United States Patent [19]

Wilson

[11] **3,759,003**

[45] **Sept. 18, 1973**

[54] **PINNED JOINT**

[76] Inventor: **John C. Wilson,** 130 Homewood Ln., Rochester, N.Y.

[22] Filed: **Dec. 23, 1971**

[21] Appl. No.: **211,340**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 67,004, Aug. 26, 1970, abandoned.

[52] **U.S. Cl.** **52/285,** 52/396, 52/426, 52/428, 52/573, 52/585, 52/220

[51] **Int. Cl.** **E04c 1/10**

[58] **Field of Search** 52/220, 285, 396, 52/448, 426, 428, 466, 573, 585, 586, 592

[56] **References Cited**

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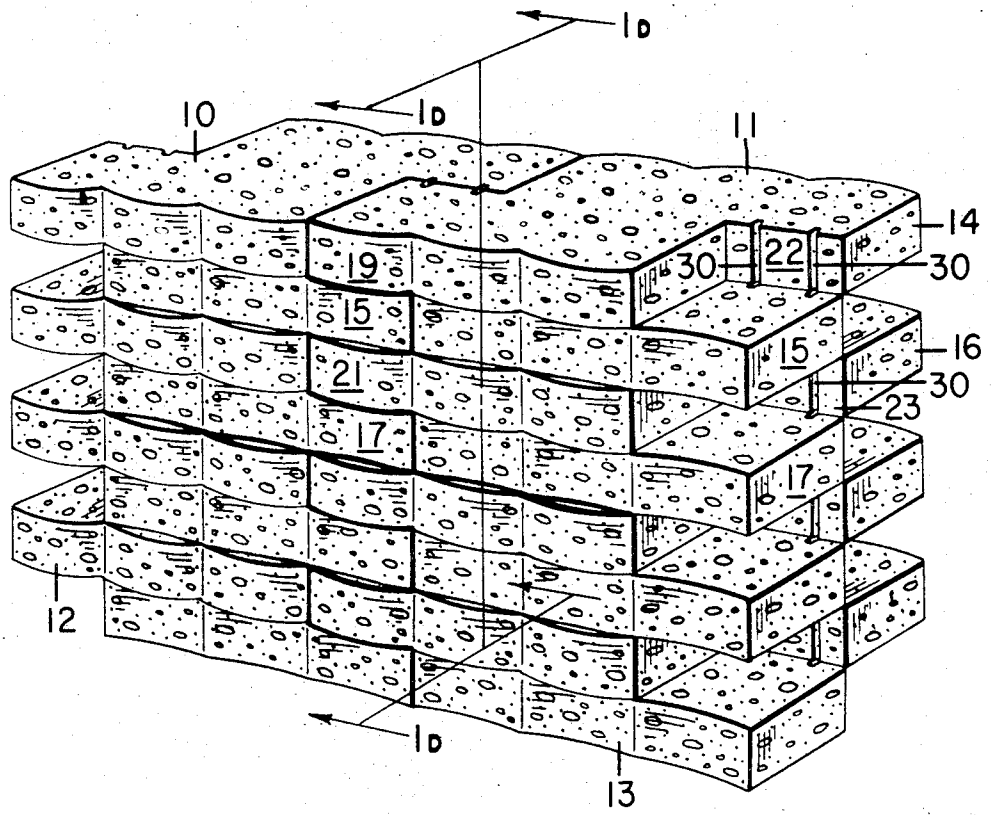
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Primary Examiner—Alfred C. Perham
Attorney—Cumpston, Shaw & Stephens

[57] **ABSTRACT**

A pinned joint connects joinable edges of two bodies having complementary projections arranged so that the bodies can be moved together with the projections alternately overlapping in a common parting region between confronting surfaces of the projections. The confronting surfaces of the projections have recesses that are aligned when the bodies are fitted together to form a slot extending along the common parting region transversely to the direction of fitting the bodies together, and a pin is placed into the slot to lock the bodies together. Such bodies can be formed in a simple, two-part mold, and easily assembled for construction and other purposes.

65 Claims, 68 Drawing Figures



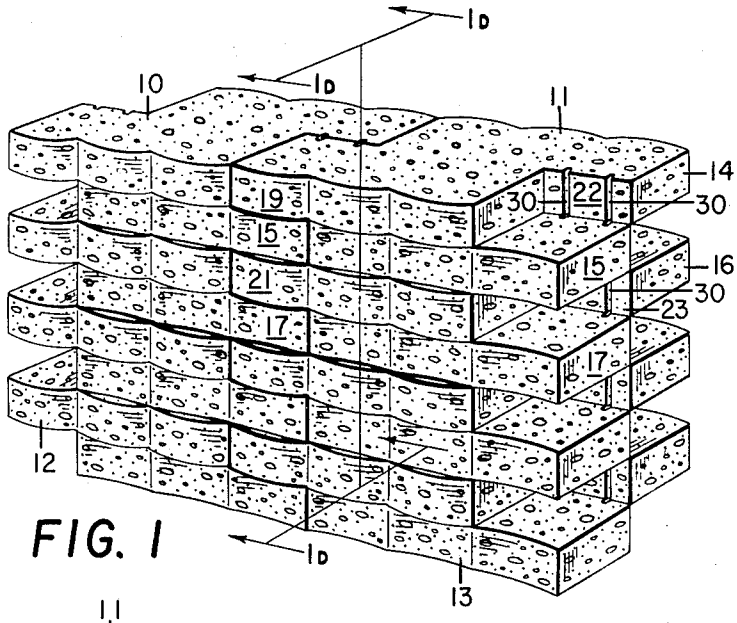


FIG. 1

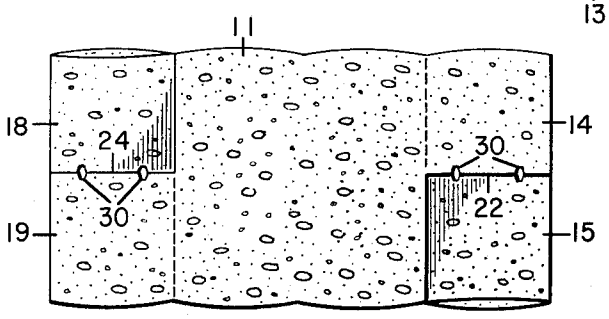


FIG. 1A

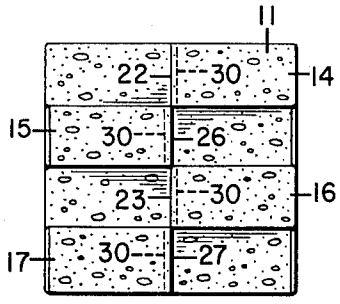


FIG. 1B

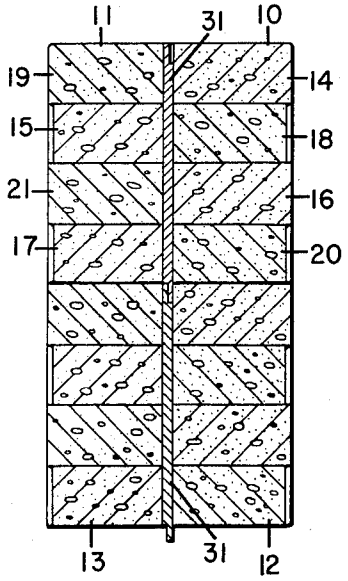


FIG. 1D



FIG. 1E

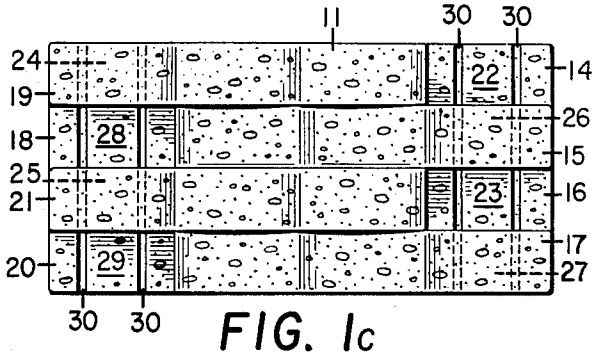


FIG. 1C

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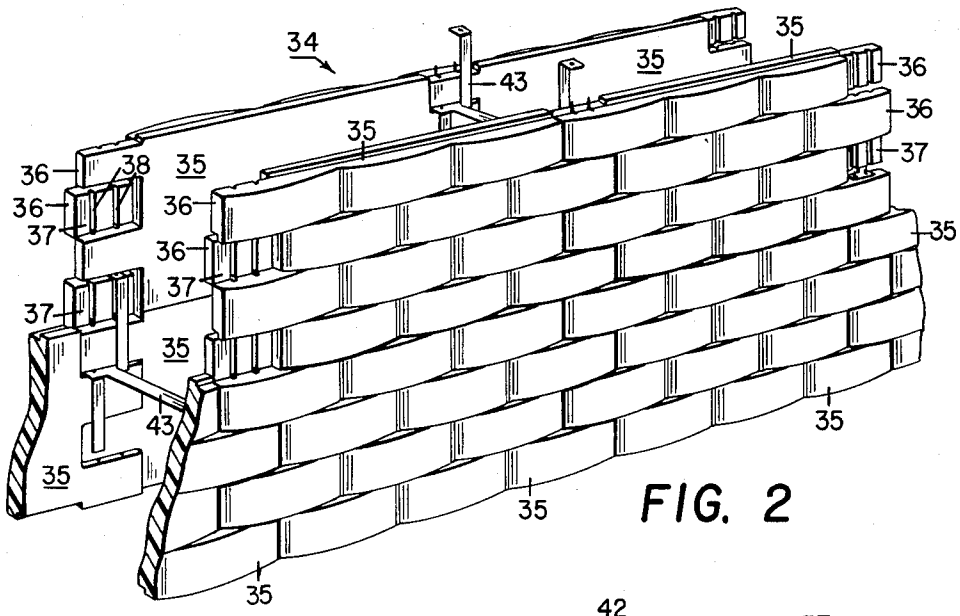


