

Oct. 29, 1940.

A. LANG

2,219,595

METHOD OF FORMING METALLIC FRAME STRUCTURES

Filed Aug. 26, 1939

3 Sheets-Sheet 1

Fig. 1.

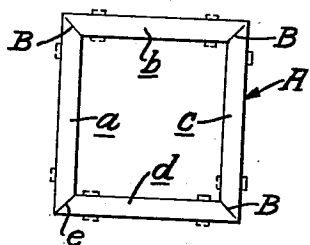


Fig. 2.

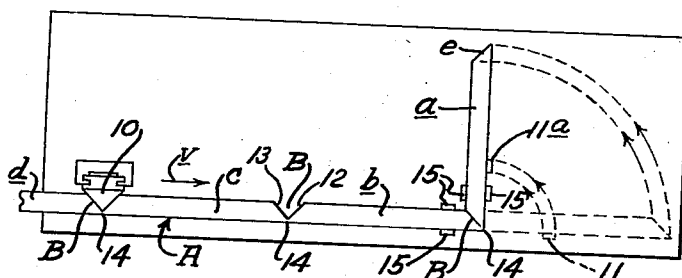


Fig. 3.

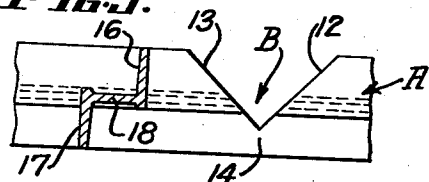


Fig. 7.

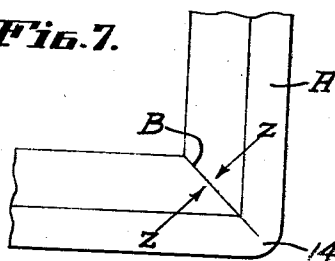


Fig. 4.

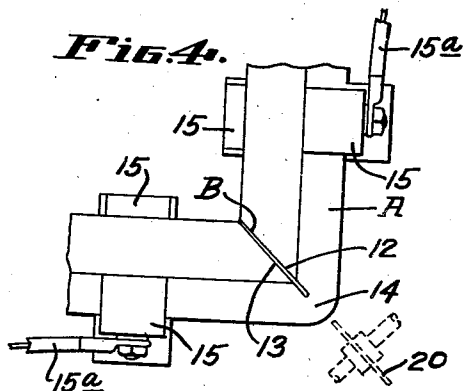


Fig. 8.

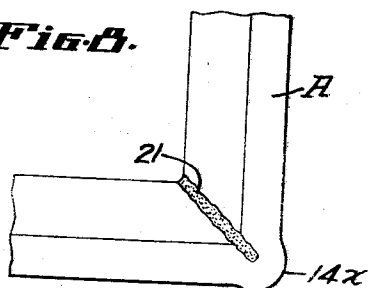


Fig. 5.

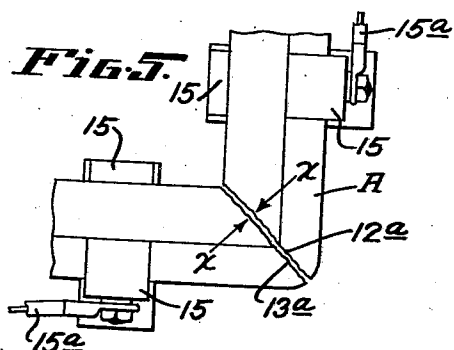


Fig. 9.

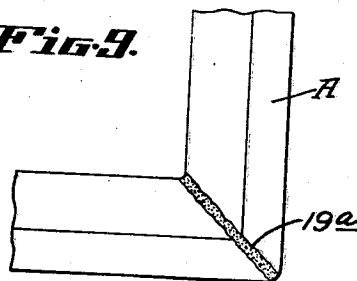
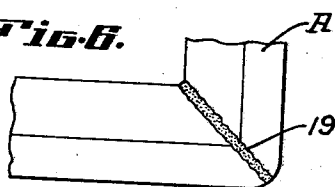


Fig. 6.



