. A valve **70** is interposed in the conduit **68** and underlies a foot pedal **72** carried by a base **74** for the valve **70**. As the pedal **72** is depressed, valve **70** will be opened to permit fluid under pressure to enter the cylinder **54** and extend rod **56** for the purpose of swinging arm **64** downwardly to rotate shaft **44** to a position for lowering the head member. When the pedal **72** is released, its hinge spring **76** raises it and valve **70** is actuated to retract piston rod **56** causing arm **64** to be swung upwardly for rotating shaft **44** to a head-member raising position.

Obviously, many operative raising and lowering mechanisms, for the head member may be used, such as a hydraulic ram, a rack and gear, cables or cams. However, in the present system, valve **70** may also be operatively connected to conduits **32** so that when the head

member is raised air under pressure will enter passages **30** to lift a sheet of metal overlying the female die member. **14**.

A male die **78** is removably secured to the flat undersurface of the head member **40** and includes a rib **80** that overlies the groove **18**. The downwardly offset end **82** of rib **80** is formed with a concave undersurface **84** complemental to the shape of the convexed wall of groove portion **22** and the forwardly divergent side edges **86** of end **82** are inwardly spaced relative to edges **26** to permit end **82** to enter end portion **22** as the head member is lowered.

A second male die **88** underlies the head member **40** and supports vertical rods **90** that are slidably received by vertical sleeves **92** carried by the head member **40**. Coil springs **94** embrace the rods **90** and are braced between head member **40** and toward the upper major portion of groove **20**.

Pairs of ears **96** and **98** are fixed to the undersurface of head member **40** in front of the die **88**. These ears **96**, **98** support horizontal pins **100** and **102** that extend horizontally through the upper outer corners of a pair of coacting pressure jaws **104** and **106**. The opposing ends of the jaws **104** and **106** are formed with recesses that accommodate the ends of a coil spring **108** that yieldingly urges the lower inner corners of the jaws apart as shown in Figure 8. Resilient pods **110** and **112** are suitably fixed to the undersides of the jaws **104** and **106**. The rear lower portions of the jaws **104**, **106** are upwardly offset as shown in Figures 1 and 9 to conform to the offset end portion **24** they overlie.

A stationary cutter blade or bar **114** is suitably fixed on the upper face of bed plate **12** in front of the die member **14** with its rear cutting face spaced from and disposed transversely of the groove portion **24**. A coacting blade **116**, held by hanger brackets **118** on the head member **40**, will move downwardly with the head member across the rear face of blade **114** to cut and trim metal along the rear face of blade **114**.

A spring arm **120** (Figure 1) is fixed to and extends forwardly from the die **88** and over the offset end portion **24** of groove **20**. Arm or finger **120** is of a size to fit into end portion **24** without coacting the size edges of end portion **24**.

In practical use of the present invention, a sheet of metal **11** is placed over the die member **14** and the pedal **72** actuated to activate the cylinder **54** and cause the head member to be lowered so that rib **80** and portion **82** will force a part of the sheet **17** into groove **18** and end portion **22**. The head member is next raised.

The sheet of metal is then shifted so that the groove formed therein will enter groove **20** and with the offset portion of the groove in sheet **17** in offset end portion **24** of groove **20**. The head member **40** is again lowered with the jaws **104**, **106** forcing and folding the edges E of the groove G inwardly at the downwardly offset end thereof. At the same time the rib **80**, **82** will coact with groove **18**, **22** in forming a second groove in the sheet of metal, which groove will then be received under the finger **120** and be positioned in groove **20**, **24** as the sheet of metal is shifted toward the groove **20**.

The sheet of metal thus fluted will have an offset leading end portion P with the side edges E of the groove G folded inwardly to reduce the depth of the grooves offset portion while the side edges of this offset portion diverge forwardly to increase the flexibility of end portion P and permit the same to be spot welded to a similarly fluted sheet of metal.

What is claimed as new is as follows:

1. A fluted construction sheet comprising a yieldable sheet member having an outer edge, said sheet member having a channel shaped groove therein extending perpendicular to said edge, the outer edge of the sheet member and the end portion of said groove at said edge being offset, said end portion being progressively increased in width as it extends toward said edge, the side edges of the groove at the said end portion being folded inwardly toward each other to reduce the depth of the said end portion.

2. A method of producing fluted sheets for expansion and contraction purposes, the method consisting of first forming a channel shaped groove in a sheet of metal having a downwardly offset end portion; then folding the side edges of the groove at said end portion inwardly to reduce the depth of the groove at said end portion.

3. A method of producing fluted sheets for expansion and contraction purposes, the method consisting of first forming a channel shaped groove with a downwardly offset end portion of a width greater than the width of the intermediate part of the groove in a sheet of metal having an offset edge; then folding the side edges of said end portion inwardly to reduce the depth of said end portion.

4. A method of producing fluted sheets for expansion and contraction purposes, the method consisting of first forming a channel shaped groove with a downwardly offset end portion of a width greater than the width of the intermediate part of the groove in a sheet of metal having an offset edge; then folding the side edges of said end portion inwardly to reduce the depth of said end portion, and trimming the sheet of material transversely of said groove at the outer extremities of said end portion.