FIG. 2

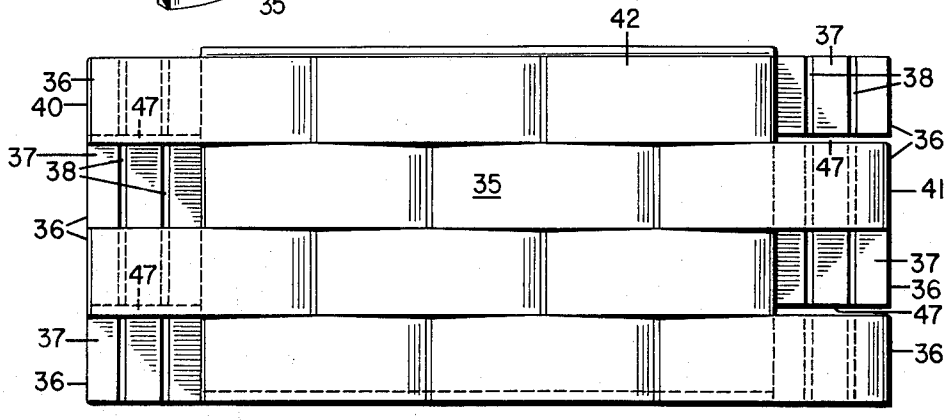


FIG. 2A

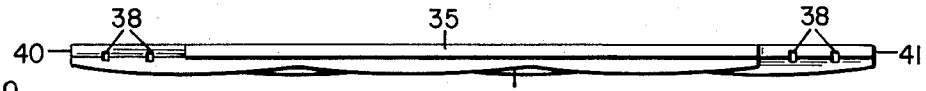


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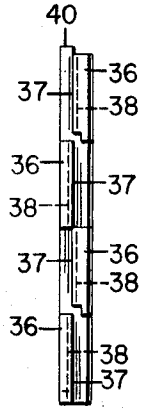


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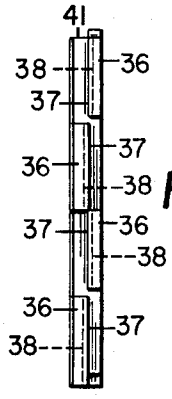


FIG. 2D

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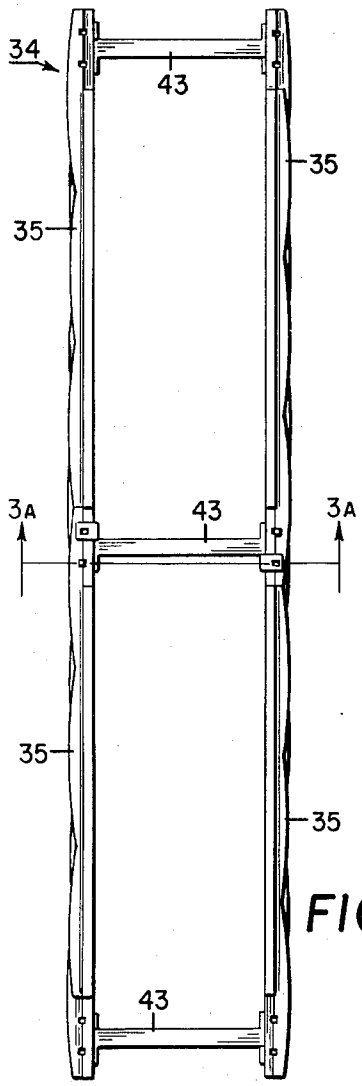


FIG. 3

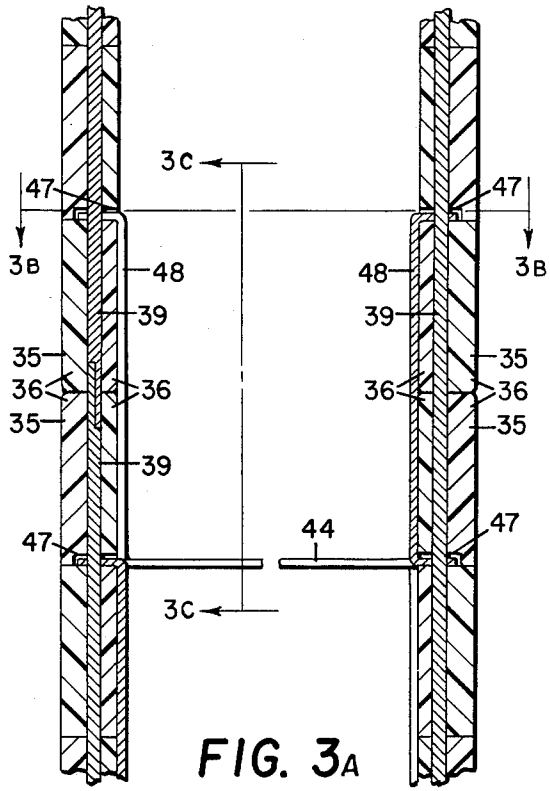


FIG. 3A

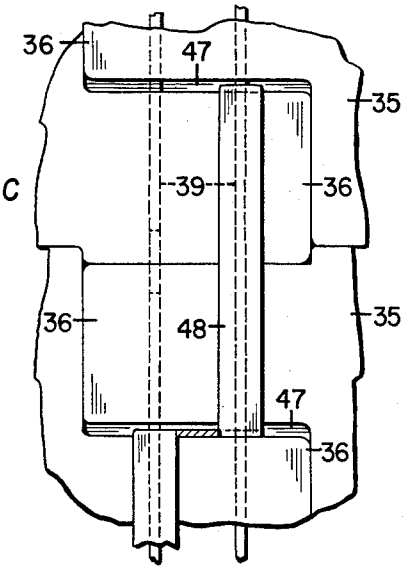


FIG. 3C

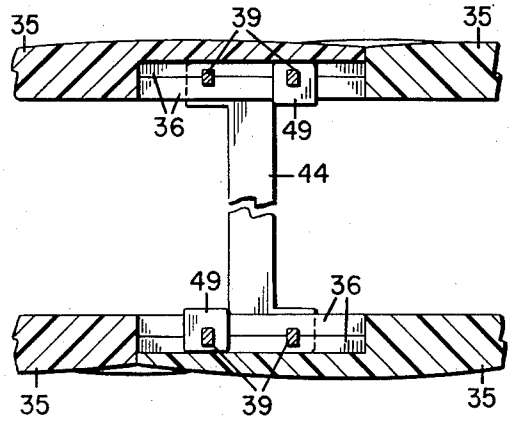


FIG. 3B

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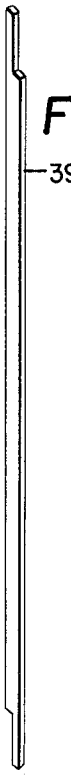


FIG. 3D

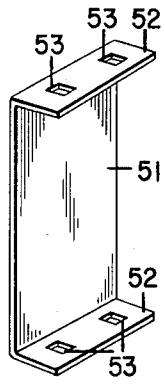


FIG. 18

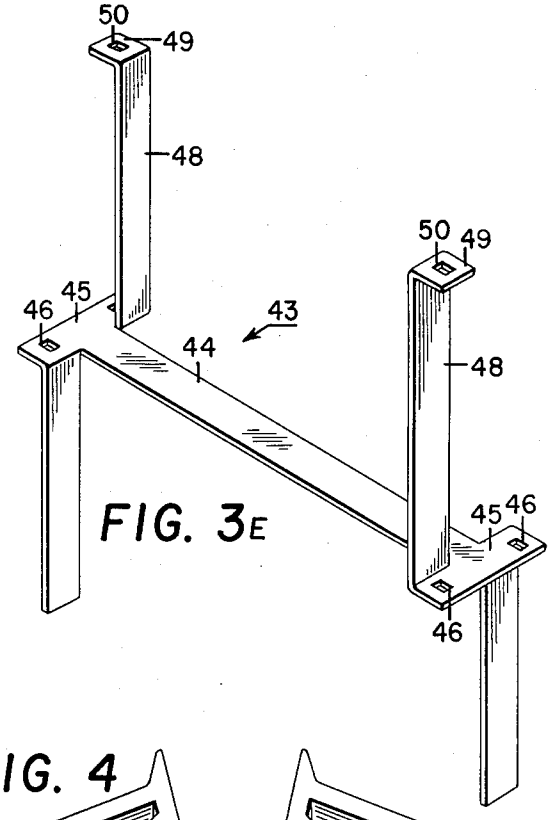


FIG. 3E

FIG. 4

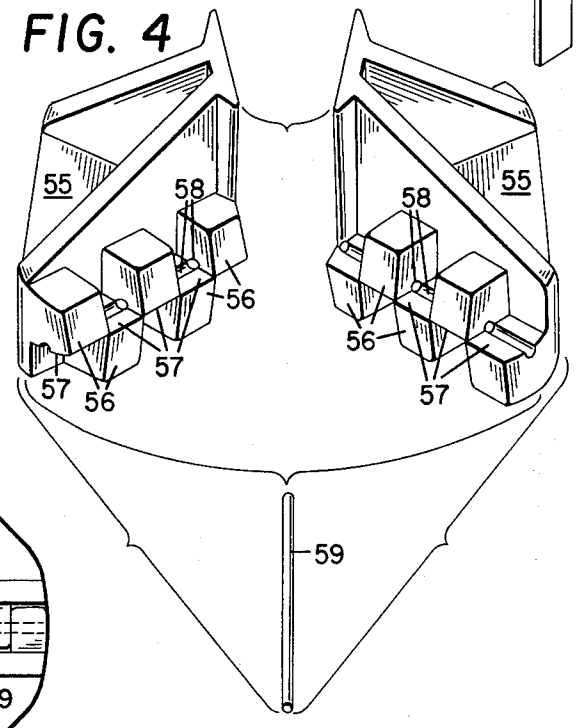
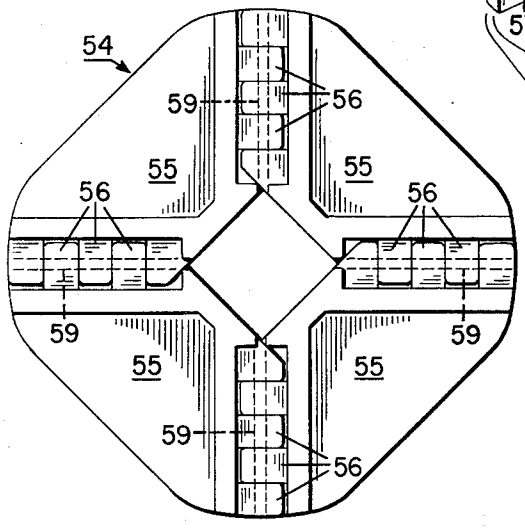


