

Nov. 1, 1927.

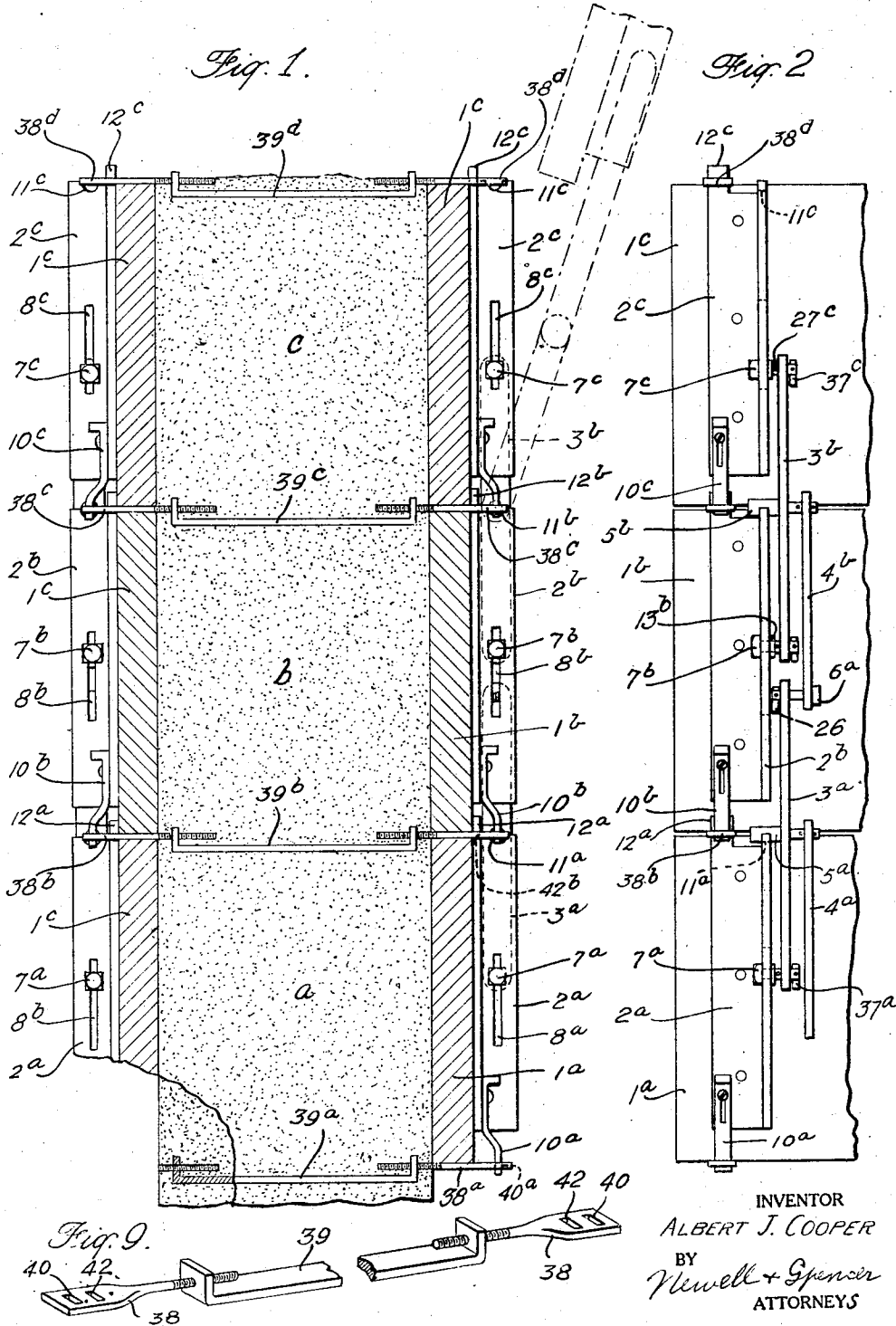
1,647,685

A. J. COOPER

CONCRETE WALL BOXING

Original Filed Aug. 25, 1925

5 Sheets-Sheet 1



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CONCRETE WALL BOXING

