United States Patent [19]

Williams

[11] **3,905,093**

[45] **Sept. 16, 1975**

[54] **METHOD OF ERECTING WALL-FORM**

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[22] Filed: **Jan. 18, 1973**

[21] Appl. No.: **324,599**

Related U.S. Application Data

[62] Division of Ser. No. 59,466, July 30, 1970, abandoned.

[52] **U.S. Cl.** **29/526;** 249/43; 249/217

[51] **Int. Cl.** **B23p 19/00**

[58] **Field of Search** 29/455, 452, 469, 526; 249/191, 217, 190, 43, 42

[56] **References Cited**

UNITED STATES PATENTS

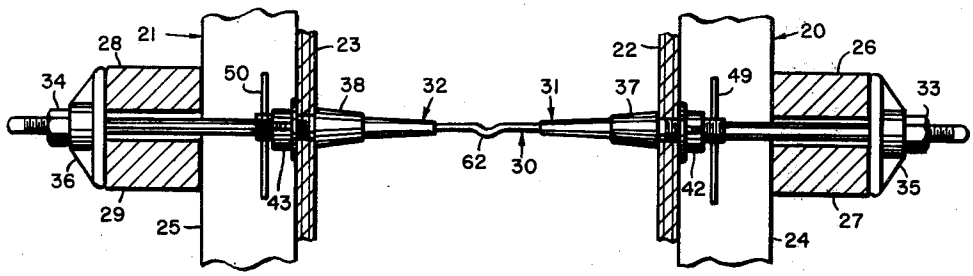
2,002,526	5/1935	Colt	249/42 X
2,014,080	9/1935	Colt	249/217
2,259,555	10/1941	Day	249/217
2,502,672	4/1950	Royther	249/42 X
3,464,667	9/1969	Sledz	249/217 X
3,614,052	10/1971	Babbage	249/43

Primary Examiner—Charlie T. Moon

[57] **ABSTRACT**

A method of erecting wall forms of the type used to cast concrete walls in which a pair of form panels are first positioned in spaced, wall-defining relation to one another, tie rod assemblies are inserted transversely through the panels and attached thereto to hold the panels in spaced relation, external stud and waller bracing is subsequently erected on the outer sides of the panels, and the tie rod assemblies are then connected in force-transmitting relation to the bracing.