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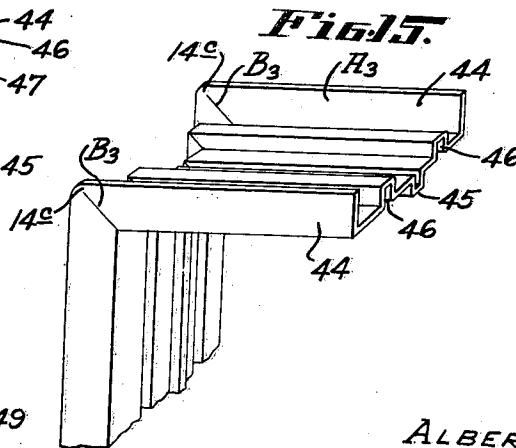
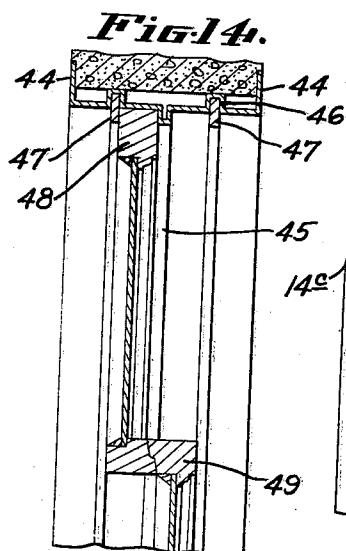
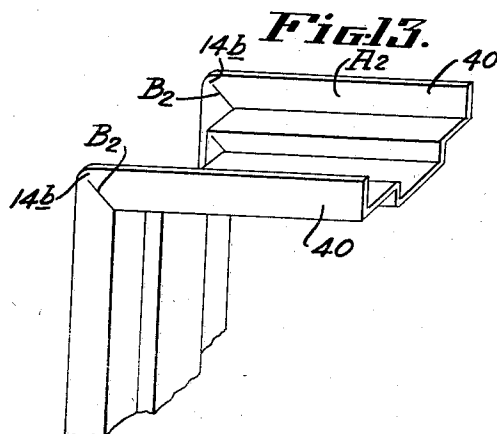
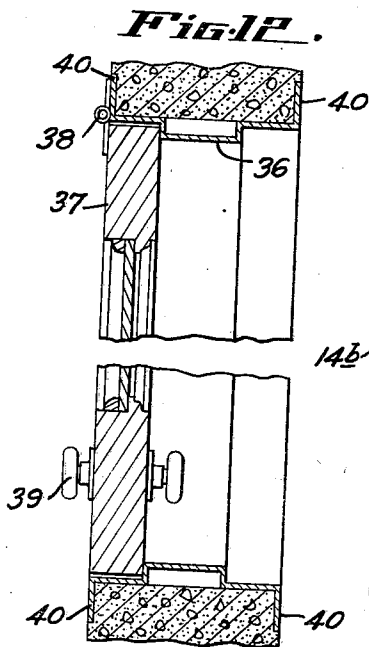
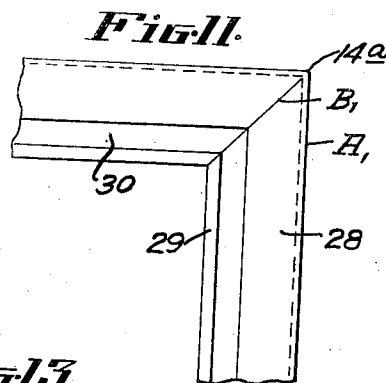
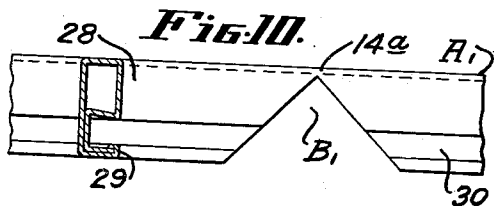
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METHOD OF FORMING METALLIC FRAME STRUCTURES

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3 Sheets-Sheet 3

Fig. 16.

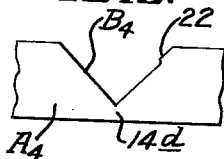


Fig. 20.

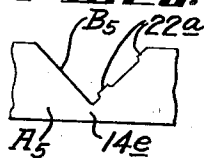


Fig. 24.

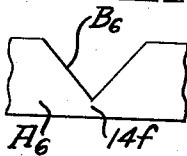


Fig. 28.

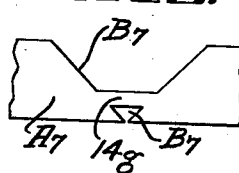


Fig. 17.

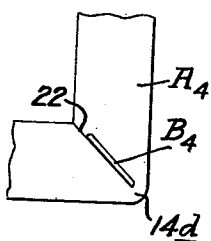


Fig. 21.

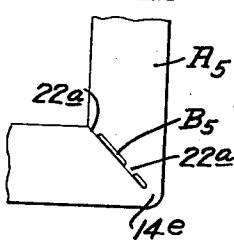


Fig. 25.

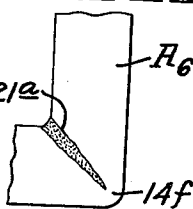


Fig. 29.

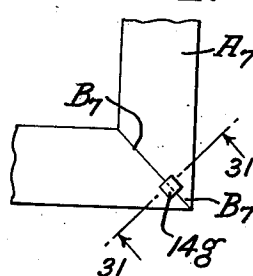


Fig. 18.

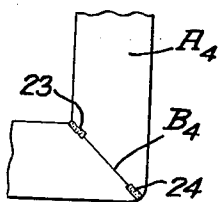


Fig. 22.

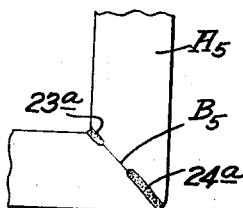


Fig. 26.

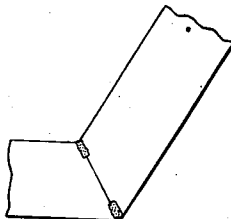


Fig. 30.

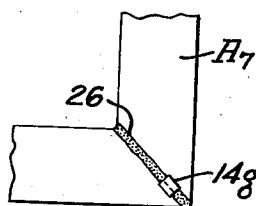


Fig. 19.