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5 Sheets-Sheet 2

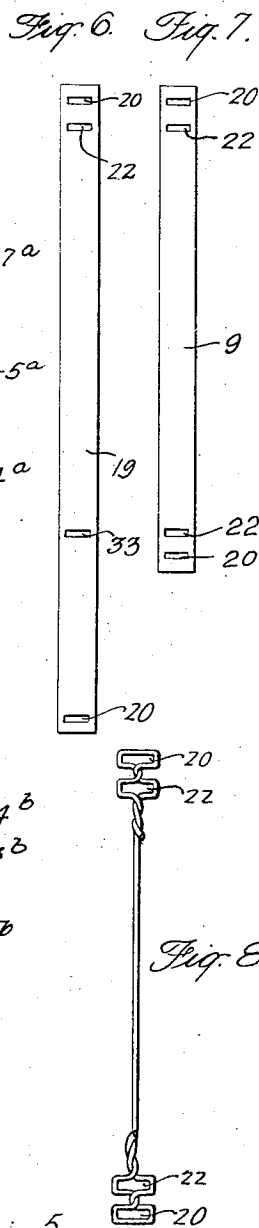
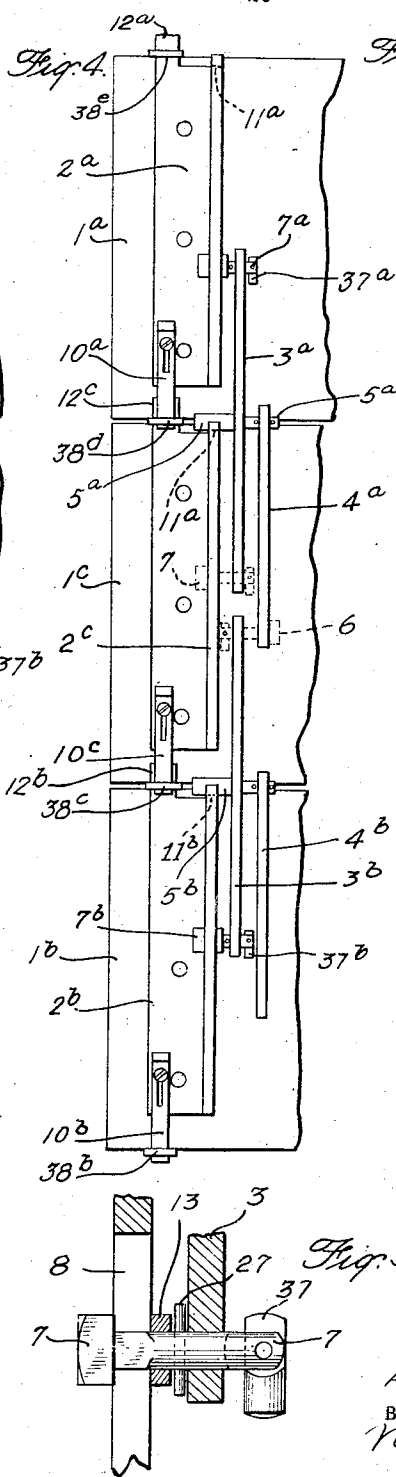
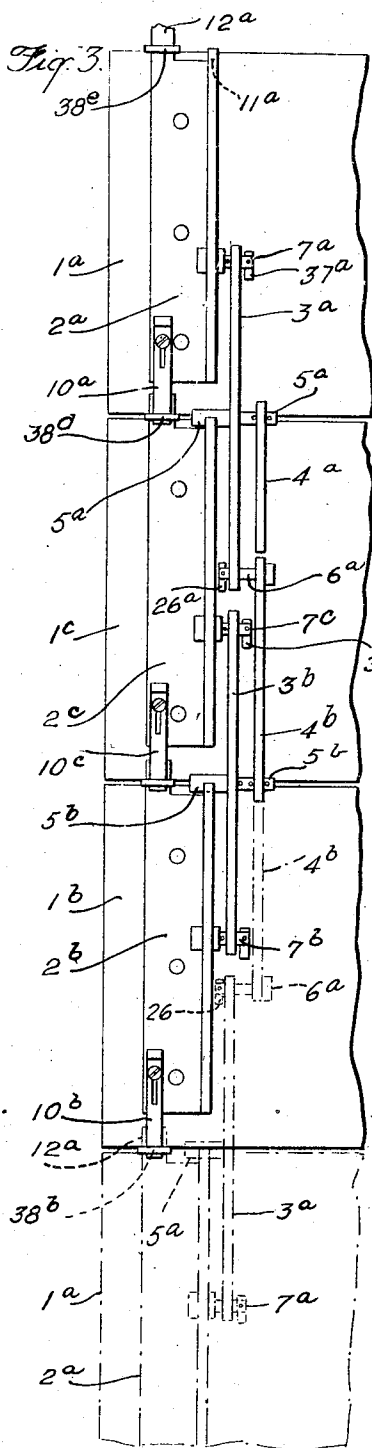
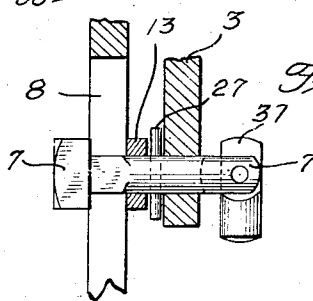