FIG. 4A



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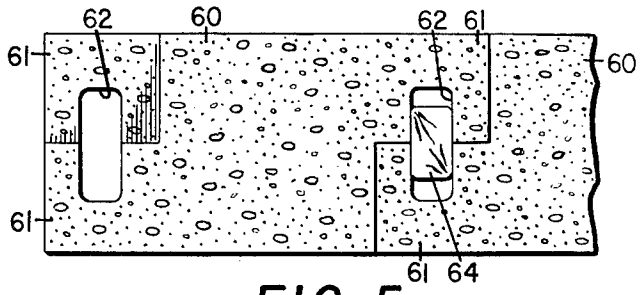


FIG. 5

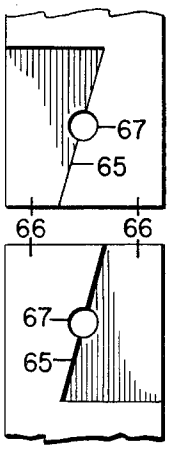


FIG. 6

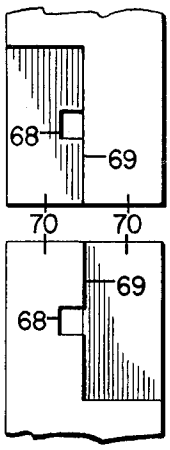


FIG. 7

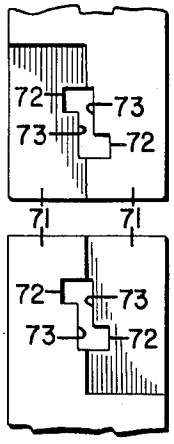


FIG. 8



FIG. 8A

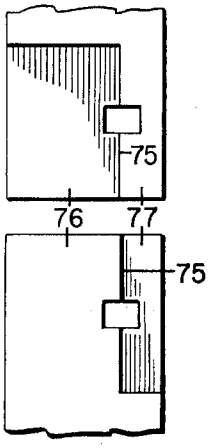


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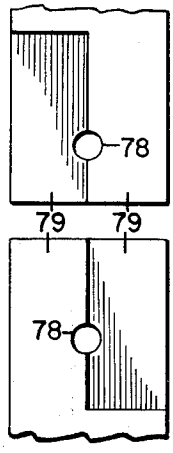


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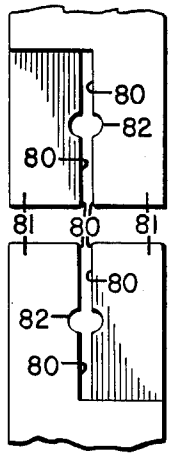


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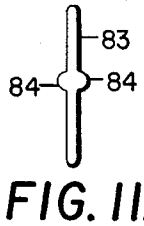


FIG. 11A

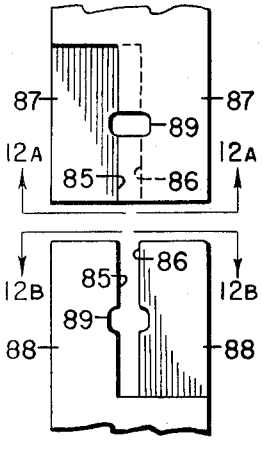


FIG. 12

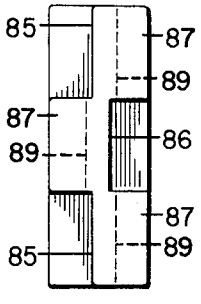


FIG. 12A

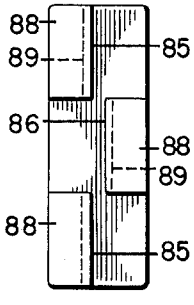


FIG. 12B

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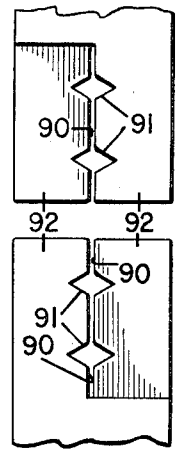


FIG. 13

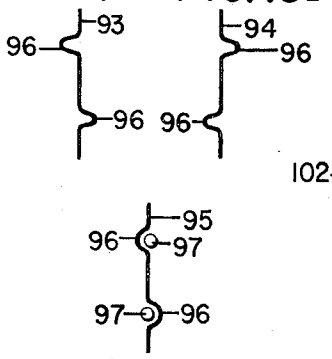


FIG. 13A FIG. 13B

FIG. 13C

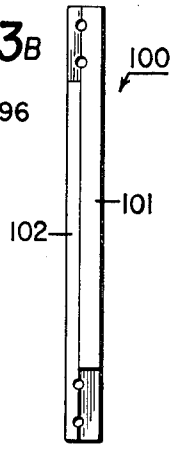


FIG. 14

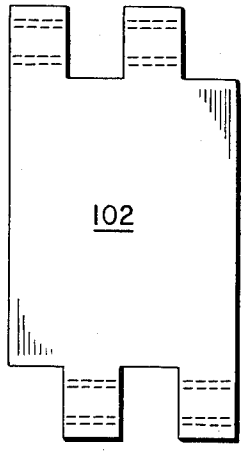


FIG. 14A

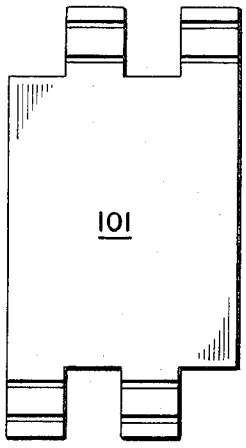


FIG. 14B

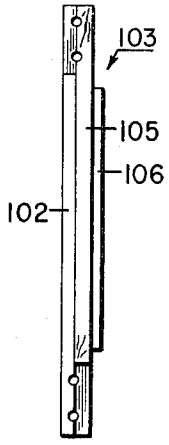


FIG. 15

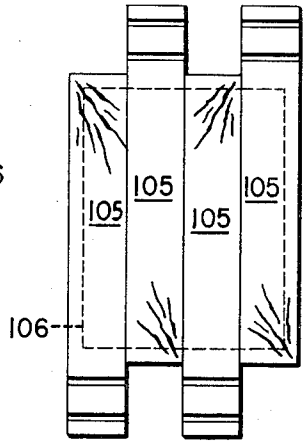


FIG. 15A

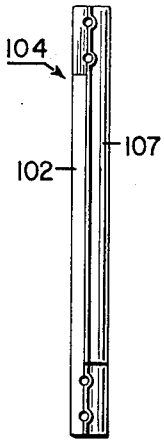


FIG. 16

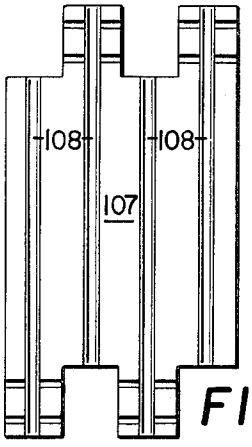


FIG. 16A

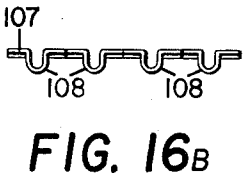


FIG. 16B

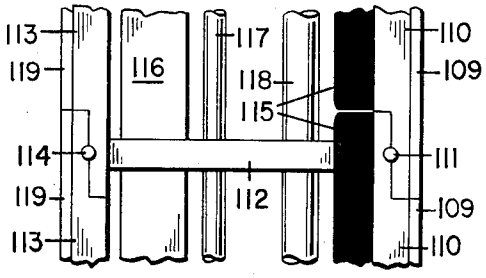


FIG. 17

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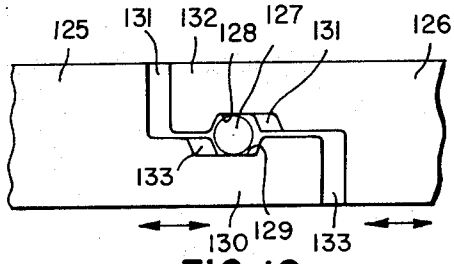