1 Claim, 10 Drawing Figures



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SHEET 1 OF 2

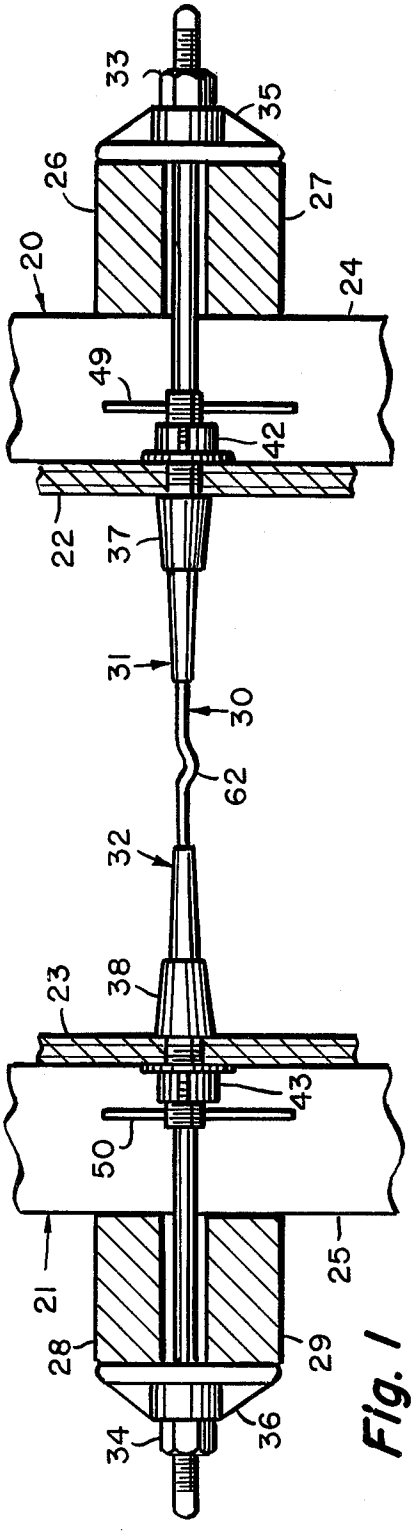


Fig. 1

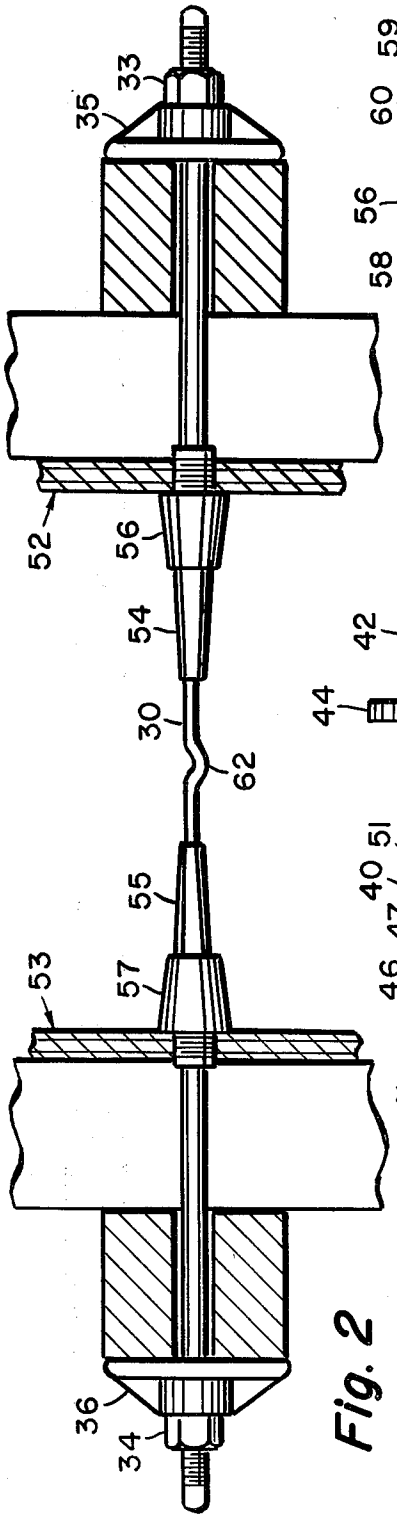


Fig. 2

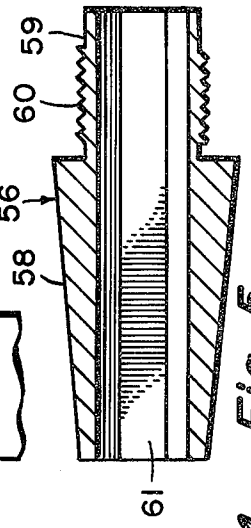