Fig. 8



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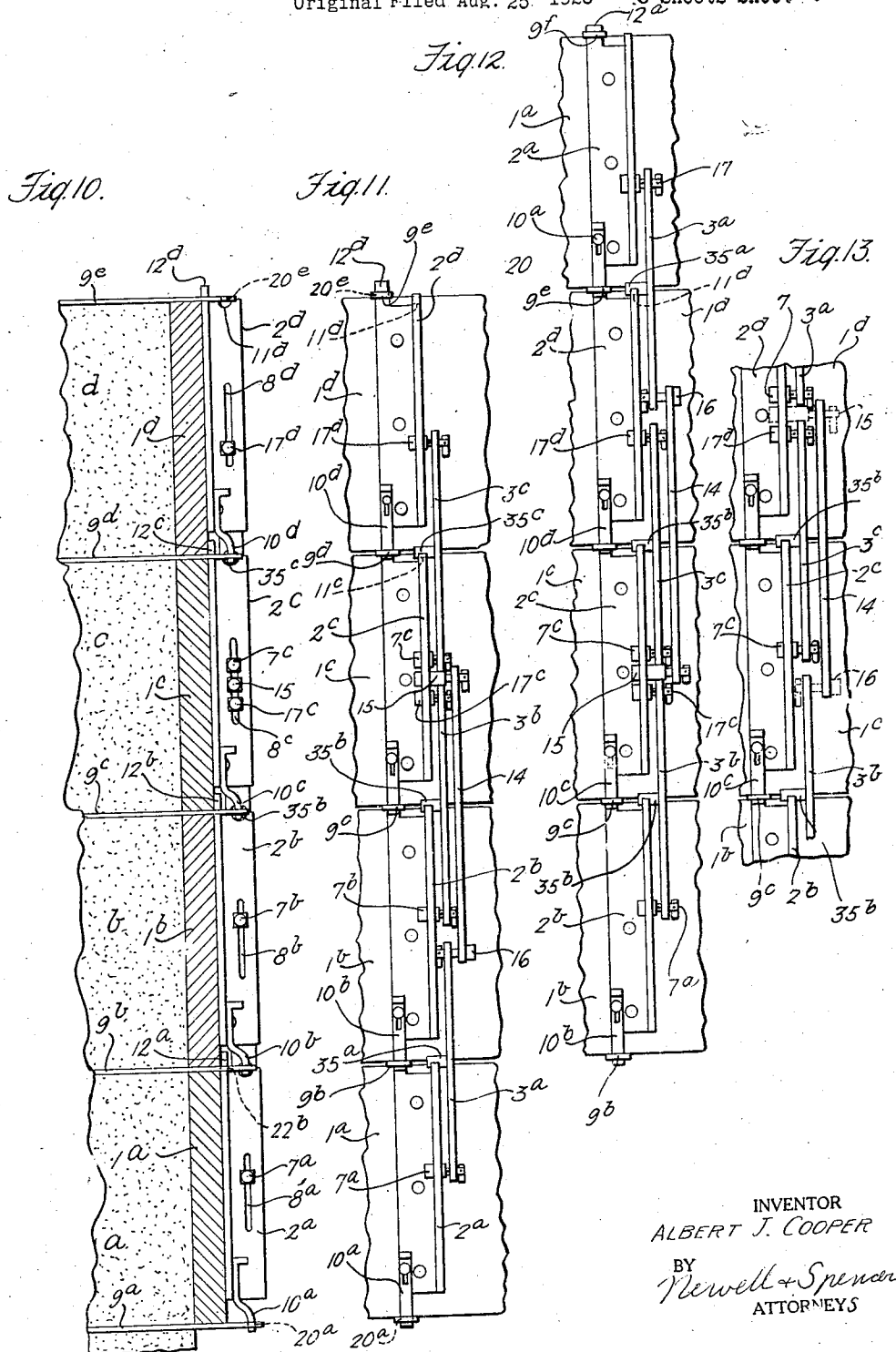
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Fig. 14

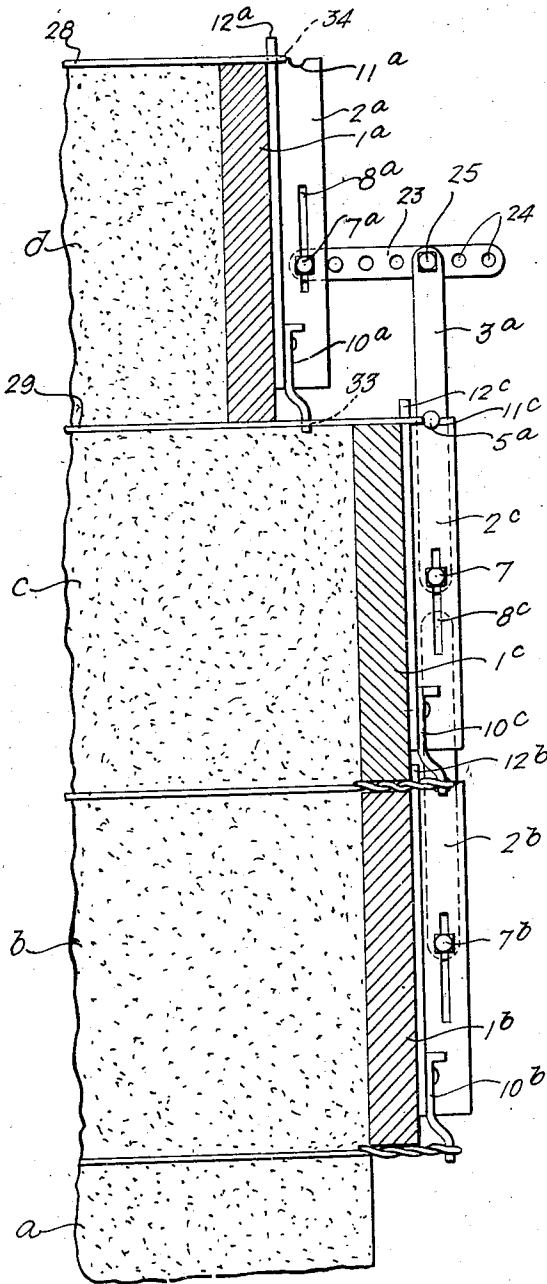
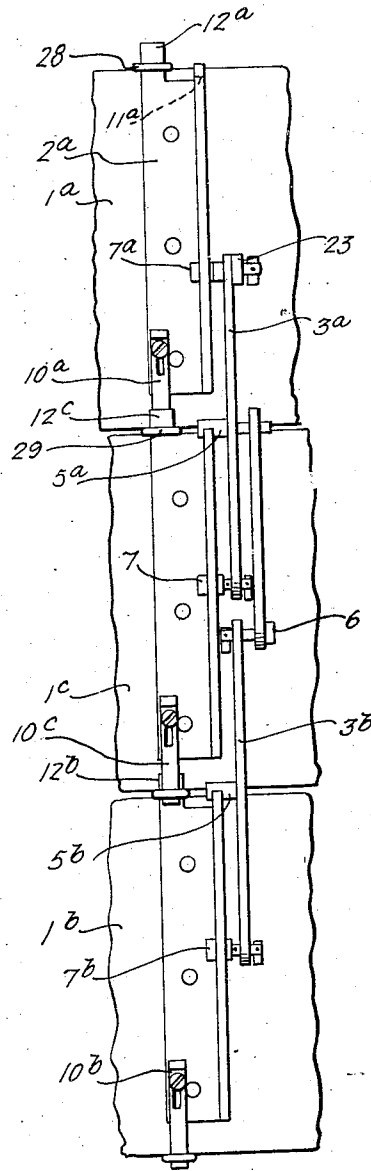


