To all whom it may concern:

Be it known that I, LEE CALLAHAN, citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Apparatus for Forming Concrete Building-Work, of which the following is a specification.

My present invention has to do with apparatus for use in the construction of buildings of plastic material; and it has for one of its objects to provide simple, practical and efficient forms, adapted for repeated use, at small cost of time and labor, and capable of withstanding the considerable pressure exerted by concrete or other plastic material when poured or otherwise put in place and also capable of withstanding the general rough usage to which building apparatus is ordinarily subjected.

Another object of the invention is the provision of forms for columns and beams and girders, adjustable as to length and cross-sectional size to suit the same to buildings of different sizes and description.

Another object is to provide improved means for connecting the various elements of the apparatus together in proper relative positions.

Another object is to provide forms adapted to be expeditiously and easily placed and secured in position and as readily "stripped" from the work, and which will prevent waste of fine cement and water, and will leave the work in a finished state so that the owner can tint the same with calcimine or can apply plaster, if he so elects.

Other objects and advantageous characteristics of the invention will be fully understood from the following description and claims when the same are read in connection with the drawings, accompanying and forming part of this specification, in which:

Figure 1 is a view, partly in elevation and partly in vertical section, illustrating a column form, beam or girder forms, and floor forms constructed and assembled in accordance with my invention. Fig. 2 is a fragmentary plan view hereinafter referred to in detail. Fig. 3 is a horizontal section taken through the column form, in the plane indicated by the line 3—3 of Fig. 1. Fig. 4 is a detail horizontal section taken through a column form and illustrating modified means for regulating the size of the column form in cross-section.

Fig. 5 is an enlarged detail section, hereinafter specifically referred to, of a portion of the construction shown in Fig. 3. Fig. 6 is a detail horizontal section taken in the plane indicated by the line 6—6 of Fig. 1 and showing the arrangement of the bolts for adjusting the column as to height. Fig. 7 is a view, partly in side elevation and partly in vertical section, of one of the forms for use in making girders and beams. Fig. 8 is a transverse section, taken in the plane of the line 8—8 of Fig. 7. Fig. 9 is an enlarged detail view illustrative of the manner in which the upper ends of the bolts shown in Fig. 7 and 8 are connected. Fig. 10 is a transverse section taken in the plane of the line 10—10 of Fig. 7. Fig. 11 is an inverted plan view of the floor form. Fig. 12 is a section of some, taken on the line 12—12 of Fig. 11, looking in the direction of the arrow. Figs. 13 and 14 are detail views illustrating my novel mode of detachably connecting forms that stand at right angles to each other.

Similar letters of reference designate corresponding parts in all of the views of the drawings.

For the sake of brevity and clearness I will first describe the column form and apparatus shown in Figs. 1, 2, 3, 4 and 6. Referring therefore to the said figures, A are the four right-angle sections, of sheet-steel, of which the lower member of the column is formed; the said sections being lapped after the manner best shown in Fig. 3 so as to slide one within the other, and each section being provided on its corner with an angle-iron reinforcement a. Two of the said sections A are provided on vertical edges with upright angle-iron bars b, and two are provided on their outer sides adjacent vertical edges with upright metallic strips c.

Disposed at opposite sides of the grouped sections A, at intervals in the height thereof (see Fig. 1) are pairs of retaining bars B, one pair of which is clearly shown in Fig. 3. Each of the said retaining bars B comprises spaced angle iron d, and three (more or less) spacing blocks e interposed between and connected by bolts f to the opposite horizontal portions of said irons. The bars of each pair are disposed at opposite sides of the group of sections A, and are connected through the medium of the headed and threaded bolts C, disposed at opposite sides.
of the group of sections A, and nuts D arranged on the threaded portions of the bolts and adapted to press interposed washers or blocks E against the adjacent bar B. It will be noted at this point that the angle-iron bars b and the straps c bear outward against the bolts C and retaining bars B, respectively, and in that way prevent outward bulging of the sheet-steel sections A under the pressure of plastic material poured or otherwise placed in the column; and it will also be noted that when the nuts D are loosened, the sections A may be adjusted to increase or lessen the cross-sectional size of the column, and the retaining bars B and the bolts C may be correspondingly adjusted, after which the nuts may be tightened to hold the retaining bars B against two of the sides of the form, and the bolts or rods C against the other two sides of the form. It will further be noted that the vertical portions of the angle-irons d afford broad and strong bearings against the column walls, while the horizontal portions of the angle-irons are capable of withstanding great pressure exerted by the heads or blocks or washers E carried by the threaded rods or bolts C. The bolts that connect the end blocks e in the retaining bars B are preferably provided with removable nuts, as shown, in order that the position of said blocks can be changed to suit the adjustment of the column in cross-section, when occasion demands. I would also have it distinctly understood that while in Fig. 1, I show the bars B arranged one above the other and opposed to the same sides of the grouped sections A, the bars B of one pair may be arranged at right-angles to the bars B of the other pair—i.e., the bars of the lower pair may be opposed to opposite sides of the grouped sections A, and the upper upper bars B may be opposed to the other two sides of the grouped sections A, without affecting my invention.