FIG. 19

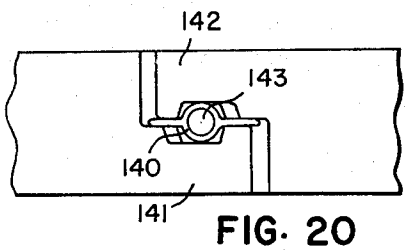


FIG. 20

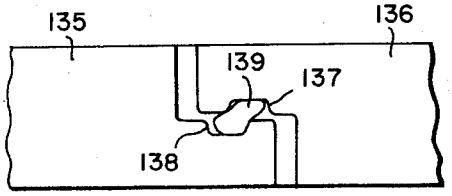


FIG. 21

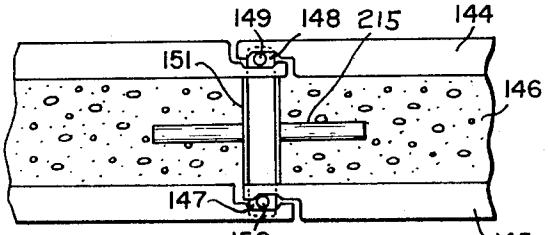


FIG. 22

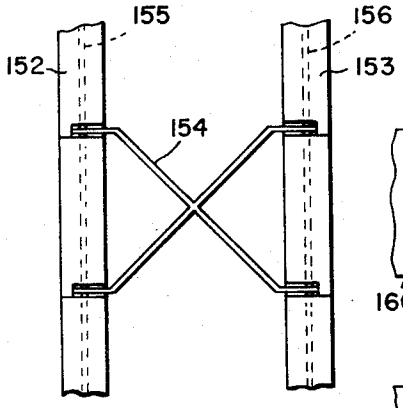


FIG. 23

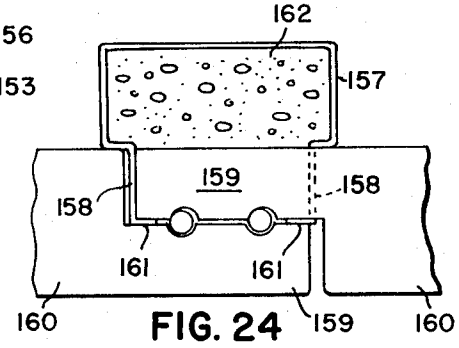


FIG. 24

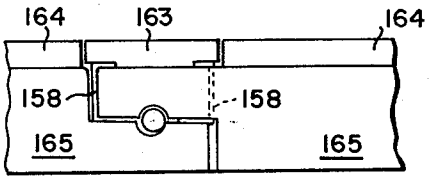


FIG. 25

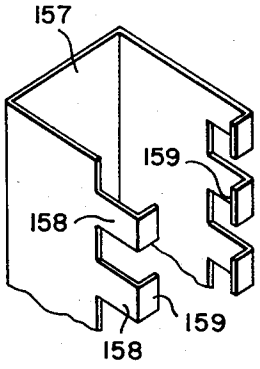


FIG. 26

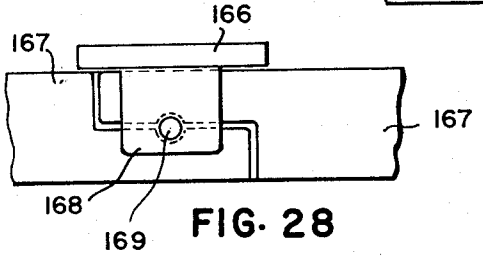


FIG. 28

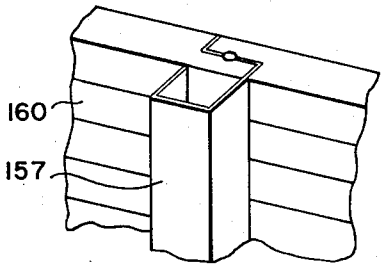


FIG. 27

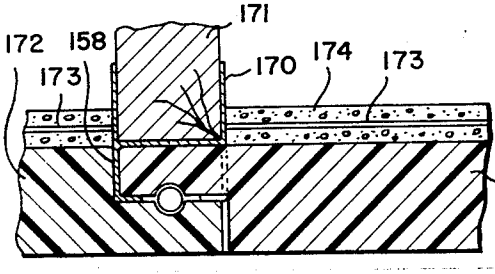


FIG. 29

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BY Cumpston, Shaw and Stephens

HIS ATTORNEYS

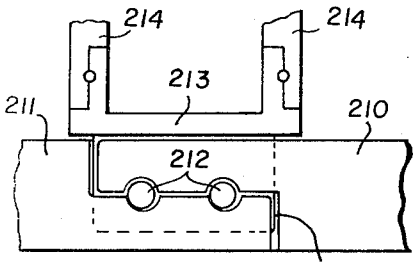


FIG. 30

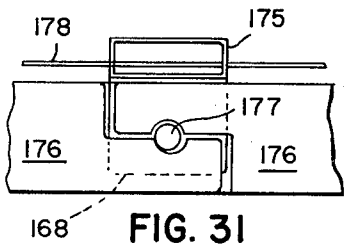


FIG. 31

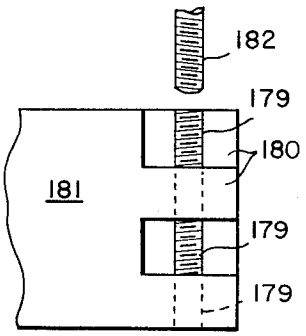
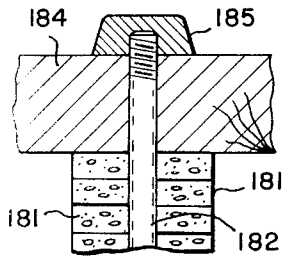


FIG. 32



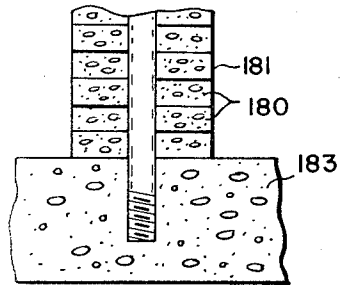


FIG. 33

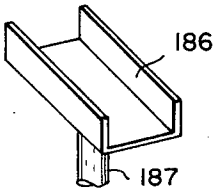


FIG. 34

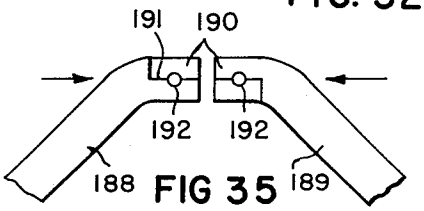


FIG 35

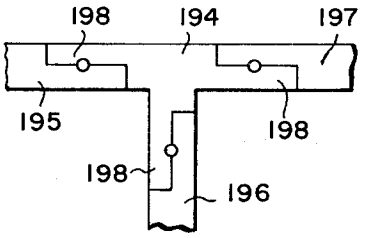


FIG. 37

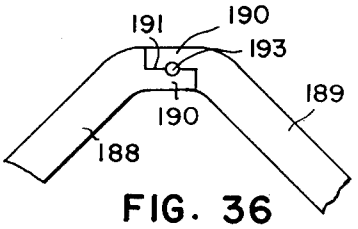


FIG. 36

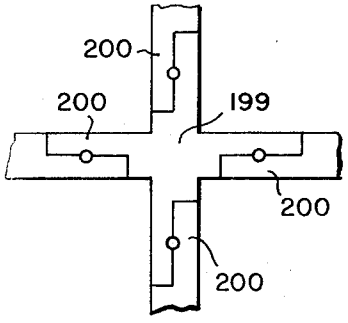


FIG. 38

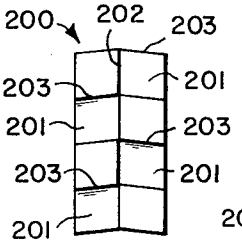


FIG. 39

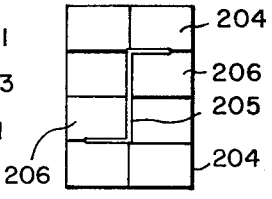


FIG. 40

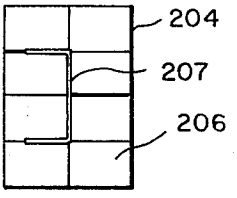


FIG. 41

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PINNED JOINT

RELATED APPLICATIONS

This application is a continuation-in-part of my copending parent application Ser. No. 067,004, filed Aug. 26, 1970, entitled: PINNED JOINT, and abandoned upon the filing of this application.

INVENTIVE IMPROVEMENT

Pinned joints are generally known and have usually been formed by boring a hole through interlocking bodies and driving a pin through the hole. This is expensive and wasteful. The boring can be avoided by molding holes in the bodies by means of retractable rods that are positioned in the mold and withdrawn from the molded bodies to form holes for receiving the locking pin. Withdrawing retractable rods from molds is expensive and often impractical. It is impossible with some materials, and hole length is limited with any material; also mold expense is greatly increased, movement of the rods wears the mold much faster, and the rejection rate for parts is much higher.

The invention involves recognition of a simpler and more efficient way of making a pinned joint without boring holes or retracting rods from molds. The invention aims at molding joinable bodies with simple, two-part molds, saving in materials and labor, and an easily assembled and strong pinned joint. The invention includes several preferred structures including wall constructions using such a joint.

SUMMARY OF THE INVENTION

Bodies to be connected with the inventive joint have joinable edges with projections arranged alternately on opposite sides of a parting region. The projections on the respective joinable edges are arranged in complementary orientation so the bodies can be fitted together by a relative movement that slides the parting regions together in a common parting region between confronting surfaces of the alternate projections. The confronting surfaces of the projections have recesses that are aligned when the bodies are fitted together to form a slot or slots extending along a common parting region transversely to the direction of relative movement sliding the bodies together, and a locking member is placed into the slot to prevent separation of the bodies.