Fig. 15



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Fig. 16.

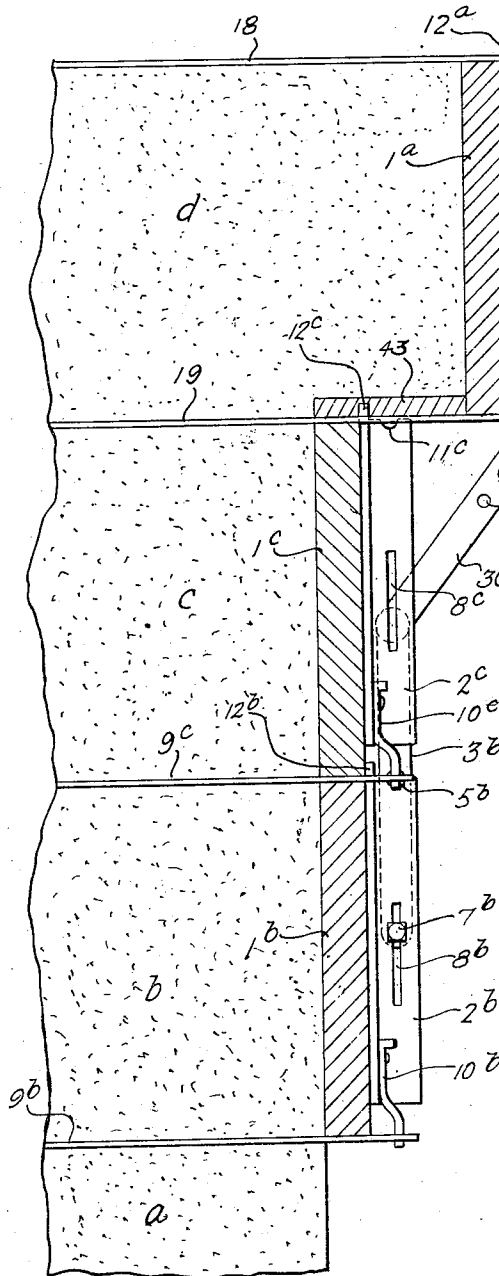
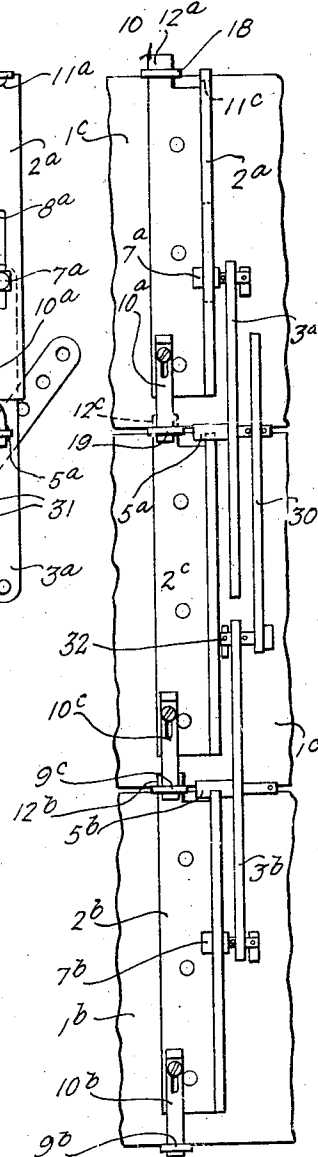


Fig. 17.



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UNITED STATES PATENT OFFICE.

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CONCRETE-WALL BOXING.

Application filed August 25, 1925, Serial No. 52,263. Renewed September 22, 1927.

This invention relates to a concrete wall boxing for the pouring of concrete walls in progressive stages.

It has been proposed in United States Patent No. 1,478,653, to A. E. Holmes, issued December 25, 1923, to pour concrete walls in progressive stages by means of boxing consisting in series of paired side units for each side of the wall linked together so that after the second stage is poured and the bottom stage is set, the bottom units can be swung over the top units to form a boxing or form for a succeeding stage. The boxings are aligned by means of horizontal spreaders locking into fixtures mounted on the boxing and preventing lateral strain. This type of wall boxing operates satisfactorily where the perimeter of the wall to be poured is sufficiently large and the concrete is quick setting so that the first stage is hardened after completion of the pouring of the second stage.

The above described wall boxing is, however, open to the serious disadvantage that where the perimeter of the wall to be poured is relatively small and where the concrete does not set very quickly, it is not possible to pour continuously as the lower stage will not set during the time taken in pouring the upper stage, and it is accordingly necessary to pour intermittently or to provide for auxiliary forms. The boxing of the above mentioned patent is also adapted only for pouring walls having straight faces and can not be used where insets or projecting ledges are to be formed in the wall.