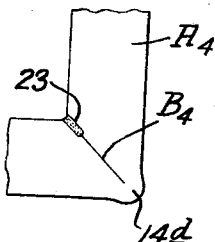


Fig. 23.

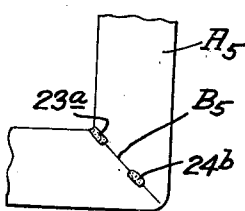


Fig. 27.

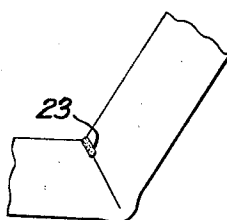
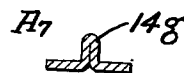


Fig. 31.



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METHOD OF FORMING METALLIC FRAME STRUCTURES

Albert Lang, Berkeley, Calif.

Application August 26, 1939, Serial No. 292,103

17 Claims. (Cl. 29-148)

This application is a continuation in part of my pending application entitled "Method of forming metallic frames," filed January 3, 1938, and bearing Serial No. 183,079.

The invention relates generally to the manufacture of metallic frame structures having angularly related portions and is more particularly directed to a method of forming a frame structure of this character from a single length or strip of rolled stock preformed to a desired cross-sectional contour or from standard or special structural shapes of steel or other metals.

It is the principal object of the present invention to provide a new, improved and simpler method of forming a frame structure having mitred and welded corners, in a manner which entirely eliminates the separate handling and mating of individual frame parts; which renders unnecessary the use of assembling templates, spacers, indexing pins or like devices, and which enables frame structures of this nature to be manufactured with exceptional speed and economy. The method involves mitre cutting a single strip of material at points defining the locations of the respective corners of the completed frame, which mitre cuts do not completely sever the strip at such points but leave correlating ties at the intended corners which are bendable to permit said strip to be bent at said points to the desired frame form. The correlating ties are of sufficient strength to maintain the connected portions in correlated relationship during the bending operation. The welding of the mated edges at the corners of the frame is accomplished by bringing said edges to a welding temperature and the application thereto of a translating pressure of sufficient force to forge said edges into a substantially homogeneous weld.

The invention is exemplified in the following description and is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a plan view illustrating one form of frame structure which may be constructed in accordance with the method of the present invention.

Fig. 2 is a semi-diagrammatic view illustrative of certain steps in the method of manufacturing a frame structure of the general type shown in Fig. 1.

Fig. 3 is an enlarged fragmentary view of the frame forming stock showing one of the mitre cuts formed therein.

Figs. 4 and 5 are detail views illustrating subsequent steps in the forming of a mitred frame corner from a strip mitre cut as shown in Fig. 3,

and the joining of the abutting edges thereof by electric flash welding.

Fig. 6 is a view showing the frame corner of Figs. 4 and 5 in completed form.

Fig. 7 is a view, similar to Fig. 4, illustrating a frame corner prepared for welding by means of ordinary electric resistance butt welding.

Fig. 8 is a view showing the frame corner of Fig. 7 as completed in a manner to upset the connecting correlated tie.

Fig. 9 is a view, showing the frame corner of Fig. 7 as completed, after severing the tie.

Fig. 10 is a fragmentary view showing a screen frame forming strip mitre cut in accordance with the present invention.

Fig. 11 is a fragmentary view showing the strip of Fig. 10 bent to form a frame corner.

Fig. 12 is a horizontal section through a door structure showing a metallic door frame of a type to which the present invention is applicable.

Fig. 13 is a fragmentary perspective view of a corner of the door frame of Fig. 12.

Fig. 14 is a partial vertical section through a window structure showing a metallic window frame of a type to which the present invention is applicable.

Fig. 15 is a fragmentary perspective view of a corner of the window frame of Fig. 14.

Figs. 16 to 19 illustrate the forming of corner structures from a strip mitre cut as shown in Fig. 16.

Figs. 20 to 23 illustrate the forming of corner structures from a strip mitre cut as shown in Fig. 20.

Figs. 24 and 25 illustrate the forming of corner structures from a strip mitre cut as shown in Fig. 24.

Figs. 26 and 27 illustrate corner structures similar to those shown in Figs. 18 and 19 but of a lesser angle than ninety degrees.

Figs. 28 to 31 illustrate the forming of a corner structure from a strip mitre cut as shown in Fig. 28.

In the art of forming frame structures having mitred and welded corners from preformed metallic stock or from structural shapes of steel or other metals, it has heretofore been standard practice to cut said stock into short lengths to correspond to the ends and sides of the frame and then weld these separate lengths at the corners along the diagonally cut edges. In such a method the operator must necessarily handle four separate pieces of stock in the construction of a rectangular frame and he must also properly position the adjacent parts with respect to each

other before the welding operations are started. This entails the handling of at least two separate pieces at each weld and also requires time consuming effort to effect a neat and proper alignment of the parts.

To save time and eliminate error in properly positioning such separate frame parts in cooperative aligned relationship, the standard practice has been to employ assembling templets, spacers, indexing pins or like devices, which expedients, while being of some advantage, have in no manner eliminated the necessity of the separate handling of detached frame parts.

In my improved method, the handling of separate pieces of the metal stock is entirely eliminated and the adjacent frame parts are connected in the proper order and in correlated relationship so that the frame structure may be constructed without the aid of assembling templets, spacers, indexing pins or like devices.