FIG. 1 is an isometric view of a block wall formed with the inventive pinned joint;

FIG. 1*a* is a plan view of a block used in the wall of FIG. 1;

FIG. 1*b* is an end elevation of the block of FIG. 1*a;*

FIG. 1*c* is a front elevation of the block of FIG. 1*a;*

FIG. 1*d* is a cross-sectional view of the wall of FIG. 1 taken along the 1d plane therein;

FIG. 1*e* is a isometric view of a pin used in the wall of FIG. 1;

FIG. 2 is an isometric view of a form assembly having the inventive pinned joint;

FIG. 2*a* is a front elevation of a panel body used in the form assembly of FIG. 2;

FIG. 2*b* is a plan view of the panel body of FIG. 2*a;*

FIG. 2*c* and 2*d* are opposite end elevations of the panel body of FIG. 2*a;*

FIG. 3 is a plan view of the form assembly of FIG. 2;

FIG. 3*a* is a fragmentary cross-sectional end elevational view of the form assembly of FIG. 3 taken along the line 3*a*—3*a* thereof;

FIG. 3*b* is a fragmentary, cross-sectional plan view of the form assembly of FIG. 3*a* taken along the line 3*b*—3*b* thereof;

FIG. 3*c* is a fragmentary, cross-sectional side elevational view of the form assembly of FIG. 3*a* taken along the line of 3*c*—3*c thereof;*

FIG. 3*e* is an isometric view of a tying device used in the form assembly of FIG. 3;

FIG. 3*d* is an isometric view of a pin used in the form assembly of FIG. 3;

FIG. 4 is an isometric view of float parts using the inventive joint and shown as dis-assembled;

FIG. 4*a* is a plan view of four of the float parts of FIG. 4 assembled according to the invention;

FIG. 5 is a fragmentary plan view of an alternate version of the inventive joint in a block wall construction;

FIGS. 6 – 13 are partially schematic, fragmentary plan views of alternative versions of the inventive joint with FIG. 8*a* showing a locking member for the joint of FIG. 8; FIG. 11*a* showing a locking member for the joint of FIG. 11; FIGS. 12*a* and 12*b* showing end elevations of the blocks of the joint of FIG. 12; and FIGS. 13*a* through c showing locking members for the joint of FIG. 13;

FIG. 14 is a top view of a body usable in the inventive joint;

FIGS. 14*a* and 14*b* are respective plan views of front and back portions of the body of FIG. 14;

FIG. 15 is a top view of a body usable in the inventive joint;

FIG. 15*a* is a plan view of the back portion of the body of FIG. 15;

FIG. 16 is a top view of a body usable in the inventive joint;

FIGS. 16*a* and 16*b* are respective plan and end elevation views of the back portion of the body of FIG. 16;

FIG. 17 is a partially schematic, fragmentary view of a form assembly of pinned bodies according to the invention;

FIG. 18 is an isometric view of a clip for use in construction with the inventive joint;

FIG. 19 is a plan view of an expansion joint between either individual bodies or bodies in a wall;

FIG. 20 is a plan view of a sealed expansion joint;

FIG. 21 is a plan view of an alternative expansion joint;

FIG. 22 is a plan view of an expansion joint in a wall made with forms.

FIG. 23 is a fragmentary, cut-away, end elevation of a preferred anchoring clip between forms for a wall;

FIG. 24 is a plan view of an accessory attached to a pinned joint either between individual bodies or bodies in a wall;

FIG. 25 is a plan view of another accessory attached to a pinned joint in a wall;

FIG. 26 is a perspective view of a preferred embodiment of an accessory for attachment to a pinned joint in a wall;

FIG. 27 is a perspective view of the accessory of FIG. 26 pinned in place against a wall;

FIG. 28 is a plan view of an alternative accessory attcachment covering a pinned joint;

FIG. 29 is a section view of another accessory secured to a pinned joint in a wall to support a partition panel;

FIG. 30 is a plan view of another accessory secured to a pinned joint in a wall to support forms for an adjoining wall;

FIG. 31 is a plan view of another accessory attachment to a pinned joint in a wall;

FIG. 32 is a fragmentary, elevational view of a block having screw-threaded recesses to fit a screw-threaded locking pin;

FIG. 33 is cut-away, elevational view of a wall having a screw-threaded joint slot and a screw pin locking member;

FIG. 34 is a perspective view of the top of a locking pin for pinning the joints of a wall and supporting a structure resting atop the wall;

FIG. 35 is a plan view of two bodies shaped to form a corner joint;

FIG. 36 is a plan view of the bodies of FIG. 35 assembled in a corner joint;

FIG. 37 is a plan view of three walls pinned together with a junction body;

FIG. 38 is a plan view of another junction body for pinned joints;

FIG. 39 is an end elevation of a block for use in building exterior walls; and

FIGS. 40 and 41 are cut-away, elevational views of alternative interior clips for securing together courses of blocks pinned together.

DETAILED DESCRIPTION

FIG. 1 shows a wall section containing two pairs of identical blocks 10–11 and 12–13 fitted together with the inventive pinned joints. Each of the blocks 10–13 is molded of concrete in a simple, two-part mold separating along a central parting plane extending longitudinal of the block and through the center of the joinable edges. Of course, blocks 10 - 13 can be formed of many moldable materials other than concrete. As best shown in FIGS. 1*a* – 1*c* illustrating block 11, projections 14 – 21 extend from the ends of block 11 alternately on opposite sides of such longitudinal central parting region. Projections 14 – 17 are complementary to projections 18 – 21 so that duplicates of block 11 can be fitted together end-to-end with projections 14 – 17 overlapping and interlocking with projections 18 – 21 as illustrated in FIG. 1.

With such an arrangement, inward facing surfaces 22 and 23 of projections 14 and 16 at one end of block 11 are arranged to confront and engage the inward facing surfaces 24 and 25 of projections 19 and 21 of an adjoining block 11. Similarly, surfaces 26 and 27 of projections 15 and 17 confront and engage surfaces 28 and 29 of projections 18 and 20 of an adjoining block 11. This produces a solid interlock against lateral or bending stress.

Confronting surfaces 22 – 29 each have a pair of recesses 30 that are aligned through projections 14 – 17 and 18 – 21 to form slots extending transversely across the joinable edges of block 11. Since confronting surfaces 22 – 29 lie on the parting region for the mold forming block 11, recess slots 30 are readily formed in the molding process in each of the block surfaces 22 – 29. Slots 30 allot a longitudinal interlock as described below.

The joint is assembled as best shown in FIGS. 1 and 1*d*. For example, block 10, which is a duplicate of block 11, is fitted in interlocking relation with block 11 as illustrated. This is accomplished by sliding blocks 10 and 11 endwise toward each other so that confronting surfaces 22 – 29 slide over each other and into engagement with each other in a common parting plane. This brings recess slots 30 in each block into registering alignment. Then pins 31 are placed in slots 30 to lock blocks 10 and 11 together. Slots 30 and pins 31 extend out beyond each side of the common parting plane between confronting surfaces 22 – 29 and prevent separation of blocks 10 and 11 which cannot be forced apart without shearing pins 31 in half or breaking projections 14 – 21.

The assembled joints between blocks 10 – 11 and 12 – 13 are shown in FIG. 1*d* where projections 14 – 17 of block 10 are identified by section lines that slope upward to the right and projections 18 – 21 of block 11 are identified by section lines that slope upward to the left. The interlocking and pinning of projections 14 – 21 prevents any lateral or longitudinal motion of blocks 10 – 13, and forms tight and secure pinned joints between blocks 10 – 13, to form a rigid and strong wall. At the same time, blocks 10 – 13 are easily molded in simple two-part molds not requiring any removable rods because recesses 30 are half-formed in the confronting surface of 14 – 21. Molding is thus economical, labor involves merely fitting blocks 10 – 13 together and placing pins 31 in slots 30.

Pins 31 have half-lap notches 32 so that they interlock in between superposed courses of blocks. Some of the pins 31 can be made long enough to extend through two or more courses of blocks if desired.

The outside surfaces of blocks 10 – 13 are formed in an alternate convex and concave pattern for aesthetic purposes and to help conceal the joint between blocks. Many other patterns are available for such a purpose, and outside surfaces can be left plain.

The wall form assembly 34 as shown in FIG. 2 is formed of similar panel bodies 35 that are pinned together according to the invention to make two spaced forms that are filled with a bonding material such as concrete. As best shown in FIGS. 2*a* – 2*d*, bodies 35 have alternate projections 36 lying on opposite sides of a parting region and having confronting surfaces 37 that engage in a common parting region when panels 35 are fitted together to align recesses 38 in continuous slots for receiving pins 39 (FIGS. 3*d* and 1*e*). FIG. 2*c* shows the left end 40 of panel 35, and FIG. 2*d* shows the right end 41 of panel 35 as illustrated in FIGS. 2*a* and 2*b*. The outer face 42 of bodies 35 is formed with convex segments to conceal joints and improve the appearances of the wall.

Form assembly 34 is intended to become a permanent part of the resulting wall when the space between the forms is filled with a bonding material such as concrete. To facilitate this bodies 35 are preferably formed of a material giving a durable outer surface and an attractive inner surface to the resulting wall. Also, form assembly 34 is preferably built to include insulation where desired, and ducts and conduits for wiring, heating, plumbing, air conditioning, etc.

As best shown in FIGS. 3 – 3*e*, form assembly 34 is tied together with brackets 43 that include a tie rod 44 extending between bodies 35 to connect the two sides of the form assembly 34, and T-bars 45 at the ends of tie-rods 44 having holes 46 to receive pins 39. T-bars 45 fit into slots 47 molded into bodies 35 so that tension on tie-rods 44 from a filling material inside the form assembly is transmitted to pins 39 and to panels

35 to hold form assembly 34 together. Clips 48 extend upward from T-bars 45 and have inturned tabs 49 with holes 50 to extend into a slot 47 in a superposed panel 35. Pins 39 extend through holes 50 and 46 to lock tabs 49 into bodies 35 so that clips 48 vertically bridge a joint between bodies 35 and hold superposed courses of panels 35 together to prevent any floating of the courses when the form assembly 34 is filled. An alternative clip 51 as shown in FIG. 18 has inturned tabs 52 with holes 53 arranged so that tabs 52 can be fitted into superposed slots 47 and held in place by pins 39 through holes 53 for bridging and tying together superposed courses of blocks 35. The inventive pinned joint allows clips 51 or brackets 43 to be invisibly anchored in the wall without requiring any finishing.