It is the object of the present invention to provide a wall boxing which operates in an improved manner and obviates the disadvantages mentioned above in connection with the boxing of the Holmes patent and enables walls of varying perimeter to be poured in stages continuously.

It is a further object of the present invention to provide a boxing which may be used not only for pouring straight walls, but also for insets and ledges in a continuous and efficient manner.

With the above objects in view, the invention will be illustrated by the description of the preferred construction shown in the drawings. It should be understood, of course, that the preferred constructions to be described below are only illustrations of the principle of the present invention which is not limited thereto. More particularly,

the invention is not limited to a specific construction, shape of fittings and number of boxing units, but, on the contrary, other and similar fittings and linkages may be used and a greater number of units may be employed. Other and further variations will be clear to those skilled in the art.

In the drawings which illustrate the preferred constructions and modifications of the invention,

Fig. 1 is a vertical cross-section of a concrete wall being poured in stages and having the lower left hand corner broken away to show the mounting of the spreaders in the concrete. The figure illustrates a three-unit boxing of the present invention;

Fig. 2 is a vertical elevation of a portion of the boxing units showing the fittings and linkages set for swinging the bottom boxing unit over the two upper units as indicated in dotted lines in Fig. 1;

Fig. 3 is a vertical elevation of a portion of the boxing unit shown in Fig. 2 and shows the units after the bottom section has been swung over the upper two sections;

Fig. 4 is a similar elevation showing the changed connections ready for the second swing;

Fig. 5 is a detailed view of a bolt and link connection in the unit fitting;

Figs. 6 and 7 illustrate two types of flat spreaders in plan view;

Fig. 8 is an elevation of a different type of spreader;

Fig. 9 is a perspective view of an adjustable spreader having removable slotted ends;

Fig. 10 is a cross-section through a concrete wall similar to Fig. 1, showing a four-unit boxing;

Figs. 11 and 12 are illustrations of the four-unit boxing shown in Fig. 10, showing the position of the linkages before and after swinging the bottom unit over the three upper units;

Fig. 13 is an elevation of part of the linkages shown in Fig. 12 and indicating the change of connections for the next swing;

Fig. 14 is a cross-section through a concrete wall showing the method of pouring an inset;

Fig. 15 is an elevation showing the linkages of Fig. 4; and

Figs. 16 and 17 are respectively a cross-section and elevation similar to Figs. 14 and 15, but illustrating the pouring of an off-set ledge.

In the drawings, the various concrete stages are indicated by the letters *a*, *b*, *c*, *d*, etc., and individual parts of the units used in pouring these sections bear a reference numeral followed by the letter corresponding to the stage originally poured by means of the unit. Linkages connecting two units will bear the letter corresponding to the lower unit.

The three-unit boxing shown in Figs. 1 to 4 consists in three sets of horizontal forms 1, provided at suitable intervals with angle iron fittings 2. The angle iron faces which are at right angles to the forms 1 are provided with long slots 8 in which the toggle bolts 7 are arranged to slide. The bolts are preferably provided with washers 13 and with two spaced holes to take the pins 27 which serve to retain the washer 13 while the links 3 are connected by means of the toggles 37 (see Fig. 5). The angle irons are provided with upper projections 12 and at their lower ends with the movable latches 10. The vertical faces of the angle irons are also provided at the top with grooves 11.

In the position shown in Figs. 1 and 2, the lowest fitting 2^a is connected by the bolt 7^a to the link 3^a which is slightly shorter than the fitting and is provided at its center with the stud 5^a fitting on one side in the groove 11^a and carrying on its other extension the short link 4^a which is slightly longer than one-half the length of the angle iron fitting. In a similar manner, the fitting 2^b is connected to the link 3^b by the bolt 7^b, the stud 5^b of the link fitting into the groove 11^b and carrying on its opposite projection the short link 4^b. The links 3^a and 4^b are connected by the bolt 6 provided with the toggle 26. The upper end of the link 3^b is connected to the fitting 2^c by means of the bolt 7^c and is held in position by the toggle 37^c. The units 1^a, 1^b and 1^c are prevented from lateral movement by the spreaders 39, provided with the slots 40 and 42 (see Figure 9). The slots 42 engage with the projection 12 on the angle iron fittings and the slots 40 engage with the movable latches 10.

The spreaders illustrated are of the type shown in Figure 9 and consist of a flat body 39 with turned-up and screw-threaded ends, into which two slotted end pieces 38 are screwed. The end pieces carry the slots 40 and 42. The above described type of spreader constitutes the preferred shape as it is adjustable for width and when the concrete wall is poured, the end pieces may be removed, leaving no projecting metal and providing holes in the concrete to anchor reinforcements and which may be used for attaching hinges, moldings, brackets or other attachments without the use of wooden clubs which have heretofore been necessary where attachments were fastened to concrete walls.

The invention, however, is not limited to

the use of the preferred type of spreader, but flat spreaders such as those illustrated in Fig. 6 and wire spreaders as illustrated in Fig. 8 may also be used.