To accomplish my purpose, I form the frame structure from a single length or strip of metal stock in which I define the location of each frame corner by a mitre cut which does not completely sever the strip but leaves a correlating tie that is of sufficient strength to maintain the adjacent frame parts connected in correlated relationship and is, at the same time, bendable when subjected to a proper frame forming pressure.

When this mitre cut strip is bent to frame form to bring the opposed edges of the mitre cuts into welding relationship, I join these mating edges at each frame corner by heating the adjacent frame parts sufficient to plasticise or bring said edges to a welding temperature and by subjecting said parts to a translating pressure of sufficient force to forge said edges into a substantially homogeneous weld.

To insure a uniform weld and to take full advantage of the productive speed of machine welding, I preferably accomplish the welding by means of what is known in the welding art as electric resistance welding in which a welding current is employed to plasticize the adjacent edges and a relatively high translating or upsetting pressure is applied to the adjacent parts to forge these edges together.

In some instances it is preferable to apply the forging pressure before and during the application of the electric heating current so as to effect an upsetting of the correlating tie, while in other instances it will be preferable to utilize flash welding in which the opposed edges are lightly contacted during the initial heating so as to flash or burn away the tie before the forging pressure is applied. I may also elect to employ flash or other welding after the correlating tie is destroyed in other ways than by fusing. In either instance the actual welding is effected by abutting the plasticised edges under a translating pressure of sufficient magnitude as to consolidate said edges into a substantially uniform weld of exceptional strength.

In Fig. 1 of the drawings is shown a rectangular frame such as may be formed in accordance with the improved method herein disclosed. Disregarding for the time being the dotted lines in this view, the frame comprises a single strip A of metal which has been mitre cut and bent to form adjacent frame portions a, b, c and d.

In the semi-diagrammatic view of Fig. 2 there is indicated mechanism by which certain steps of the method may be carried into effect although it will be understood that the method is

not dependent upon such mechanism since it is evident that, particularly with small frame structures made of relatively light stock, the strip may be mitre cut with hand tools and manually bent to frame form without the employment of bending mechanism.

However, it is desirable, in all instances where production speed and accuracy is of importance, to employ such mechanisms as may expedite the carrying into effect of the method of the present invention.

In Fig. 2 one of many possible arrangements is indicated as including a mitreing die 10 and a bending or angulating means 11 which may be operated in timed relation with a suitable controlled feeding mechanism (not shown). Carrying out my improved method with mechanism of this general character, the strip A, with its lead end mitred as at e, will be fed in the direction of the arrow v and will be mitre cut by the mitreing die 10 at properly spaced intervals to define the locations of the respective corners of the complete frame.

For the construction of a rectangular frame, each mitre cut B will be of substantially right angled form to extend approximately forty-five degrees on opposite sides of a plane perpendicular to the strip, and while each mitre cut B forms opposed edges 12 and 13, which are aligned for subsequent abutting engagement, it is to be noted that these mitre cut do not completely sever the strip A, but stop short of the outer edge of the strip so that at the apex of each mitre cut B there is a correlating tie 14 which connects the adjacent frame portions of the strip to maintain them in a predetermined correlated relationship.

When the strip A has advanced past the bending or angulating element 11, as indicated in dotted lines in Fig. 2, and to bring its first mitre notch B to the bending station, the angulating element 11 will be actuated to the position 11a to bend the strip at the first tie 14 and angulate the frame section a in relation to the frame section b thus to substantially close said mitre cut and bring its opposed edges into mating relationship with the associated correlating tie 14 serving as a hinge for the angulating movement of the section a and serving to maintain the correlated relationship of these two connected frame sections. As each succeeding mitre cut B reaches the bending station, a similar bending operation takes place, and with the bending of the strip A at the third mitre cut B, the mitred end e of the strip will mate with the trailing end of the strip which will be similarly mitred, as shown in Fig. 1.

By thus bending the strip A at the connecting correlating ties 14, the frame is formed as an integral unit which may safely be handled as partially manufactured stock to be subsequently welded at the corners to complete the frame.

However, it is preferable to weld each corner as it is formed at the bending station, by applying to the adjacent angulated frame sections, the welding current leads or electrodes 15 which will be constructed and actuated to provide the necessary forging pressure, as will be understood by those skilled in the welding art, although in some cases it may be desired to simultaneously weld all of the corners after the frame is formed by the use of several sets of electrodes, as indicated in dotted lines in Fig. 1.

Figs. 3 to 6 of the drawings illustrate more clearly the method of forming and welding a frame corner, the strip A being formed from

Z-bar stock and having an inner co-planar flange 16 and an outer co-planar flange 17, which flanges extend in opposite directions from a connecting web 18, as is indicated in Fig. 3. In this instance the mitre cut B is of approximate right angle form and extends entirely through the inner flange 16 and the connecting web 13 and a substantial distance into the outer flange 17 to leave at its apex only the bendable correlating tie 14 which connects the adjacent frame portions and maintains them correlated during the subsequent handling and bending operations.

In Fig. 4 the mitre cut strip A is shown bent to frame form, as previously described, and having applied to the adjacent frame portions the welding electrodes 15 with their respective current leads 15a these being of the usual vise-jaw type and capable of relative translation towards each other to provide the forging pressure necessary in resistance welding, as will be understood by those skilled in the art.