5. A method of producing fluted sheets for expansion and contraction purposes, the method consisting of first forming a channel shaped groove perpendicular to one edge of a sheet of metal having an offset edge which groove is provided with a downwardly offset end portion at said edge, said groove having side edges which are progressively spaced apart a greater distance as they extend across said offset end portion toward said edge; then folding the side edges of said end portion inwardly to reduce the depth of the said end portion to less than the depth of the remaining portion of said groove.

6. A metal expansion joint press and die comprising a bed plate, a head member movable selectively toward and away from said bed plate, a female die supported on the bed plate and having a downwardly offset end portion, a channel-shaped groove formed in the upper surface of the female die and extending across the offset end portion, the side walls of the groove being progressively spaced apart a greater distance as they extend outwardly to the edge of the die, a male die supported on the head member and constructed with a die portion for entering the groove of the female die when the head is moved towards the bed plate and with laterally extending die portions which cooperate with the upper surfaces of the female die at the edges of the groove to shape the ungrooved portion of the work, said female die also having a second channel-shaped groove with an offset end portion whose depth is less than the depth of the remaining portion of this groove and whose side edges are progressively spaced apart a greater distance as they extend away from the major portion of the second channel, and means supported on the head member and overlying the offset end portion of the second channel for folding inwardly the side edges of a channel formed in a sheet of metal by the first named female die and male die.

7. A metal expansion joint press and die comprising a bed plate, a head member movable selectively toward and away from said bed plate, a female die supported on the bed plate and having a downwardly offset end portion, a channel-shaped groove formed in the upper surface of the female die and extending across the offset end portion, the side walls of the groove being progressively spaced apart a greater distance as they extend outwardly to the edge of the die, a male die supported on the head member and constructed with a die portion for entering the groove of the female die when the head is moved towards the bed plate and with laterally extending die portions which cooperate with the upper surfaces of the female die at the edges of the groove to

shape the ungrooved portion of the work, said female die also having a second channel-shaped groove with an offset end portion whose depth is less than the depth of the remaining portion of this groove and whose side edges are progressively spaced apart a greater distance as they extend away from the major portion of the second channel, and means supported on the head member and overlying the offset end portion of the second channel for folding inwardly the side edges of a channel formed in a sheet of metal by the first named female die and male die, and means supported by the head member directly over the second groove for entering a channel formed in a sheet of metal to force the walls of the channel against the walls of the second groove.

8. A metal expansion joint press and die comprising a bed plate, a head member movable selectively toward and away from said bed plate, a female die supported on the bed plate and having a downwardly offset end portion, a channel-shaped groove formed in the upper surface of the female die and extending across the offset end portion, the side walls of the groove being progressively spaced apart a greater distance as they extend outwardly to the edge of the die, a male die supported on the head member and constructed with a die portion for entering the groove of the female die when the head is moved towards the bed plate and with laterally extending die portions which cooperate with the upper surfaces of the female die at the edges of the groove to shape the ungrooved portion of the work, said female die also having a second channel-shaped groove with an offset end portion whose depth is less than the depth of the remaining portion of this groove and whose side edges are progressively spaced apart a greater distance as they extend away from the major portion of the second channel, and means supported on the head member and overlying the offset end portion of the second channel for folding inwardly the side edges of a channel formed in a sheet of metal by the first named female die and male die, a stationary blade secured to the bed plate transversely of the second groove, and a movable blade held stationary on the head member and coacting with the stationary blade for trimming sheets of metal after grooves have been formed therein.

9. A metal expansion joint press and die comprising a bed plate, a head member movable selectively toward and away from said bed plate, a female die supported on the bed plate and having a downwardly offset end portion,

a channel-shaped groove formed in the upper surface of the female die and extending across the offset end portion, the side walls of the groove being progressively spaced apart a greater distance as they extend outwardly to the edge of the die, a male die supported on the head member and constructed with a die portion for entering the groove of the female die when the head is moved towards the bed plate and with laterally extending die portions which cooperate with the upper surfaces of the female die at the edges of the groove to shape the ungrooved portion of the work, said female die also having a second channel-shaped groove with an offset end portion whose depth is less than the depth of the remaining portion of this groove and whose side edges are progressively spaced apart a greater distance as they extend away from the major portion of the second channel, and means supported on the head member and overlying the offset end portion of the second channel for folding inwardly the side edges of a channel formed in a sheet of metal by the first named female die and male die, said last named means including a pair of substantially rectangular jaws having upper outer corners that are pivoted to the head member and a coil spring biased between the inner ends of said jaws, the inner ends of said jaws overlying the offset end portions of said second groove.

10. A fluted construction sheet comprising a yieldable sheet member having an angular portion and an offset edge portion, said sheet having a channel-shaped groove therein, the groove decreasing in depth as it extends across said angular portion to said offset portion, the side walls of the portion of the groove extending across the offset portion being folded between the bottom of the groove and the top portion of the sheet with the sides of the bottom of the groove extending in diverging relation to the bottom of the groove in the angular portion.

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