The concrete stage *a* is first poured, followed in succession by the stages *b* and *c*. On completion of the pouring of stage *c*, stage *a* is usually sufficiently set to permit removal of the boxing to form a new stage. This is effected by lowering the fittings 2^a until the upper projection 12^a clears the slot 42^b in the spreader 39^b, the bolt 7^a sliding in the slot 8^a. A latch 10^a is then withdrawn from the slot 40^a in the spreader 39^a and the unit 1^a is swung outwardly and upwardly in an arc about the studs 5^b as a pivot and at the same time is rotated about the bolts 7^a as pivots until the units swing on top of the units 1^c, as illustrated in dotted lines in Fig. 1. Owing to the fact that the unit 1^a performs a complete rotation about the bolts 7^a as pivots, the lower edge of 1^a rests on the spreaders 39^a which is across the tops of the units 1^c. Additional spreaders 39^c (see Figs. 3 and 4) are placed across the upper edges of the units 1^a and engage with the projections 12^a. The latches 10^a are also lowered engaging with the slots 40^a in the spreaders 39^a.

An additional stage of concrete is then poured and the connections are shifted as shown in Fig. 4 so that the upper end of the link 3^b is disconnected from the bolt 7^c and is connected by means of the bolt 6 to the short link 4^a. The bolt 7^c is slid upwardly in its slot 8^c and is connected to the lower end of link 3^a. The changed positions of bolts 6 and 7^c are indicated in Fig. 4. An inspection of the new connections will show that the links are in the same relation as in Fig. 2, except that the units 1^a and 1^c with their connected fittings have interchanged places. After pouring the stage in the mold formed by the units 1^a in their raised position, the stage *b* is sufficiently set to remove the form and the units 1^b are swung up in the manner just described in connection with the swing of the units 1^a. The cycle is repeated until the top of the wall is reached.

In Figs. 2 to 4, a short link 4 is shown connected to each of the links 3^a and 3^b. This is a preferred construction as it obviates the necessity of disconnecting two bolts and shifting the short link bodily. But it is clear that a single short link may be used instead of two short links and may be shifted from stud 5^b in Fig. 3 to 5^a in Fig. 4.

The toggle fitting for connecting the links to the bolts constitute my preferred construction as it makes a rapid change from one link to the other while at the same time providing a substantially firm anchorage when opened. The invention is, however, not limited to the double fastening on the

bolts but other equivalent fastening such as pins, nuts, and the like, may be used instead of toggles illustrated in the drawings.

Links 3^a and 3^b in Figs. 2 to 4 are somewhat loosely connected at their ends and are capable of sufficient play to move outwardly to clear the bolts 7 when the links are disconnected from one bolt 7 and connected to the short arm through bolt 6 as shown in Fig. 4. It is, accordingly, unnecessary to disconnect the pins 27 and withdraw the bolts 7 through the slots when changing, but where a tight fitting link is desired, this procedure may be adopted, although it is less advantageous, involving, as it does, two extra operations.

Figs. 10 to 13 are similar to Figs. 1 to 4 and illustrate a second preferred form of my invention in which four units of boxing are employed. This construction makes it possible to pour four successive layers without shifting forms and thus allows the lowest stage or section a longer time to set. This is of advantage where a slow setting concrete is used or where the perimeter of the wall is not very great as in the case of small buildings, such as concrete garages, and the like. Figs. 10 to 13 also illustrate the use of wire spreaders shown in Fig. 8. Other types of spreaders may be used and I prefer to use the adjustable and removable end spreader shown in Fig. 9, the provision of wire spreaders in these figures of the drawing being purely for the purpose of illustrating the use of this type of spreader and does not indicate that the wire spreader is particularly suitable in connection with the casting of insets.

The four forms 1 on each side of the wall are provided with angle iron fittings 2 of the same shape as the fittings on the three-unit boxing shown in Figs. 1 to 4. Three links 3 of lengths slightly less than the angle iron fittings are used to connect the fittings, but instead of being provided with double studs 5 as shown in Figs. 2 to 4, they are provided with single studs 35 fitting into the grooves 11 of the angle irons. In the position shown in Fig. 11, the fitting 2^a is connected to the lower end of link 3^a by the bolt 7^a which slides in the slot 8^a. The stud 35^a of the link 3^a fits in the groove 11^a. The upper end of the link 3^a is connected to the link 14 by the bolt 16. The link 14 is of the same length as an angle iron fitting and is connected to the bolt 15 which passes through the center of the slot 8^c in the angle iron 2^c. The angle irons 2^c and 2^b are joined by means of the link 3^b carrying the stud 35^b which fits in the groove 11^b. The lower end of the link 3^b is in turn connected to the angle iron 2^b by means of the bolt 7^b at the upper end of the slot, while the upper end of the link 3^b is connected to the fitting 2^c by means of the bolt

17^c in the lower end of the slot 8^c. In a similar manner, the angle iron fittings 2^c and 2^d are joined by the link 3^c carrying the stud 35^c fitting in the groove 11^c. The lower end of the link 3^c is connected to the fitting 2^c by means of the bolt 7^c at the upper end of the slot, while the upper end is connected to the fitting 2^d by means of the bolt 17^d fitting in the lower end of the slot 8^d. The bolts 7, 15, 16 and 17 are provided with pins and toggles in the same manner as the corresponding bolts 7, 6 and 5 in Figs. 2 to 5, but any other detachable connection may be used.

After the stage *a* is set, the unit 1^a is slid downwardly until the projections 12^a on the fittings 2^a are withdrawn from the slots 22^b of the spreaders 9^b. The latches 10^a are then withdrawn from the slots 20^a of the spreaders 9^a and the unit 1^a is freed and is swung outwardly and upwardly by the links 3^a and 14 about the pivot 15 into the position shown in Fig. 10, the unit 1^a being rotated about the bolts 7^a as pivots during the swing so as to present its lower edge to the spreader 9^c. The latches 10^a are then engaged with the slots 20^c of the spreaders 9^c and spreaders 9^c are placed across the forms 1^a engaging the projections 12^a (see Fig. 10).