Fig. 5

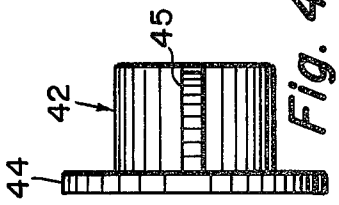


Fig. 4

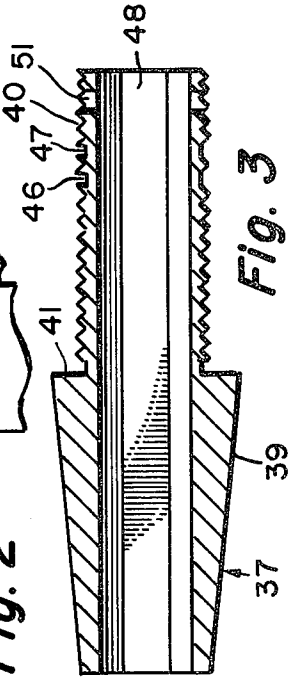


Fig. 3

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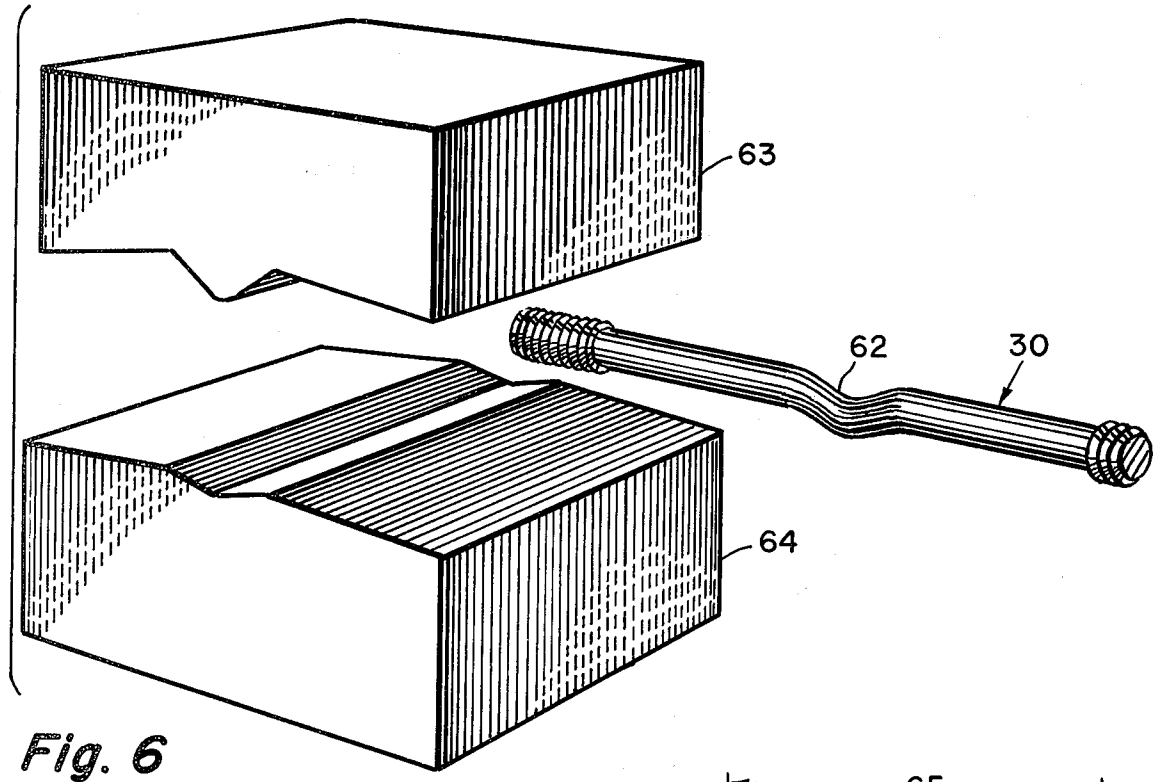