In lieu of the means shown in Figs. 1, 3 and 5 for clamping and holding the grouped sections of the column, I may employ the construction shown in Fig. 4 in which A' A' are two of the lapped sheet-steel sections; B', B', apertured lugs of which there are two fixed on each section A'; and C' C' threaded rods extending through the lugs B' and equipped, at opposite sides of each of the latter, with nuts D'. By adjustment of the said nuts D', the sections A' may obviously be adjustable fixed with respect to each other to determine the cross-sectional size of the column.

The upper member of the column is designed to fit at its lower end in a telescopic manner in the upper end of the inclosure formed by the grouped sections A of the lower member; the said upper member comprising lapped sections A2, which are similar to the sections A with the exception that they lack the angle-irons a, angle bars b and straps c. The telescopic fit of the grouped sections A2 of the upper member in the grouped sections A of the lower member prevents leakage, at the joint between the members, of plastic material or liquid poured into the upper member, and, at the same time, permits of the upper member being raised or lowered to increase or diminish the height of the column form, as a whole.

For the purpose of adjustably supporting the upper member of the column form on the lower member thereof and adjustably fixing the two together, I provide apertured lugs F on the sections A of the lower member and similar lugs G on the sections A2 of the upper member, and in the said lugs I arrange threaded rods H having heads g disposed above the upper lugs G and also having nuts k, i and j, the nuts k being disposed under the lugs G, and the nuts i and j above and below the lugs F. By adjusting the nuts i the upper member may be raised or lowered to increase or diminish the height of the column form, as the work in hand requires, and by adjusting the nuts j against the lugs F, the rods H are securely fastened in said lugs and enabled to effect rigid connection of the sections A2 of the upper member to the sections A of the lower member.

At the upper end of the column form are angle-irons I, Figs. 1 and 2, which are provided in their vertical portions with slots k for the passage of bolts l which take through apertures m in the column sections A2 and serve to connect the angle-irons to the said sections. The slots k in the angle-irons I are provided in order that the adjustments necessary to increase or diminish the cross-sectional size of the upper member of the column form may be made without difficulty. The said angle-irons I are designed to be connected by bolts m which extend through their horizontal portions and also through the superposed horizontal portions of angle-irons n, Fig. 8, on the girder and beam forms, hereinafter described, this with a view of holding the said forms in correct position while the concrete or other plastic material is being poured.

In practice I first correctly set up and suitably fasten the column form on a level base (not shown), and then in order to hold the said column form in upright position during the pouring of the concrete I set up a temporary shoring of timber which I have also deemed it unnecessary to illustrate. I then take the beam and girder forms and after adjusting the same to proper size, as hereinafter set forth in detail, I place and connect the said forms on the column form, after which I place temporary shoring under said beam and girder forms to carry
the weight thereof during the pouring of concrete therein.

**Beam and girder forms.**—The beam and girder forms M may differ in size but are identical in construction, and, therefore, a detailed description of the one shown in Figs. 7 to 10 will suffice to impart a definite understanding of all. The said form M, Figs. 7 to 10, comprises a large member p, Fig. 8, and a small member r, Fig. 10, telescopically arranged in the member p and adjustable in the direction of its length with respect thereto to increase or diminish the length of the form. The member p is made up of right-angle sections s, of sheet-steel, lapped as indicated by t and provided with the before-mentioned angle irons n and also provided with exterior angle-irons u, nuts v riveted on the horizontal portions of said angle-irons u, sections w, of sheet-steel, arranged inside of and against the vertical portions of the sections s, and adjustable vertically with respect to the same, housings x fixed exteriorly on the upper portions of the sections w and open at their ends and having longitudinal slots y in their bottom walls z, rods a' swiveled in the notched bottom walls z of the housings x and having threaded portions extending through and engaging the nuts v and also extending through the angle-irons u and provided at their lower ends with angular portions b' for the application of a wrench or the like, and angle-irons c' carried by the sections s and interposed between the same and the rods a' and having for their office to bear against the rods a' and thereby prevent bulging of the side walls of the member under the pressure of plastic material placed in the form. The smaller member r comprises angular sections d', of sheet-steel, lapped at e', and upper sections f', of sheet-steel, arranged inside of and adjustable vertically against the upright portions of the sections d'. As shown by dotted and full lines at the right of Fig. 7, the sections f' of the member r are connected with the sections d' thereof in the same manner that the sections w of the member p are connected with the sections s of said member p. From this it follows that both the member p and the member r may be adjusted as to width and depth, and absolutely fixed according to the size it is desired for the same to have, the members being absolutely fixed as to depth by the rods A' complementary thereto, and the elements cooperating with said rods, and the width of the member p being absolutely fixed by the connection of the angle-irons n thereof to one of the brackets or angle-irons I, best shown in Fig. 2. It will also be understood that when the member r is telescopically arranged in the member p, as shown in Fig. 7 and also in Fig. 1 at the left of the upper portion thereof, the said member r may be adjusted lengthwise to increase or diminish the length of the form. Any suitable means may be employed for adjusting the member r and absolutely fixing the same with respect to the member p, the means illustrated in Figs. 7 and 10 comprising threaded lugs g' fixed to the sections s of the member p, threaded lugs h' fixed to the sections d' of the member r, and rods s' having intermediate portions j' adapted for the application of a wrench or the like, and also having oppositely threaded portions k' and l' engaged in the threaded apertures of the lugs g' and h', respectively. Obviously by turning the threaded rods s', the form may be increased or diminished in length as occasion requires.