The welding of this frame corner may be effected by following the procedure incident to electric flash welding or that incident to what is usually termed resistance butt welding, although flash welding is in fact the same as resistance butt welding insofar as the actual welding is concerned, the difference between the two being in the heating effect which prepares the opposed edges for the actual welding and the time of application of the required forging pressure.

Broadly, resistance welding comprises passing an electric current through abutting pieces of metal to plasticise the contacting edges, and applying thereto a clamping pressure of sufficient force to forge said edges into a consolidated substantially homogeneous weld, the term plasticise being herein employed to define the heating of said edges to a welding temperature which will render such edges plastic to a degree that will enable the applied pressure to force said edges beyond a mere meeting contact and actually upset and forge the edges together. Such forging pressure is necessary in order to prevent the formation of a porous and weak weld. The heat is developed between the surfaces in contact and depends upon the current employed and the resistance of the contacting surfaces to the current flow, with such resistance varying inversely in relation to the clamping pressure which abuts the contacting surfaces of the work during the heating period.

In flash welding, the pieces to be joined are brought into welding relationship with their surfaces lightly touching and the welding current is then applied while the pieces are slowly moved towards each other during the heating period. As the surfaces make contact, the metal is burned in a continuous flash of molten metal. This flashing prepares the surfaces for intimate contact and leaves them plastic for the upsetting and forging which is subsequently effected by forcing the pieces together under a relatively high forging pressure.

The ordinary butt welding differs from the flash welding in that comparatively high forging pressure is applied before the current is applied and is maintained throughout the welding process. The pressure decreases the resistance and thus increases the time required to bring the contacting surfaces to a welding temperature. Also, by applying the higher pressure during the heating period, flashing and burning of the metal is prevented.

In Fig. 4 the strip A is shown as bent to substantially close the mitre cut B in preparation for a flash welding operation. In this view, the opposed edges 12 and 13 are shown slightly separated, this being for the purpose of clearly indicating that in flash welding these edges are not subjected to a high clamping pressure, but are only lightly contacted or at least brought into such close relationship as to cause the welding current to arc between said edges. With the application of the electric current, the tie 14 and the opposed edges will be fused and burned away in a continuous flash of molten metal, the opposed edges throughout the width of the strip being thus reduced to a molten or plastic state for forging.

In Fig. 5 such molten or plasticised edges are indicated at 12a and 13a. In the actual welding of these edges together, the opposed frame sections are subjected to a relatively high translating pressure directed perpendicularly to said edges, as indicated by the arrows x, and of a magnitude sufficient to forge said edges into a substantially homogeneous weld 19, as shown in Fig. 6.

In some instances it may be advantageous to sever or destroy the connecting tie 14 before the welding current is applied, by mechanical means, such as a saw 20, as indicated in Fig. 4. In such instances the flash welding will proceed in the usual manner and will produce a corner joint of the same character as will be produced when the tie is destroyed by the flash welding current.

In Fig. 7 the strip A is shown as bent to fully close the mitre cut B in preparation for an ordinary resistance butt welding operation in which the connected frame sections are forcefully clamped to bring the opposed mitred edges together under a relatively high pressure directed perpendicular to said edges, as indicated by the arrows z. This high pressure is applied before the welding current is applied and continues throughout the entire welding operation. With the application of the welding current, the high pressure will effectively prevent arcing or flashing at the contacting surfaces and therefore will not destroy the connecting tie 14, but will merely heat it and the opposed mitred edges to a welding temperature. As this tie and said edges become plasticised, the high applied pressure will immediately become effective to translate the adjacent frame sections with a force sufficient to upset said tie outwardly, as shown at 14x in Fig. 8, and to forge the opposed plasticised edges together into a substantially homogeneous weld 21.

The outwardly extending upset 14x tends to fill out or square the corner of the frame and may subsequently be dressed by suitable means to remove excess metal and true said corner.

As in the previously described flash welding operation, the tie 14 may be severed or destroyed by mechanical means before the ordinary butt welding operation and after said tie has performed the function of hingedly connecting the adjacent frame sections and maintaining them in correlated relationship during the handling and bending operation. In this event the weld 19a produced by the ordinary butt welding operation will, in essential respects, be similar to the weld 19 produced by the previously described flash welding operation, as is shown in Fig. 9.

In Fig. 10 there is shown a portion of a screen frame forming strip A1 which has a box-like outer portion 28 and an inwardly disposed upstanding and spaced flange 29, which, in conjunction with

the box-like portion 28, forms an intermediate channel 30.

In accordance with the present invention, a frame forming strip of this character will be provided with a mitre cut B1 at locations defining the respective corners of the frame. Such mitre cut will extend through the strip from its inside edge to a point corresponding to the inside surface of the outer side wall of the box-like portion 28 so as to leave at the apex of said mitre cut the correlating tie 14a which connects the adjacent frame sections and maintains them in correlated relationship, as previously explained in connection with the strip A.

In forming a frame structure from the mitred strip A1, it will be bent at each tie 14a to close the respective mitre cut and dispose the adjacent frame sections in angled relationship, as shown in Fig. 11. Each corner is then welded, as heretofore explained, to complete the frame structure.