FIGS. 4 and 4a show a float assembly 54 made of four molded sections 55 fitted together with the inventive pinned joint. Float 54 is formed of a lightweight material such as foamed resin and is used for floating a device on water. Manufacturing and shipping economy of float 54 are greatly enhanced by four separate sections 55 that are easily assembled and pinned according to the invention.

This is accomplished by molding alternate projections 56 having confronting surfaces 57 lying on opposite sides of a common parting plane and formed in a simple, two-part mold separating along such common parting plane. Recesses 54 are formed in each of the confronting surfaces 57 to form a continuous, linear slot when projections 56 are fitted together as shown in FIG. 4*a*. A pin 59 inserted into slot 58 secures sections 55 together, and the complete assembly 54 is made secure and strong by four pins 59, or two of such pins made long enough to extend all the way across float 54.

Several alternative joint configurations are shown in FIGS. 5 – 13. Concrete blocks 60 of FIG. 5 are similar to blocks 19 – 13 of FIG. 1, and have alternate, interlocking projections 61 at their ends as previously described, but projections 61 have relatively deep and large recesses 62. The large size of recesses 62 helps lighten the weight of blocks 60 and allows convenient pinning together of blocks 60 with a two-by-four pin 64, or by concrete poured into recess 62. Pin 64 or a poured concrete locking member need not fill the entire recess 62 so long as it overlaps the common parting plane between blocks 60.

FIGS. 6 – 13 show several workable configurations for alternating projections at the joinable edges of pairs of blocks shown as matable fragments. All of these joints function as previously described, and only the differences will be pointed out.

The common parting region 65 of the blocks of FIG. 6 is oblique to the general plane of such blocks to form projections 66 that are generally dove-tail shaped as illustrated. Projections 66 are slid together along oblique parting regions 65 until recesses 67 register to form a slot that is pinned as described above.

The joinable edges of the blocks of FIG. 7 have recesses 68 that lie entirely on one side of common parting plane 69 between projections 70. This means that only one-half of the projections 70 on each of the blocks has a recess 68, but since the recessed projections 70 alternate between the blocks, a pin in slot 68 nevertheless locks the blocks securely together.

The projections 71 of the blocks of FIG. 8 have a pair of recesses 72 that are spaced apart, and the confronting surfaces 73 of projections 71 are also spaced apart between recesses 72 to form a connecting channel between recesses 72. An irregular shaped locking member 74 such as shown in FIG. 8*a* is fitted between projections 71 to fill recesses 72 and the space between confronting surfaces 73 to lock the joint closed.

The common parting region 75 between projections 76 and 77 of the blocks of FIG. 9 is offset as illustrated so that projections 76 are thicker than projections 77. This makes projections 76 stronger and able to bear a greater stress load. Such an arrangement is especially advantageous in form assemblies such as shown in FIGS. 2 and 3 where the interior portion of each half of the form bears a much greater load than the exterior portion.

The recess 78 between projections 79 of the blocks of FIG. 10 is set further from the end of one block than another so that projections 79 have unequal extensions beyond recesses 78.

The confronting surfaces 80 of projections 81 of the blocks of FIG. 11 are spaced apart to form a long, narrow slot extending on either side of recesses 82. A sheet-like locking member 83 as shown in FIG. 11a has central ridges 84 so that it can be inserted between projections 81 to fill recess 82 and the space between confronting surfaces 80 to lock the joint. Locking member 83 can be formed of extruded plastic or other material suitable for sealing the joint against penetration by fluids.

The confronting surfaces 85 and 86 of projections 87 and 88 of the blocks of FIG. 12 lie on parallel planes that are alternately offset or spaced apart along the common parting region between the blocks. Relatively thinner projections 88 on one block are spaced apart by the distance between parting planes 85 and 86 of the common parting region, and relatively thicker projections 87 on the other block overlap parting planes 85 and 86. Recess 89 is preferably wide enough to extend beyond each parting plate 85 and 86 so that a locking member filling recess 89 extends beyond both confronting surfaces 85 and 86. An end elevation of projections 87 is shown in FIG. 12*a* and an end elevation of projections 88 is shown in FIG. 12*b*.

The blocks of FIG. 13 are similar to the blocks of FIG. 11 with spaced-apart confronting surfaces 90, but twin recesses 91 are formed between projections 92 and given generally diamond shapes. This allows locking members 93, 94, or 95, with extruded, rolled or stamped corrugations 96 to be inserted into recesses 91 and the space between confronting surfaces 90 to lock the joint. Rods 97 can be added as shown in FIG. 13*c*. Locking members 93 – 95 are similar to locking member 83 of FIG. 11*a* in providing a barrier or seal through the assembled joint.

Bodies to be joined according to the invention need not be molded, but can also be formed in two parts as shown in FIGS. 14 – 16. Two-part construction of each body is especially feasible for making form assemblies such as shown in FIGS. 2 and 3 where an interior part of each form section is buried in the final wall, and only one exterior facing surface is exposed. Also, in such form assemblies, the inner facing portion of each block bears a far greater load than the exterior facing portion so that it is feasible to form each block of two parts with a strong and rugged inner facing portion that is not attractive, and a weaker but more attractive external facing portion. Such an arrangement is shown in body 100 of FIG. 14 having a relatively thick and strong inner

facing panel **101**, and a relatively thin and weaker outer facing panel **102**. Panels **102** and **101** are shown in plan view in FIGS. **14***a* and **14***b* and if such panels are overlaid as illustrated, secured together in any convenient way, and then turned on edge, they form body **100** as shown in FIG. **14**. Exterior facing panel **102** can be relatively tough, durable, and attractive veneer, and interior facing panel **101** is preferably formed of a material that is cheap and strong. Alternating projections have recesses for pinning bodies **100** together according to the invention.

Exterior facing panel **102** is also applied to the different interior facing panels of bodies **103** and **104** shown respectively in FIGS. **15** and **16**. The interior facing panel of body **103** is formed of boards **105** that are longitudinally offset and secured together along their edges with an additional backing panel **106** overlying boards **105** and adding to their strength strength. panel **107** of body **104** is formed of a steel stamping having stiffening ridges or corrugations **108** as illustrated to enhance the longitudinal strength of body **104**. Exterior facing panel **102** can be secured to any of the interior, backing panels by any convenient means such as fasteners, cement, welding, fusion, etc.

The form assembly of FIG. **17** schematically illustrates some of the additional construction features that can be combined with the inventive pinned joint. An exterior veneer panel **109** is secured to the exterior face of bodies **110** that are pinned together according to the invention by pin **111** to form an outer portion of the wall. A tie rod **112** anchored in place by pin **111** extends through the wall to inner bodies **113** that are pinned together by pin **114** anchoring the inner end of tie rod **112** in place. The interior facing surface of bodies **110** carry insulation material **115** which can also be assembled with the inventive pinned joint if desired. The space between insulation **115** and bodies **113** is used for building utilities such as heat conduit **116**, electrical conduit **117**, and plumbing conduit **118**. Conduits **116 – 118** are buried securely in the resulting wall when the space between insulation **115** and bodies **113** is filled with a bonding material. An interior veneer **119** is formed on bodies **113** to finish off the inside of the resulting wall.

FIGS. **19 – 22** show several forms of expansion joints made with the inventive pinned joint. Expansion joints are readily made by elongating or widening the slot that receives the locking member, so that the bodies joined together have limited relative movement along the common parting region because the locking member is not as wide as the slot.

As shown in FIG. **19**, bodies **125** and **126** are pinned together by a locking pin **127** held in elongated recesses **128** and **129**. Recesses **128** and **129** are wide enough in the direction of relative motion along the common parting region between bodies **125** and **126**, so that projections **130** and **131** on body **125** can move relative to projections **132** and **133** of body **126** to close or narrow the locking slots until they engage locking pin **127**. Such relative motion is indicated by the arrows showing that the joint of FIG. **19** can expand and contract freely. From the position illustrated in FIG. **19**, bodies **125** and **126** can move closer together to full abutment of projections **130 – 133** and full registration of recesses **128** and **129**, or slightly farther apart to firm engagement of both recesses **128** and **129** with locking pin **127**.

Preferably, locking pin **127** is made cylindrical for rolling engagement in recesses **128** and **129** to facilitate relative motion between the joined blocks. The joint of FIG. **19** can be made between individual bodies **125** and **126**, or between bodies or panels extending upward or superposed to form a wall.

FIG. **21** shows a similar expansion joint between bodies **135** and **136**, using a combination of somewhat elongated recesses **137** and **138** joined with a resilient locking member **139** that is deformable as illustrated to allow bodies **135** and **136** to separate slightly. Locking member **139** can be an elastomeric, solid cylinder or resilient tube.