The ends of the beam and girder forms remote from the column form shown in Fig. 1 may be supported on and connected to brackets or angle-irons similar to the brackets or angle-irons I before described, carried by other column forms or other suitable supports such for instance as the partition forms hereinafter set forth.

**Floor and partition forms.**—In Figs. 11 and 12, I show a form of a type suitable for both floors and partitions, and in Figs. 13 and 14 I show a peculiar and advantageous means for detachably connecting two of said forms that stand at right angles to each other; and at this point I would have it definitely understood that the peculiar connection shown in Figs. 13 and 14 may be employed in the attachment of any one of the elements of my improvements that stands or extends at a right-angle to any other.

The forms P respectively comprise a sheet of steel c and channel iron h, and angle irons c riveted to and disposed at one side of the said sheet. The manner of arranging forms P when used as floor forms is shown in Fig. 1, and at R R in said figure is shown the manner in which said forms may be connected to the beam and girder forms. I would also have it understood that I contemplate supporting the forms P during the pouring of concrete by temporary shoring or frame-work, but this I have deemed it unnecessary to illustrate.

Where two of the forms P are arranged at right-angles to each other as shown in Fig. 18, for use in the production of concrete partitions, said forms are connected through the medium of angle-irons c, which are riveted or otherwise connected to the forms at f' and have opposed portions g' in which are registered curvilinear slots k' to receive a headed bolt 8 on which a nut y' is threaded. By virtue of this the two forms can be placed together to produce a corner, and the connecting bolt may be dropped in place and a wrench used to tighten the nut and secure the connecting bolt in place. Then when it is desired to disconnect the forms, the nut
may be as readily loosened and the bolt re-
moved.

The space between the beam and girdler
forms at the top of the column form is filled
in from the top of the column form and the
bottoms of the beam and girdler forms to
that of the under side of the floor slab by
pieces of wood, metal or other suitable mate-
rial which I have deemed it unnecessary to
illustrate.

It will be gathered from the foregoing
that my improved forms are adapted for re-
peated use, and that therefore the said forms
are as useful after the completion of a build-
ing in which they are employed as before.

It will also be gathered that my novel forms
may be set and used, and afterward may be
“stripped” from the work with the employ-
ment of but little labor, and further, that
my novel forms leave the work in a finished
state, and without the marred or rough
places so often left by wood forms.

While I have shown and described one em-
bodyment of my invention, it is to be under-
stood that I am not limited to the details or
the form or relative arrangement of parts
disclosed, but that extensive modifications
may be made therein without departing from
the spirit thereof.

Having described my invention, what I
claim and desire to secure by Letters-Pat-
ent, is:

1. In apparatus for the purpose set forth,
a beam and girdler form comprising a mem-
ber made up of lapped angular sections ad-
justable to increase or diminish the width
of the member and having exterior nuts
fixed thereto, sections adjustable relative to
the angular sections to increase the depth of
the member and having exterior housings
and also having open slots in the bot-
toms of said housings, and rods swiveled in
the slotted bottom walls of the housings and
having threaded portions extending through
and engaging the said nuts; a second mem-
ber telescopically arranged in the first-named
member and adjustable lengthwise with re-
spect thereto and made up of lapped angular
sections adjustable to increase the width
of the second-named member and having ex-
terior nuts fixed thereto, sections adjustable
relative to the angular sections to increase
the depth of the member and having exter-
or housings and also having open slots in
the bottoms of said housings, and rods swive-
eled in the slotted bottom walls of the hous-
ings and having threaded portions extending
through and engaging the said nuts; and
means for adjusting the second-named mem-
ers longitudinally with respect to the first-
named member to increase or diminish the
length of the form and for adjustably fixing
the members with respect to each other.

2. In apparatus for the purpose set forth,
a beam and girdler form comprising lapped
angular sections adjustable to increase or
diminish the width of the form and having
exterior nuts fixed thereto, sections adjust-
able relative to the angular sections to in-
crease the depth of the form and having ex-
terior housings and also having open slots
in the bottoms of said housings, and rods swiveled in the slotted bottom walls of the
housings and having threaded portions ex-
tending through and engaging the said nuts.

In testimony whereof I have hereunto set
my hand in presence of two subscribing wit-
tesses.

LEE CALLAHAN.

Witnesses:
W. J. T. GREENFIELD,
THOMAS J. STEPHENS.