In Fig. 12 of the drawings, there is shown a further type of metallic frame structure, which may be also formed in accordance with the present invention. The frame structure here shown is particularly adapted to the outlining of a door opening, and it therefore has a central raised portion 36 that will function as a door stop for a door 37, which may be mounted at either side of the frame. As here shown, a door 37 is mounted upon hinges 38, and at its free edge it is provided with the usual latch and door knobs 39.

As illustrated in Fig. 13 of the drawings, the door frame forming strip A2 has spaced flanges 40 that project outwardly and provide a means by which the door frame may be secured in a building structure. Strips of this type come from the rolling mill in relatively long straight lengths, from which the door frame may be formed by providing the mitre cuts B2 that extend through the strip to a point closely adjacent to the outer edges of the flanges 40. This will leave in each flange at the apex of each mitre cut a correlating tie 14b connecting the sides and end portions of the frame and having the same purpose and function as the previously described correlating ties.

In Figs. 14 and 15 there is shown a further form of metallic frame, to which the present invention is also applicable. In this showing the metallic frame has outwardly extending flanges 44, by means of which it may be secured in the window opening of a building. This frame has a central window guiding ridge 45, and at each side of this ridge there are cleat receiving grooves 46, into which cleats 47 may be placed to retain the upper and lower sashes 48 and 49 of a window in movable relation within the frame. This frame, like the frame shown in Figs. 12 and 13, is formed of rolled stock which comes in long strips, and when the frame forming strip A3 is provided with mitre cuts B3 at points corresponding to the corners of the window frame, in accordance with the present invention, the strip can then be bent at the correlating ties 14c which are disposed at the apex of each of said mitre cuts. After the frame has been thus formed by bending the frame forming strip at the mitre cuts, each of the corners can then be welded, in the manner previously described, to complete the frame.

In Fig. 16 there is shown a portion of a strip A4 provided with a mitre cut B4 formed to provide a welding projection 22 laterally extended from one of the opposed mitred edges and a correlating tie 14d connecting the adjacent frame

sections. In forming the frame structure from a strip of this character, said strip is bent at the connecting tie 14d to angulate said sections and to contact the projection 22 with a comparable portion of the opposed mitred edge, as shown in Fig. 17. The welding of this corner structure may be accomplished by flash welding to produce a projection weld 23 at the inner corner and to destroy the tie 14d and produce a weld 24 at the outer corner, as shown in Fig. 18. In event this corner structure is welded by the previously described ordinary resistance butt welding process, the tie 14d will be upset outwardly as shown in Fig. 19.

If a strip A5 having a mitre cut B5 providing two welding projections 22a, as shown in Fig. 20, is employed, a bending of the strip at the connecting correlating tie 14e will contact both welding projections 22a with comparable portions of the opposed mitred edge, as shown in Fig. 21, and a subsequent flash welding operation will produce welds 23a and 24a, as shown in Fig. 22. In event the tie 14e is destroyed by mechanical or other means after angulating the frame sections and before the welding operation, resistance butt or flash welding will produce welds 23a and 24b, as shown in Fig. 23.

Fig. 24 discloses a portion of a strip A6 mitre cut to form a ninety degree corner. However, this mitre cut B6 is slightly less than ninety degrees and is formed to leave a correlating tie 14f at its apex. For example, said mitre cut may be eighty-six degrees so that when the strip is bent at the tie 14f to contact the opposed mitred edges, the connected frame portions will be at an angle of ninety-four degrees. When this corner is butt welded, the forging pressure will be applied to force the frame portions to the required ninety degree disposition to produce a weld 21a having its maximum upset at the inner frame corner with such upset diminishing towards the apex of the mitre cut, as indicated in Fig. 25.

Figs. 26 and 27, respectively, show corner structures welded similarly to the corner structures shown in Figs. 18 and 19, but with the adjacent frame portions disposed in widely angled relationship, these two specific examples being intended to illustrate that the herein disclosed method is fully adapted to the forming of variously angled frame structures in which the mitre cuts will be of a degree suitable to produce the desired relative angulation of the adjacent frame sections.

In certain instances it may be desirable to use a strip A7 which is formed as shown in Fig. 28, wherein the mitre cut B7 is shaped to leave a connecting correlating tie 14g that is disposed inwardly from the apex of said mitre cut, which in this particular instance extends through the outer edge of the strip. A strip of this character, when angulated to frame form, will deform the connecting tie and produce a substantially square or pointed outer corner, as shown in Figs. 29 to 31. When this corner structure is flash welded, the connected tie will be flashed or burned away and opposed edges will be forged together to form a weld similar to that illustrated in Fig. 6, while if ordinary resistance butt welding is employed, the tie 14g will remain intact and opposed edges will be joined by a weld 26, as shown in Fig. 30. Obviously, this deformed tie 14g may, if desirable, be subsequently trimmed off in order to smooth the surface of the frame.

From the foregoing it should be evident that the present invention provides a novel and improved method of forming mitred and welded frame structures from a single strip of material formed to provide bendable correlating means permitting angulation of adjacent frame portions or sections to welding relationship, with such correlating means so disposed as to permit the opposed meeting edges of the mitre cuts to be forged together under the pressure incident to electric resistance welding.