Fig. 6

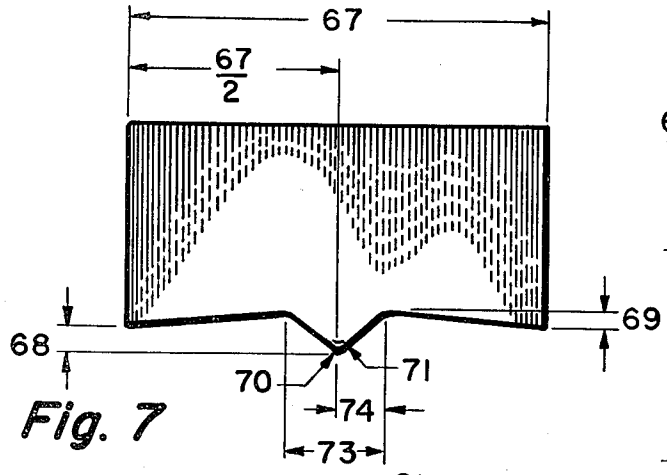


Fig. 7

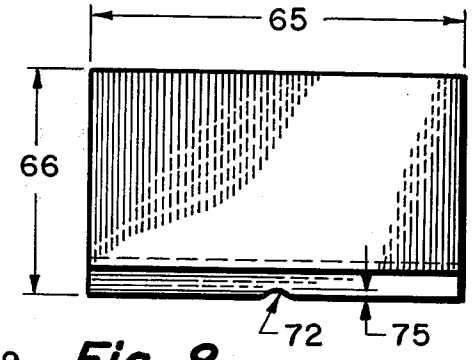


Fig. 8

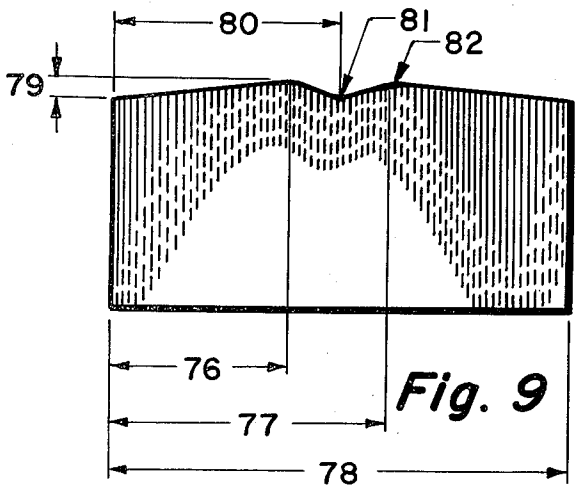


Fig. 9

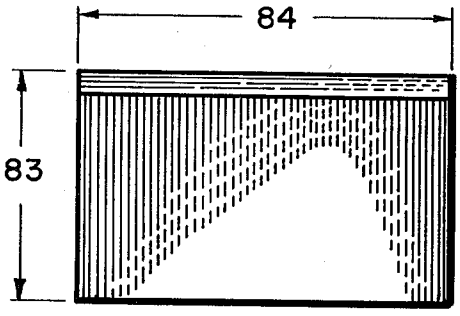


Fig. 10

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METHOD OF ERECTING WALL-FORM

This is a division of application Ser. No. 59,466, filed July 30, 1970, and now abandoned.

BACKGROUND OF THE INVENTION

The construction of concrete walls normally involves the pouring of fresh concrete in the space between parallel panels. The liquid pressure generated by the concrete is approximately a 160 pounds per square foot at the bottom of the pour for every foot of poured height. The resulting forces confined by the form panels are very high, and require the presence of either cross-tie systems securing one form with respect to the other, or extensive exterior bracing. Where the cross-tie system is used, the exterior bracing need only be of sufficient strength to maintain the vertical orientation of the forms, as the forces generated by the poured concrete are transferred from one form to the other, and thus confined within the form system.

One of the common methods of cross-tying forms involves the use of a tie rod extending partially across the space between the forms, with the opposite ends of this tie rod in threaded engagement with bolts traversing the forms and secured to them. After the forms have been removed from the set concrete, the tie rod remains embedded in the resulting wall. It has been common practice to provide the bolts with a conical end positioned in the space between the form panels, resulting in the formation of a similarly-shaped conical depression in the concrete after the bolt has been removed. This arrangement obviously removes the necessity for having the tie rod extend beyond the face of the poured wall. The outer end of the bolt is usually engaged by a nut bearing on some sort of bracket capable of transferring the forces involved over to beams extending across parallel stiffeners placed against the outside of the form panel.