The mold defined by the units 1^a in its raised position is then used to pour the fifth stage. On completion of the pouring when the stage *b* has set, the connections of the links are changed to the position shown in Fig. 11. Bolt 16 is disconnected from link 3^a and bolt 17^c from link 3^b. Bolt 15 is then disconnected from link 14, removed from slot 8^c and inserted in slot 8^d. Link 14 is then connected to bolt 15 in the new position and bolt 16 is connected to the upper end of link 3^b after removing bolt 17^c. This latter bolt is then used to connect fitting 2^d with link 3^a. After the change is completed and the bolts are in the positions shown in Fig. 11, unit 1^b can be swung up on top of 1^a by going through the same procedure described above in connection with the swinging of unit 1^a. The cycle is then repeated until the top of the wall is reached.

Insets can be poured in the wall by the modification of linkage shown in Figs. 14 and 15 which illustrate a three stage linkage adapted for use in casting insets into walls. The figures show the staging after the inset unit has been swung into position. When comparing Figs. 14 and 15 with Fig. 3, which shows a straight three unit boxing after swinging the bottom unit on top of the two upper units, it will be seen that the change consists in connecting the end of the link 3^a to the short adjustable link 23 provided with adjustment holes 24 instead of connecting it directly to the bolt 7^a in the fitting 2^a. This connection may be effected by the pro-

vision of a bolt 25 uniting the two links. The dimensions of the inset are determined by the hole in the adjusting link 23 to which the link 3^a is connected. The details of swinging are precisely the same as where a straight wall has been poured except that at the top of its swing, unit 1^a is above the level of the unit 1^c by a distance equivalent to the distance between 7^a and 25, and accordingly the swing is continued until the unit 1^a has swung inwardly and downwardly a distance equal to that between 7^a and 25 and engages with the spreader 29 of the shape of spreader 19, shown in Fig. 6. A latch 10^a connects with an extra slot 33. A short spreader 28 of the same shape as the ordinary spreaders 9 is placed across the top of the forms 1^a and is provided with slots 34 engaging with the projections 12^a. The linked connections are then shifted in the manner similar to Fig. 4 and after pouring the stage *d*, the unit 1^b is swung into position about the pivot 5^a, a second adjusting link being interposed between the bolt 7^b and the link 3^b.

Where it is desired to cast an inset or groove of a width of one stage and return it immediately to the former wall line, a spreader 28 of the shape of spreader 29 is used and the form 1^b is swung without using a spacing link. A removable bottom board for the outward jut must then be provided which is illustrated in connection with the embodiment of my invention shown in Figs. 16 and 17.

It is clear that any number of successive insets may be cast by using inset links of the proper length and I do not limit myself to the construction for use in casting single insets.

A further modification of the invention which can be used for casting jutting ledges is illustrated in Figs. 16 and 17. The drawings show the links in the position after the unit 1^a has been swung up into position and the concrete poured.

The connections are similar to those shown in Fig. 3, except that instead of a link 4 of one-half the length of the fitting and turning on the stud 5^b as a pivot, an adjustable full length link 30 is attached to the link 3^a at its center, the stud 5^a being connected to the desired wall 31. The opposite end of the off-set link 30 is then connected to the upper end of the link 3^b by the bolt 32. Form 1^a is then swung on the bolt 32 as a pivot to the position shown in Figs. 16 and 17, the length of the off-set being determined by the length of the off-set link 30. When the stage *d* has been poured, the fitting 2^b is connected to the swinging linkage through a second adjustable link so as to swing into position on top of the spreader 18, the swing being made from the bottom of link 30 as a pivot. In a similar manner, form 1^c is swung after

a further stage is poured and thereafter the adjustable link is dispensed with and the usual one-half length link shown in Figs. 2 to 4 is used to swing up the forms. The length of the outset is determined by connecting the bolt with the stud 5^a to the attaching hole 31 in the offset link 30. The lengthened spreader 19, shown in Fig. 7, is used and an auxiliary bottom board 15 is inserted in order to form a flat form for the concrete poured in the off-set sections. Spreaders 18 are used to lock with the projections 12^a, these spreaders being of the same shape as the spreaders 9 but of greater length.

The wall can be continued with the increased thickness or it may be immediately inset to the former thickness. Offsets and insets of different width may also be combined in various sequences as will appear to those skilled in the art, the thickness being determined by the adjustment of the offset or inset links.

The present invention is applicable to any type or form of construction, whether wood or metal and the length of the units can be adjusted to permit easy swinging. In general, with wooden form units of average thickness, I find that about 12 feet is a desirable length of form for straight wall work, but longer or shorter lengths may be used. The height may vary, but I prefer to use heights of about 1 to 2 feet. The fittings 2 are usually placed about every three feet, but the spacing may be varied depending on the weight of the form units, the fittings being sufficiently close to provide for a firm swinging of the units.

In the preferred modification illustrated in the drawings, I have shown the use of angle iron fittings and I find that this type of fitting is very satisfactory for most forms but it should be understood that the invention is in no wise limited to the particular shape of the fittings and other shapes may be used, such as T-shapes and the like which provide for the attaching face to the form and a projecting face to carry the link pivots.