While I have shown and described certain forms of mechanism and specific types of frame structures, it is to be understood that this has been done primarily for the purpose of presenting a clear disclosure, to those skilled in the art, of the essential features of the method involved and not to limit the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being formed to leave at the apex thereof only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said tie to form a rounded corner and to dispose the connected parts in relatively angled position and to bring said opposed edges into welding relationship, heating said parts to plasticise said opposed edges and applying thereto a translating pressure capable of abutting the plasticized edges with a force sufficient to forge said edges into a substantially homogeneous weld and simultaneously heating and swaging the metal defining said rounded corner and thereby tending to point said corner.

2. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to form a rounded corner and to dispose the connected parts in relatively angled position and to bring said opposed edges into welding relationship, heating said parts to plasticise said tie and said opposed edges and applying thereto a translating pressure capable of upsetting said tie and of abutting the plasticised edges with a force sufficient to forge said edges into a substantially homogeneous weld and simultaneously heating and swaging the metal defining said rounded corner and thereby tending to point said corner.

3. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being formed to leave at the apex thereof only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said

parts in correlated relationship, bending said strip at said tie to dispose the connected parts in relatively angled position and thereby form a rounded corner and to bring said opposed edges into welding relationship, heating said parts to plasticize said tie and said opposed edges and applying thereto a translating pressure and thereby upsetting said tie outwardly in a manner tending to point said corner and abutting the plasticized edges with a force sufficient to forge said edges into a substantially homogeneous weld.

4. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to form a rounded corner and to dispose the connected parts in relatively angled position and to bring said opposed edges into welding relationship, and subjecting the bent strip to an electric welding current of a magnitude sufficient to plasticise said edges and applying thereto a translating pressure capable of abutting the plasticised edges with a force sufficient to forge said edges into a substantially homogeneous weld and simultaneously heating and swaging the metal defining said rounded corner and thereby tending to point said corner.

5. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, and forming a welding projection extending from one of said edges and leaving only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to dispose the connected parts in relatively angled position and to bring the edge of said welding projection into welding relationship with a comparable portion of the opposed mitred edge, and subjecting the bent strip to an electric welding current of a magnitude sufficient to plasticise said edges and applying thereto a translating pressure capable of abutting the plasticised edges with a force sufficient to forge said edges into a substantially homogeneous weld.

6. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to dispose the connected parts in relatively angled position and to bring said opposed edges into welding relationship, holding said correlated parts against accidental displacement, destroying said tie, and subsequently welding together said opposed edges.

7. In a method of forming a metallic frame structure having a mitred and welded corner, the

steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being shaped to provide a welding projection extending from one of said edges and being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to dispose the connected parts in relatively angled position and to bring the edge of said welding projection into welding relationship with a comparable portion of the opposed mitred edge, holding said correlated parts against accidental displacement, destroying said tie, and subsequently welding together the opposed edges at said projection.

8. In a method of forming a metallic frame structure having a mitred and welded corner, the steps comprising mitre cutting a metal strip from which said structure is to be formed to define the location of said corner and provide opposed mitred edges relatively aligned for subsequent abutting engagement, said mitre cut being shaped to provide a welding projection extending from one of said edges and being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, bending said strip at said mitre cut to dispose the connected parts in relatively angled position and to bring the edge of said welding projection into welding relationship with a comparable portion of the opposed mitred edge, holding said correlated parts against accidental displacement and subjecting them to an electric flash welding current of a magnitude sufficient to destroy said tie and to plasticise said contacting edges, and subsequently applying to said parts a translating pressure capable of abutting the plasticised edges with a force sufficient to forge said edges into a substantially homogeneous projection weld.

9. The method of forming metallic casement and window frames from a continuous metal strip of the type having an outwardly extending co-planar flange and a connecting web, which comprises forming mitre cuts extending through said strip and into said co-planar flange corresponding to the positions of the corners of a frame, trimming the ends of said strip to provide meeting ends, bending said strip at said mitre cuts, and subsequently subjecting the mitre cut portions of the frame to an electric welding current, said mitre cuts when formed extending through the inner co-planar flange and web of said strip and partially into the other co-planar flange leaving an uncut portion in the latter flange of sufficient strength to retain the adjacent portions of the strip in cooperating relation when the strip is bent, said uncut portion in the latter flange also being of such cross-section that it will fuse upon subjection to said welding current and result in a substantially continuous weld throughout the entire cross-section of the frame at the mitred corners thereof.

10. The method of forming metallic frames and like structures having angularly disposed portions formed from a continuous strip, which comprises mitre cutting the strip from which the frame is to be formed at points corresponding to the corners of the frame, said mitre cuts extending from the inside of the strip to a depth sufficient to leave only a small uncut bendable por-

tion in the strip at the apex of the mitre cuts to retain the adjacent parts in welding relation when bent into their final position, and subsequently subjecting the joint formed between the angularly disposed meeting portions of the strip at said mitre cut to a butt welding current to fuse said uncut bendable portion and form a substantially homogeneous weld throughout the entire area of the meeting surfaces of the angularly disposed portions.