This arrangement easily prevents separation of the form panels, but a problem remains as to how to secure the proper spacing of the panels during the initial placement preparatory to pouring the concrete. Efficiency in erecting these form systems requires that it be possible to tighten the exterior nuts down to some positive established spacing abutment so that the thickness of the poured wall can be controlled without the necessity of making measurements at each point where the tie system is adjusted. Arrangements have been devised for positively interrelating the position of the bolt with respect to the form structure so that the form cannot move either way, once the bolts are engaged with the tie rod. The present invention relates to this type of tie system, and provides an assembly of components that is easier to install than anything known to applicant, and involves components that are easily manufactured of relatively inexpensive materials.

SUMMARY OF THE INVENTION

The wall-form tie system provided by this invention utilizes a tubular cone member with its conical portion disposed normally on the inside of the form panel with which it is associated. A shank extending from the cone member traverses a suitable hole in the form panel, and the securing bolt traverses both this shank and the cone section. The cone member is secured with respect to the form panel preferably either by threaded interengagement between the shank and the material of the form panel, or by the addition of a nut in threaded engagement with the shank and bearing against the outside of the form panel. The diameter of the shank is sufficiently less than that of the major diameter of the conical portion to provide a shoulder bearing against the inside of the form panel. The axial position of the bolt within the cone member is preferably established by a cross pin intersecting both the shank and the bolt. The stress-transfer nut at the outer end of the bolt can thus be tightened against the bracket bearing against the waler beams supporting the form without altering the position of the bolt in a direction transverse to the form panel. Proper tightening can thus be established without concern for continually having to measure the space between the form panels, or place temporary control abutments between the form panels for the adjustment. It is preferable to utilize a system for controlling the degree of threaded interengagement between the inner tie rod and the bolts by an abutment arrangement of the type described and claimed in my application for U.S. Pat. Ser. No. 751,313, now abandoned.

The removal of the forms after the concrete has set will carry the cone members along with the form panel. The resulting conical recesses in the concrete wall can either be filled with grout, or with a molded plug of some convenient material. Occasionally, the conical recesses are left in the wall as a decorative measure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation of a wall-form system in condition to receive the poured concrete.

FIG. 2 is a sectional elevation of a modified form of the invention, in which the cone members are in threaded interengagement with the material of the form panels.

FIG. 3 is an axial section of the cone member shown in the FIG. 1 assembly, on an enlarged scale.

FIG. 4 is a view of enlarged scale over FIG. 1 of the nut for securing the cone member with respect to the form panel.

FIG. 5 is a sectional elevation of the cone member shown in the FIG. 2 assembly, on an enlarged scale.

FIG. 6 is a perspective view of a forming die used for establishing the offset at the center of the tie rod shown in FIGS. 1 and 2.

FIG. 7 is an end view of the upper die member shown in FIG. 6, on a reduced scale.

FIG. 8 is a side elevation of the die member shown on FIG. 7.

FIG. 9 is an end view of the lower die member shown in FIG. 6.

FIG. 10 is a side elevation of the die member shown in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, the opposite form systems 20 and 21 each include a panel as shown at 22 and 23, respectively, reinforced by spaced vertical beams 24 and 25 commonly referred to as "studs." Spaced horizontal beams (walers) 26–27 bridge across the studs 24, and the beams 28 and 29 across the studs 25. The force-transfer system maintaining the position of the form systems 20 and 21 against the pressure of the poured concrete centers in the inner tie rod 30 interconnecting the bolts 31 and 32. These bolts traverse the form systems 20 and 21, respectively, and receive the nuts 33 and 34 bearing against the brackets 35 and 36. These

brackets bridge across the associated waler beams, and complete the transfer of restraining forces. The pressure of the concrete distributed across the inner faces of the panels **22** and **23** generate large forces tending to separate the form systems **20** and **21**, and these forces are resisted by the bearing pressure of the brackets **35** and **36** which are balanced out through the inner tie rod **30**. Tie systems of the type shown in FIG. **1** will be distributed about the area of the form systems **20** and **21** with a spacing related to the relationship between the strength of the tie system and the concrete pressure over the area which the particular tie system must resist.