The spreaders may be combined with reinforcements for the concrete wall in any suitable manner and in general any construction which provides for locking means to prevent lateral spreading of the forms may be used in the place of spreaders.

I have shown two preferred modifications consisting in three-unit and four-unit boxings, respectively, and for most purposes I find that it is unnecessary to go beyond four units. However, my invention is not limited to the use of three or four units and it will be clear to those skilled in the art that a greater number of units may be used by combining short and long swinging links corresponding to the links 4 and 14 shown

in the drawings in order to produce a swing of the desired length. Thus, for example, in a five-form unit, it would be necessary to use a swinging link $1\frac{1}{2}$ times as long as the individual unit fittings. In a six-stage construction, the swinging link would be twice the length of the fitting.

The swinging links may be provided with holes at both ends as shown in the drawings or they may be perforated for their whole length so that any swinging link can be used either for a straight swing or as an inset or off set link interchangeably. Other and further modifications of the invention will be clear to those skilled in the art and are intended to be included within the scope of the present invention.

What I claim is:

1. Concrete wall boxing comprising in combination a series of at least three lateral boxing units for each side of the wall, said units being connected by linkages, means for progressively swinging the lowest unit on top of the top unit without disconnecting the swinging unit during the swing, and means for permitting rotation of the unit about a horizontal axis during the swing.

2. Concrete wall boxing comprising in combination a series of at least three lateral boxing units for each side of the wall connected together through linkages and locked against lateral movement by detachable locking spreaders, means for progressively swinging the lowest unit on top of the top unit without disconnecting the swinging unit from the other units during the swing, and means for permitting rotation of the swinging units about a horizontal axis during the swing.

3. Concrete wall boxing comprising in combination a series of lateral boxing units for each side of the wall connected together through linkages, means for progressively swinging the lowest unit to the level of the top of the top unit but into a plane parallel to, but horizontally spaced from, the plane of the upper units, and means for permitting rotation of the swinging unit about a horizontal axis during the swing.

4. Concrete wall boxing comprising in combination a series of at least three lateral boxing units for each side of the wall, fittings on the outside of said units at laterally spaced intervals, the fittings on each unit being in the same vertical lines with corresponding fittings on the other units of the series, locking spreaders detachably connecting corresponding units of the two series and preventing lateral movement when locked, detachable connecting links joining the central portion of vertically adjacent fittings and being slightly shorter than the height of the boxing unit, a swinging link of the same length as the connecting links and detachably and pivotally connected to the center of

each lower fitting, pivots connected to the upper fittings of the same row and situated one-half way between the upper edge of the lowest boxing unit and the upper edge of the top unit, and a link joining the pivot and the swinging link and detachably connected to the latter.

5. Concrete wall boxing according to claim 4 in which the links are slidably attached to the fittings to permit limited vertical movement.

6. Concrete wall boxing comprising in combination two series of at least three lateral boxing units, one series for each side of the wall, angle iron fittings on each unit and arranged in vertical rows with corresponding fittings of the other units, one face of the angle iron being parallel and attached to the fitting and running vertically, a central slot in the projecting face of each angle iron, links connecting the central portion of vertically adjacent fittings on the upper units by means of bolts sliding in the angle iron slots, the connecting links being slightly shorter than the vertical height of the unit, swinging links of the same length as the connecting links and detachably pivoted to bolts sliding in the slots of the angle irons of the lowest units, pivots connected to the upper unit fittings at a position one-half way between the upper edge of the lowest unit and the upper edge of the top unit, and links mounted on the pivots and detachably connected to the upper ends of the swinging links.

7. Concrete wall boxing comprising in combination two series of at least three lateral boxing units, one series for each side of the wall, each unit being provided with angle iron fittings arranged to form vertical rows with the corresponding fittings on the other units and being opposite corresponding fitting rows of the boxing units on the opposite side of the wall, said angle irons being attached by one face to the units and extending vertically, a projection on the face parallel to the unit and extending above the unit, an off-set slidable latch on the lower end of said face reaching in its extended position below the lower edge of the unit, a circular groove at the upper end of the angle iron face perpendicular to the unit and flush with the top of the unit, locking spreaders provided with the slots at their ends and adapted to engage the projections and latches on the fittings and to prevent lateral movement of the fittings when locked, links of length slightly less than the vertical height of a unit and connecting vertically adjacent angle irons by means of detachable bolts pivoted in the ends of the links and sliding in the slots of the angle irons, said links carrying central projections registering with the grooves in the top of the angle irons, swinging links of the same shape as

- the connecting links and connected to bolts sliding in the slots of the angle irons of the lowest units, pivots connected to the fittings of the upper units one-half way between the upper edge of the lowest unit and the upper edge of the top unit, and links mounted on said pivots joining the pivots to the swinging links and detachably connected to the latter.
- 10 8. Concrete wall boxing of the type claimed in claim 7 and adapted for the casting of insets, in which the bolts which slide in the central slots of the angle iron of the lowest units are connected to the lowest ends of the swinging links through additional adjustable links.
9. Concrete wall boxing according to claim 7 and containing an odd number of units in each series, in which the central projections of the connecting links are extended to form pivots for the links connected to the swinging links.
10. Concrete wall boxing according to claim 7 in which an even number of units are present in each series and in which the pivots, to which the swinging links are joined by the joining links, are formed by bolts slidable in the center of the central slots of the upper angle iron fittings.
- Signed at New York, New York, this 15th day of August, 1925.

ALBERT J. COOPER.