11. The method of forming metallic window and door frames from a continuous preformed strip having a folded irregular cross-section, which comprises cutting mitre cuts in said preformed strip with the apex thereof located at points corresponding to the outer corners of the finished frame, said mitre cuts extending through the folded portion of said preformed strip a distance sufficient to leave a small uncut portion at the corners of the frame of sufficient strength to retain the adjacent portions of the strip in cooperating relation during and after the bending operation, and subsequently subjecting the bent strip at said mitre cuts to an electrical butt welding current of sufficient magnitude to simultaneously fuse the uncut portion of the strip at said mitre cuts and weld the meeting edges of the strip at the mitre cuts.

12. The method of forming metallic window and door frames from a continuous preformed strip having an outwardly extending flange, which comprises cutting mitre cuts in said strip with the apex thereof located in the outwardly extending flange of the strip at points corresponding to the corners of the finished frame, said mitre cuts extending through the major portion of said strip and into the outwardly extending flange a distance sufficient to leave a small uncut portion in said flange of sufficient strength to retain the adjacent portions of the strip in cooperating relation during and after the bending operation, bending said strip on said small uncut portion to bring the sides of the mitre cut in meeting relation, and subsequently subjecting the bent strip at said mitre cuts to an electric butt welding current to simultaneously fuse the uncut portion in said flange and weld the meeting edges of the strip at the mitre cuts.

13. The method of forming metallic frames which comprises shaping the frame forming strip to provide parallel outwardly extending flanges along the edge of the frame, cutting mitre cuts which extend through the inner frame surface forming portion of said formed strip and terminating with the apex of the mitre cuts located in said outwardly extending flanges and leaving uncut portions in the outwardly extending flanges at points corresponding to the corners of the frame, the uncut portions in the parallel flanges of said formed strip being of sufficient cross-section to retain the adjacent portions of the formed strip at each side of the mitre cuts in cooperating relation when bent to close said mitre cut but of insufficient cross-section to withstand an electric welding current, bending said formed strip upon the uncut portions of the parallel flanges at said mitre cuts to bring the edges of the mitre cut into meeting relation, and subsequently subjecting said bent strip at the corners to a butt welding electric current sufficient to simultaneously fuse said uncut portions and produce a butt weld between the meeting edges of the closed mitre cuts to complete the frame.

14. The method of forming metallic door and

5 window frames from a continuous strip having spaced parallel extending flanges and a connecting web that forms the inside surface of the frame, which comprises cutting mitre cuts in said strip at points corresponding to the corners of the frame, said mitre cuts when formed extending through the connecting web of said strip and partially through the parallel extending flanges to leave an uncut portion in each of said extending flanges of sufficient strength to retain the adjacent portions of the strip in cooperating relation during the bending operation, and subsequently subjecting the bent strip at said mitre cuts to an electrical welding current, the uncut portions in said parallel extending flanges being of such reduced cross-section as to fuse upon 15 subjection to said welding current whereby a substantially continuous weld will be produced throughout the entire cross-section of the frame at the mitred corners thereof.

15 15. In a method of forming a metallic frame having mitred and welded corners, the steps comprising mitre cutting a metal strip from which said frame is to be formed at points corresponding to the corners of the frame to provide opposed mitred edges relatively aligned for subsequent abutting engagement, each of said mitre cuts being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, mitreing the terminal ends of said strip, bending said strip at the respective mitre cuts to form a rounded corner and to dispose the several parts in relatively angled positions to form said frame and bring said opposed edges and said mitred ends into welding relationship, heating the corner portions of said frame to plasticise the opposed edges thereof and applying thereto a translating pressure capable of abutting the plasticised edges with a force sufficient to weld said edges together to complete the frame and simultaneously heating and swaging the metal defining each of said rounded corners and thereby 40 tending to point said corners.

45 16. In a method of forming a metallic frame

having mitred and welded corners, the steps comprising mitre cutting a metal strip from which said frame is to be formed at points corresponding to the corners of the frame to provide opposed mitred edges relatively aligned for subsequent abutting engagement, each of said mitre cuts being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, mitreing the terminal ends of said strip, bending said strip at the respective mitre cuts to form a rounded corner and to dispose the several parts in relatively angled positions to form said frame and bring said opposed edges and said mitred ends into welding relationship, and subjecting the corner portions of said frame to an electric welding current of a magnitude sufficient to plasticise the opposed edges thereof and applying thereto a translating pressure capable of abutting the plasticised edges with a force sufficient to weld said edges together to complete the frame and simultaneously heating and swaging the metal defining each of said rounded corners and thereby tending to point said corners.

17. In a method of forming a metallic frame having mitred and welded corners, the steps comprising mitre cutting a metal strip from which said frame is to be formed at points corresponding to the corners of the frame to provide opposed mitred edges relatively aligned for subsequent abutting engagement, each of said mitre cuts being formed to leave only a bendable correlating tie connecting the adjacent parts of said strip and of sufficient strength to maintain said parts in correlated relationship, mitreing the terminal ends of said strip, bending said strip at the respective mitre cuts to dispose the several parts in relatively angled positions to form said frame and bring said opposed edges and said mitred ends into welding relationship, holding the angled parts against accidental displacement, destroying the several connecting ties, and subsequently welding together the opposed edges and ends to complete the frame.

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