The arrangement as described above is obviously capable of resisting the outward pressures involved, and the remaining features are associated with the maintenance of the proper spacing between the panels **22** and **23**. The tubular cone members **37** and **38** shown in FIG. **3** have a conical section **39** and a threaded tubular shank **40**. The outside diameter of this shank is sufficiently smaller than the major diameter of the conical section **39** to provide a shoulder **41** for bearing against the inside surface of the associated form panel. The nuts **42** and **43** engage the threaded shanks, and bear against the outer surfaces of the form panels **22** and **23**, respectively. The cone members **37** and **38**, and also the nuts **42** and **43** may be molded of a durable plastic material, as the stresses transferred through those members are relatively small. FIG. **4** illustrates the preferred form of the nuts, which have a flange **44** to distribute pressures over a relatively large area of the form panels. The axial side flanges **45** (preferably on opposite sides of the nut) provide gripping surfaces so that these nuts can be tightened without the use of a pipe wrench. The discontinuities **46** and **47** in the threading on the shank **40** are preferably annular, and provide an indication of the correct tightened position of the nuts **42** and **43** for particular thicknesses of the plywood normally constituting the form panels **22** and **23**. The tightening of these nuts from the outside of the form is also facilitated by the provision of a non-circular cross-section in the internal bore **48** of the cone members **37** and **38**. A correspondingly shaped rod can be inserted as a wrench, making it possible to apply torque to the cone member in opposition to the torque applied in tightening the nuts. Usually the cross-section **48** will approach a standard hexagonal configuration commonly associated with bolts and nuts. Tools of this configuration are readily available.

The axial position of the bolts **31** and **32** in a direction transverse to the form panels **22** and **23** is established (for properly erecting the form) by the cross pins **49** and **50** intersecting the holes **51** in the shanks of the cone members and a properly-located cross hole in the bolts **31** and **32**. These pins may either be in the form of heavy nails, or of a hair pin-like configuration commonly associated with locking pins. Once these pins are inserted (after the attachment of the bolts **31** and **32** to the inner tie **30**) the nuts **33** and **34** may be tightened lightly to establish positively the spacing between the form panels **22** and **23**, on the assumption that the degree of threaded interengagement between the inner tie **30** and the bolts **31** and **32** has been carefully controlled. With the nuts **33** and **34** tightened lightly, the walers **26–27** and **28–29** are held in place against the studs **24–25** without the use of extra fastenings. It will normally be desirable to nail the studs **24–25** to the associated form panels, but the usual practice of additionally nailing the walers to the studs can be omitted. This not only results in increased efficiency on the assembly of the forms, but makes it correspondingly easy to disassemble and remove them.

In the arrangement shown on FIG. **2**, form systems **52** and **53** are similar to the form systems **20** and **21** of FIG. **1**. The inner tie, the outer nuts, and the bearing members may also be identical to those shown in FIG. **1**, but the cross hole for receiving the locating pin is not necessary in the FIG. **2** system.

The cone members **56** and **57** shown in FIG. **5** have a conical portion **58** similar to the portion **59** in FIG. **3**. The shank **59** is only of sufficient length to reach into or through the associated form panel, and the threaded portion **60** has an outside diameter interrelated with the diameter of the hole in which the shank is inserted such that the threading **60** bites into the material of the panel as it is screwed into place. A non-circular bore **61** traversing the tubular cone member **57** receives a similarly-shaped tool to facilitate screwing the cone member into the position shown in FIG. **2**. If desired, a shoulder on the bolts **54** and **55** can be formed to bear on the inner ends of the cone members **56** and **57** to establish the spacing of the form systems. Alternatively, a suitably-shaped cross hole in the bolts **54** and **55** can receive a member engaging either the studs or the walers to fix the axial position of the bolts with respect to the form systems for spacing purposes. These arrangements are well-known. In the arrangements shown in FIG. **1** and FIG. **2**, the removal of the form systems leaves the cone members secured to the form panels, and the erection of the form systems in a new position for the next pour is thus simplified.