The expansion joint of FIG. **20** is similar to the joint of FIG. **19** except that it includes a seal **140** arranged between the confronting surfaces of projections **141** and **142**. Seal **140** is preferably formed as a sleeve that lies nearly flat between projections **141** and **142**, with locking member **143** enclosed in sleeve **140** and lying in the recesses in projections **141** and **142**. To seal a joint in a wall, sleeve **140** preferably extends vertically between the confronting surfaces of all the projections from top to bottom of the wall and encloses a preferably cylindrical locking member **143** which moves inside sleeve **140** to accommodate expansion and contraction motion between the joined bodies of the wall. Seal **140** can also be formed as a generally flat sheet extending between the confronting surfaces of projections **141** and **142** and passing along one side of locking member **143**. Also, seal **140** can be made of a pair of flat sheets straddling locking member **143**, and this would be the equivalent of the illustrated sleeve with the edges slit. Furthermore, various arrangements can be made for securing seal **140** in place

FIG. **22** shows an expansion joint formed in a wall made of forms **144** and **145** filled with a filler material **146**. Selected opposed joints in forms **144** and **145** have elongated slots **147** and **148** so that forms **144** and **145** can move relative to locking pins **149** and **150**. Filler material **146** is interrupted between the expansion joints by an air space or expandable material **151** allowing expansion and contraction of the wall. The expansion space **151** can also be elongated to enclose a steel or other vertical support beam extending upward through the wall. Also, space enclosure **151** can support sleeved dowels **215** as preferred for expansion joints.

FIG. **23** shows another cross-bracing arrangement between forms **152** and **153** similar in effect to the cross-bracing shown in FIGS. **3 – 3***c*. Cross-brace **154** is generally X-shaped as illustrated with its free ends interlocking with locking pins **155** and **156** to hold forms **152** and **153** and their respective block courses securely in place. Cross-brace **154** can be conveniently cut and shaped from a single piece of metal with no waste, and preferably has stiffening ridges or grooves.

Pins **155** and **156** need not pass from top to bottom through forms **152** and **153** to traverse all the courses of the wall. One convenient construction uses relatively short pins spanning only a single course until several courses are built up, then one long pin is driven down through the courses next to the shorter pins to strengthen the assembly.

FIGS. **24– 31** show several accessories that can be interlocked with the inventive pinned joint for various purposes as described below. Such accessories have tabs that fit between the projections of joined bodies

and extend outward away from the common parting regions of the bodies to support some structure alongside the joint.

The accessory of FIG. **24** is formed as a box **157** having tabs **158** that extend around the ends of projections **159** of bodies **160** and have hook ends **161** hooked around the ends of prrjections **159** and lying in the common parting region between bodies **160.** This holds box **157** close against the outside of the assembled joint.

Box **157** is filled with a filler material **162** such as concrete to form a strengthening member alongside the joint between bodies **160.** With bodies **160** superposed to form a vertical wall, box **157** preferably extends vertically on one face of the wall, so that when filled with material **162,** it forms a pilaster strengthening the wall and helping to support a roof, beams, etc. Box **157** can also be left unfilled to serve as a conduit for utilities such as electric wiring, plumbing, or heating or air-conditioning ducts.

Box **157** is preferably formed as shown in FIG. **26** with tabs **158** alternating vertically to extend around the ends of alternate projections of blocks to be joined together in a wall. Box **157** can be the same width as the joint as shown in FIG. **26,** wider than the joint, as shown in FIG. **24,** or any other desired width.

The assembly of box **157** with blocks **160** in a wall, is best shown in FIG. **27.** Box **157** can conceal or weatherproof the joint, serve as a pilaster or load support as mentioned above, or can be used or adapted to connect other structures to the wall. It can be formed of various materials including metal and plastics.

FIG. **25** shows an alternative accessory **163** formed as a flat board or batten concealing the joint in a wall, and making the joint area flush with panels **164** covering the main bodies of blocks **165** of the wall. Blocks **165** have molded projections for joining together according to the invention, and panels **164** are secured only over the main bodies of blocks **165,** without covering the joint areas. This is convenient because panels **164** can then be made in a simple, rectangular shape. Then batten or joint-covering board **163** is secured to blocks **165** to cover the joint area and fill the space between panels **164.** Board **163** is preferably held in place by tabs **158** as described above.

Accessory **166** of FIG. **28** is a similar batten board secured over the joint area between blocks **167.** Board **166** covers, conceals and weatherproofs the joint between blocks **167,** but instead of being held in place by tabs **158,** it is secured to blocks **157** by tabs **168** that are flat and horizontal to fit between courses or projections of blocks **167.** Each tab **168** has a hole **169** registered with the slot in the joint between blocks **167** to receive the same locking member that pins blocks **167** together. Tab **168** is then securely anchored in the joint by an interlock with the joint pin to hold board **166** securely in place.

The accessory of FIG. **29** is formed as a channel **170** receiving the end of a structure **171** such as a beam, partition wall, stair tread, etc. Channel **170** is secured to the projections of blocks **172** by tabs **158** as previously described, or can use horizontal tabs **168** as shown in FIG. **28.** Channel **170** also supports reinforcing rods **173** extending along the face of the wall formed by blocks **172** to hold and interlock a covering and strengthening material **174** against the face of wall **172.** For example, blocks **172** could form the core of a wall with accessory **170** supporting reinforcing rods **173** which interlock a sprayed-on coating **174** of plaster or concrete to blocks **172** to strengthen and cover the resulting wall.

FIG. **31** shows a similar arrangement for an accessory box **175** secured to wall blocks **176** by tabs **168** that can be struck out of one wall of box **175,** or welded on as extra pieces. Tabs **168** interlock with locking pin **177** as described above, either by means of the illustrated hole in tabs **168,** or by hooks or notches hooking around pin **177.** Also, tabs **168** can hook over the confronting interior faces of the projectoons of blocks **176** to hold box **175** in place. Box **175** can be filled to form a pilaster as described above, or can serve as a conduit or other support. Box **175** also supports reinforcing screen **178** so that a strengthening or coating material can be secured to blocks **176.** One advantage in such an arrangement is that blocks **176** can be formed of a lightweight, weak, insulator material that is easily molded and assembled, such as expanded polyurethane or polystyrene, and, a coating of concrete or other material can be readily secured to reinforcing screen **178** to strengthen, beautify, or improve the wall around core blocks **176.**

The accessory of FIG. **30** connects to wall blocks **210** and **211** by tabs **168** interlocked with pins **212** and supports a channel **213** having a pair of pinned joints to receive forms **214** for an adjoining wall. The accessory of FIG. **30** could also use a single pinned joint to receive the end blocks of a wall or some other structure joinable to blocks **210** and **211.**

The molding of recesses in bodies for pinning together according to the invention preferably results in molding one-half of the recess into each of the alternate projections of the bodies to be joined. If the ultimate slot formed by the joined bodies is cylindrical as often preferred, the recess molded into each projection is semi-cylindrical. This allows each recess to be molded with a screw thread with no special problem, and no substantial additional molding expense. Then the locking member can be a screw-threaded pin that is screwed into the slot formed in the joined bodies. This has many advantages in screw-threading blocks together, screwing the blocks to footings, or screwing supported beams or trusses to the blocks.

FIG. **32** best shows screw-thread recesses **179** formed in the projections **180** of a block **181** to receive a screw-threaded locking pin **182.** Mating threads are formed in the recesses of an adjoining block so that pin **182** can be screwed down through the joint between blocks **181** as best shown in FIG. **33.** The alternate projections **180** of pairs of superposed and joined blocks **181** are screwed together by locking pin **182** that is screwed down through blocks **181** from top to bottom.

If such a long screw is undesirable, only selected projections **180** need have screw threads so that pin **182** need be screwed no further than desired. For example, as shown in FIG. **33,** pin **182** is screwed into a threaded hole in footing **183** supporting blocks **181.** It may be desirable to establish a screw-thread connection between the bottom blocks **181** and footing **183,** but unnecessary to screw superposed blocks **181** together. To accomplish this, only the lowermost projections **180** of the bottom blocks **181** need be provided with screw threads, and only the lower end of rod **182** need be threaded to screw the bottom blocks **181** to footing **183.**

A beam or truss **184** rests atop the uppermost blocks **181** as illustrated in FIG. **33**, and is conveniently secured to blocks **181** by a nut **185** screwed to the top of pin **182**. Pin **182** can also be screwed into beam **184**, and many connections can be made between blocks, locking pins, and accessories attached to blocks or locking pins once the readily moldable screw-thread recesses are available.

FIG. **34** shows a support channel **186** formed at the upper end of a locking pin **187** to support a beam, truss, or other structure on top of a wall. If pin **187** is made strong enough, it can serve not only to lock together the bodies in a wall, but it can support a channel **186**, or a plate, box, or other securing means for attaching beams, trusses, rafters, or other structures to the top of a wall.

FIGS. **35** and **36** show a preferred corner joint formed according to the invention. Bodies **188** and **189** are oriented at an angle to each other such as the illustrated 90° angle to form a corner, and their ends are formed with alternating projections **190** that slide together along a common parting region **191**. Projections **190** are formed with recesses **192** to receive a locking pin **193** when the joint is assembled as illustrated in FIG. **36**. The common parting plane **191** for sliding bodies **188** and **189** together is preferably normal to the bisector of the angle between bodies **188** and **189** as illustrated. However, any desired angle between bodies **188** and **189** can be used, and if unequal projections **190** are tolerable, the parting region between projections **190** can be somewhat off the bisector of the angle between bodies **188** and **189**.

The joint of FIGS. **35** and **36** is useful not only in making corners in walls and other constructions, but can be applied to furniture, toys, coffins, telephone booths, and various other box constructions, especially where panels can be shipped flat and assembled at the site of use. With some of these it is advantageous to use the screw thread joint of FIGS. **32** and **33** to secure the box or joined body to another structure such as a support.

FIG. **37** shows a junction body **194** interconnecting several bodies **195** – **197** at desired angles by using the inventive pinned joint. Junction body **194** has a plurality of projections **198** set at the desired angles to receive bodies **195** – **197** for inter-connection. Two, three, four or more bodies can be joined together by a junction body of suitable shape as is suggested by junction body **199** of FIG. **38** having four sets of projections **200** for inter-connecting four bodies at right angles to each other. Other angles between joined bodies can be used as desired.