The balancing of the pressure forces against the opposite form systems by the inner tie **30** places rather severe requirements on this member. Efficient utilization of material requires that the rod stock of which the inner tie is made be heavily cold-worked to the point that the yield strength is approximately eighty percent of the ultimate. These members loose their utility when substantial stretching takes place, and the yield strength is therefore the only usable strength characteristic. The heavy degree of cold work produces a problem in providing the offset **62** without generating a crack, or a point of weakness. The offset is necessary to prevent rotation of the inner tie as the bolts are disengaged, and also to prevent a breaking of the bond between the surface of the tie and the surrounding concrete. The degree of the offset **62** must be such as to strike a compromise between resistance to rotation and any tendency to substantially weaken the tie.

FIGS. **6** through **10** show a die arrangement for producing the desired offset in a typical inner tie rod of the material described above. For purposes of illustration, this tie rod is of a material having an original rod diameter of **0.272** inches, which is usually enlarged somewhat at the threaded ends through the process of rolling the threads. The upper die block **63** is shown in FIGS. **7** and **8**, and produces a form of offset that has been found to be very satisfactory. The length **65** and the height **66** may be selected to suit, but the dimension extending in the direction in which the rod is received in the die is preferably **2.68** inches. This dimension is identified at **67** in FIG. **7**. The V-shaped configuration primarily responsible for establishing the offset **62** is shown in the central portion of FIG. **7** and the differ-

ence between the dimension **68** (**0.17** inches) and **69** (**0.06** inches) is sufficient to control the spring-back of the rod stock. The radius **70** is preferably **0.15** inches, and the radius **71** at the base of the groove **72** is **0.31** inches. This is the radius that establishes the kink at the apex of the offset **62.** The dimension **73** along the base of the V-shaped section is preferably **0.68** inches, and the dimension **74** is one-half of this amount. The radius of the groove **72** is preferably **0.15** inches for the **0.272** rod stock, and the depth of this groove as shown in FIG. **8,** identified at **75,** is adequate at **0.02** inches.

The lower die member **64** is shown in detail in FIGS. **9** and **10.** The dimension **76, 77,** and **78** are respectively **1.18, 1.87,** and **3.06** inches. The dimension **79** and **80** are **0.09** and **1.53** inches. The radius **81** is preferably **0.06** inches, and the radius **82 0.12** inches. The length and height **83** and **84** shown in FIG. **10** may be selected to suit.

Die blocks of the type shown in FIGS. **6** through **10** are normally placed in the conventional punch press, supported by the usual die-set assembly. The offset produced by these die members will deviate about one-half of the diameter of the rod from the axis of the rod, and will have no substantial tendency to produce cracks or points of weakness.

I claim:

1. A method of erecting a wall-form panel assembly of the type having a pair of form panels, external bracing for said panels, tie rod assemblies extending transversely across said panels and interconnecting said bracing, and a pair of tubular cone members associated with each tie rod assembly, adapted to be secured to said panels and extend therethrough, said tie rod assemblies being slidably received in said cone members, comprising the steps of:

a. positioning said panels in spaced parallel relation to one another to define opposite faces of a wall;
b. securing said tubular cone members to said panels;
c. inserting said tie rod assemblies through said panels and said tubular cone members;
d. fixedly securing said tie rod assemblies to said cone members to prevent relative movement of said panels and said tie rod assemblies;
e. erecting said external bracing on said panels; and
f. subsequently securing the ends of said tie rod assemblies to said bracing in force transmitting relation thereto.

* * * * *