Block **200** of FIG. **39** has its alternate projections **201** formed with upper surfaces **203** that slope downward away from common parting plane **202**. This helps provide drainage of moisture from the center of the block toward the outside, and makes block **200** somewhat more weatherproof and suitable for outside wall constructions where liquid drainage is a problem.

Blocks **204** of FIGS. **40** and **41** are laid in superposed courses in a wall or form. To prevent one course from floating above another or separating for any reason, a clip **205** spans the course line between blocks **204** and hooks over a projection **206** on the upper block **204**, and under a projection **206** on the bottom block **204**. The common parting plane for blocks **204** has clearance for clip **205** so that it can be fitted in place where it is invisible inside the finished wall. Clip **207** of FIG. **41** serves the same purposes in a similar way except that it is U-shaped instead of S-shaped. Clips **205** and **207** can be lengthened to span several course lines, or can interlock with more than two projections if desired.

The inventive joint can be formed of many materials and can be used in many circumstances where a pinned joint is desired between two bodies. The size, shape and proportion of projections, slots, pins, and other locking members can vary widely within the scope of the invention, and many different surface patterns and textures can be used.

Persons wishing to practice the invention should remember that other embodiments and variations can be adapted to particular circumstances. Even though one point of view is necessarily chosen in describing and defining the invention, this should not inhibit broader or related embodiments going beyond the semantic orientation of this application but falling within the spirit of the invention. For example, those skilled in the art will understand how to adapt the inventive joint to many particular circumstances, and will be able to apply the invention to many materials, uses and environments.

The inventive joint has been described as applied to walls, building blocks, form panels and floats and yet the joint has many other uses. For example, the inventive joints could be made for attachment to structural panels and parts that are assembled by other means, with the joints used to connect such structural parts. Modular sections of building walls formed of two-by-fours, panelling, and the like, could have strips of the inventive joint material attached to their edges for connecting such modules together.

The inventive joint can be formed around inside or outside corners, between vertical and horizontal members, and can be set at any convenient orientation. Parts to be joined can be formed of different materials, and the joint can be arranged to connect wall sections with door and window frames and other components. Shiplap joints such as illustrated in FIGS. **2** – **2***d*, and other known panel configurations can be combined with blocks or bodies connected by the inventive joint.

I claim:

1. A pinned joint for connecting two bodies, said joint comprising:

a. the joinable edges of each of said bodies having projections arranged alternately on opposite sides of a parting region;

b. said projections on said respective joinable edges being arranged in complementary orientation so said bodies can be fitted together by a relative movement that slides said parting regions together in a common parting region between confronting surfaces of said alternate projections;

c. said projections having recesses in said confronting surfaces;

d. said recesses being aligned in said fitted-together relationship of said bodies to form a slot extending along said common parting region transversely to the direction of said relative movement; and

e. a locking member placed into said slot to prevent separation of said bodies.

2. The joint of claim **1** wherein said locking member is a pin.

3. The joint of claim **1** wherein said slot is linear and said locking member is a straight pin.

4. The joint of claim 1 wherein said locking member substantially fills said slot.

5. The joint of claim 1 wherein said projections have substantially the same thickness on each side of said common parting region.

6. The joint of claim 1 wherein said projections on one side of said common parting region are thinner than said projections on the other side of said common parting region.

7. The joint of claim 1 wherein said common parting region is oblique to the general plane of said bodies.

8. The joint of claim 1 including a plurality of said slots and a plurality of said locking members in said slots.

9. The joint of claim 1 wherein said bodies are formed in a two-part mold separating along said parting regions.

10. The joint of claim 1 wherein said recesses are formed in said confronting surfaces on one side of said common parting region.

11. The joint of claim 1 wherein said recesses are formed in said confronting surfaces on each side of said common parting region, and said locking member extends beyond each side of said common parting region.

12. The joint of claim 1 wherein said confronting surfaces engage each other in said common parting region.

13. The joint of claim 1 wherein said confronting surfaces are spaced apart, and said locking member fills said slot and said space between said confronting surfaces.

14. The joint of claim 1 wherein said confronting surfaces lie on parallel planes alternately offset relative to each other.

15. The joint of claim 1 wherein said common parting region is generally plane.

16. The joint of claim 15 wherein said confronting surfaces are spaced apart and lie in a pair of parallel planes, and said locking member fills said slot and said space between said confronting surfaces.

17. The joint of claim 15 wherein said confronting surfaces engage in said plane.

18. The joint of claim 17 wherein said recesses are formed in said confronting surfaces on each side of said plane, and said locking member extends on each side of said plane.

19. The joint of claim 18 wherein said bodies are formed in a two-part mold separating along said parting regions.

20. The joint of claim 1 including a pair of said slots, said confronting surfaces being spaced apart in the region between said slots, and said locking member filling said slots and said space between said slots.

21. A wall formed of a plurality of said bodies joined with the pinned joint of claim 1.

22. The wall of claim 21 wherein said bodies are arranged in superposed courses.

23. The wall of claim 22 wherein a plurality of said locking members placed between said bodies are arranged to extend vertically between said superposed courses.

24. The wall of claim 22 wherein said superposed courses are tied together by clips extending between said bodies at vertically spaced locations and anchored in place by said locking members.

25. The wall of claim 22 wherein said bodies are formed in a two-part mold separating along said parting regions.

26. A wall formed of a pair of spaced-apart and connected forms each of which comprises a plurality of said bodies joined with the pinned joint of claim 1, and a material filling the space between said forms and bonding said forms together.

27. The wall of claim 26 wherein said connection between said forms comprises ties extending between said bodies and across the space between said forms.

28. The wall of claim 27 wherein said ties are anchored between said bodies by said locking members.

29. The wall of claim 26 wherein said bodies are arranged in superposed courses.

30. The wall of claim 29 wherein a plurality of said locking members placed between said bodies are arranged to extend vertically between said superposed courses.

31. The wall of claim 29 wherein said connection between said forms comprises ties extending between said bodies and across said space between said forms, said ties being anchored between said bodies by said locking members.

32. The wall of claim 26 wherein said projections on the inside of said forms are thicker than said projections on the outside of said forms.

33. The wall of claim 26 wherein said bodies are formed of backing plates arranged on the inside of said forms and face plates arranged on the outside of said forms.

34. The wall of claim 26 wherein said filling material is concrete.

35. The joint of claim 1 wherein said slot is wider than said locking member in the direction of said relative movement so said bodies can move a limited amount relative to said locking member to provide an expansion joint.

36. The joint of claim 35 wherein said locking member is cylindrical for rolling in said slot.

37. The joint of claim 35 wherein said confronting surfaces are spaced apart, a sleeve extends across said common parting region between said confronting surfaces, and said locking member is inside said sleeve.

38. The joint of claim 35 wherein said confronting surfaces are spaced apart, and a sealing member is arranged between said confronting surfaces.

39. The joint of claim 1 wherein said bodies are angled to each other and said common parting region is approximately normal to the bisector of the angle between said bodies.

40. The joint of claim 1 wherein the upper surfaces of said projections slope downward from said common parting region.

41. The joint of claim 1 including an accessory interlocked with said joint and extending outward from said bodies away from said common parting region.

42. The joint of claim 41 wherein said accessory has tabs interlocked with said projections.

43. The joint of claim 41 wherein said accessory has a tab interlocked with said locking member.

44. The joint of claim 41 wherein said accessory overlies the outside of said joint.

45. The joint of claim 1 wherein said recesses have a screw thread, and said locking member has a mating screw thread for screwing into said slot.

46. The wall of claim 22 wherein said slot in superposed bodies is wider than said locking member in the direction of said relative movement to superposed pairs of said bodies can move a limited amount relative to

said locking member to provide an expansion joint in said wall.

47. The wall of claim 46 wherein said locking member is cylindrical for rolling in said slot.

48. The wall of claim 46 wherein said confronting surfaces of said superposed bodies are spaced apart, and a sealing member is arranged between said confronting surfaces to seal said expansion joint in said wall.

49. The wall of claim 22 including an accessory interlocked with superposed joints between said bodies and extending outward along a face of said wall.

50. The wall of claim 49 wherein said accessory has tabs interlocked with said projections.

51. The wall of claim 49 wherein said accessory has a tab interlocked with said locking member.

52. The wall of claim 49 wherein said accessory overlies the outside of said joint.

53. The wall of claim 49 wherein said accessory includes a vertical channel adjacent said wall and filled with a construction material to form a pilaster.

54. The wall of claim 49 wherein said accessory includes means for interlocking with another wall structure adjacent said wall.

55. The wall of claim 49 wherein said accessory includes a hollow body serving as a conduit.

56. The wall of claim 21 including a junction body having at least two sets of said projections at angles to each other to establish an angle between the one of said bodies joined to said junction body.

57. The wall of claim 21 wherein at least some of said recesses have screw threads, and said locking members have mating screw threads screwed into said slots.

58. The wall of claim 57 including a footing for said wall, and wherein said locking members are screwed into said footing.

59. The wall of claim 57 including a structure arranged on said wall and secured to said locking member for connection to said wall.

60. The wall of claim 22 wherein said slots through said superposed courses are screw-threaded and said locking members are screwed into said slots to hold said courses together.

61. The wall of claim 22 including a clip arranged in said common parting region and interlocking with said projections in said superposed courses to hold said courses together.

62. The wall of claim 22 including a structure on said wall secured to said locking member for connection to said wall.

63. The wall of claim 26 wherein opposite joints in said forms have said slots formed wider than said locking member in said relative movement, and said filling material between said opposite joints is arranged to allow the bodies of said forms to move a limited amount relative to said locking members in said opposite joints to provide an expansion joint in said wall.

64. The wall of claim 26 including an accessory interlocked with a joint in one of said forms, and extending outward along a face of said wall.

65. The wall of claim 31 wherein said ties are generally X-shaped.

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