Dec. 13, 1966 A. B. ÅBERG 3,290,842

DISTANCE PIECE FOR CONCRETE-REINFORCING RODS

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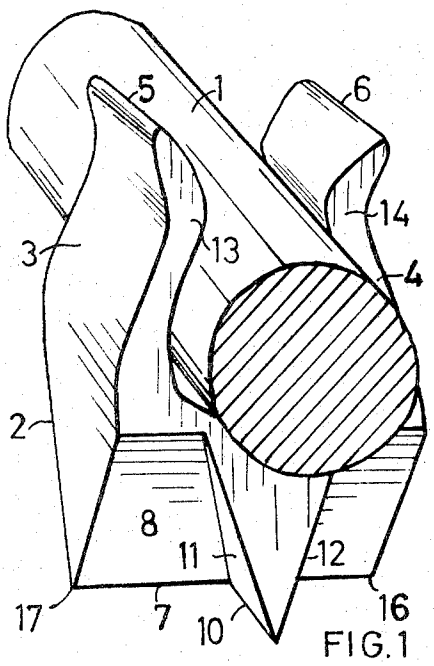


FIG. 1

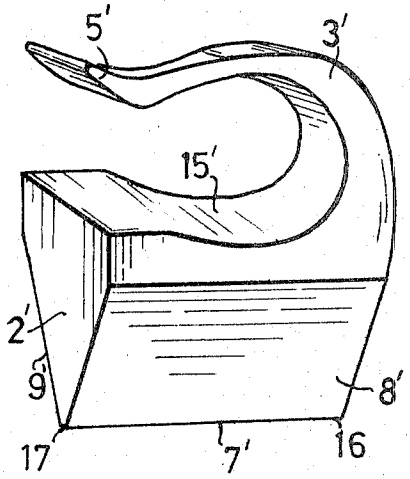


FIG. 4

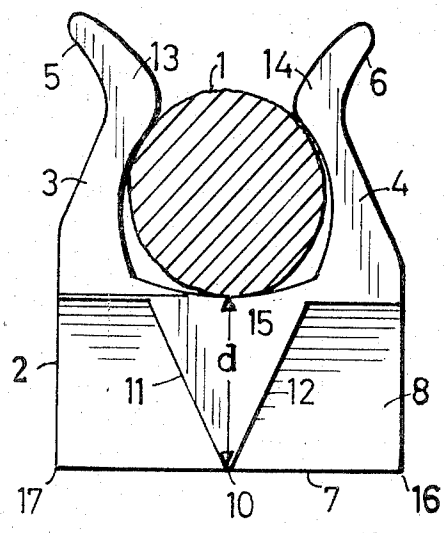


FIG. 2

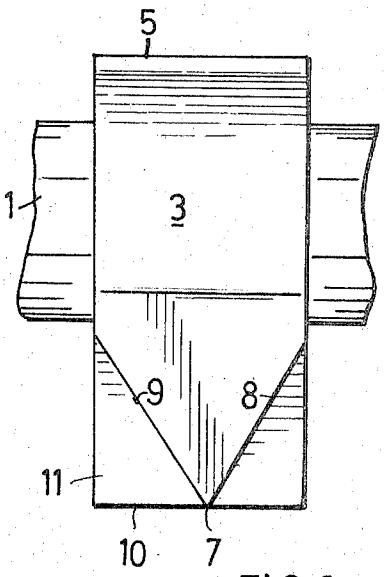
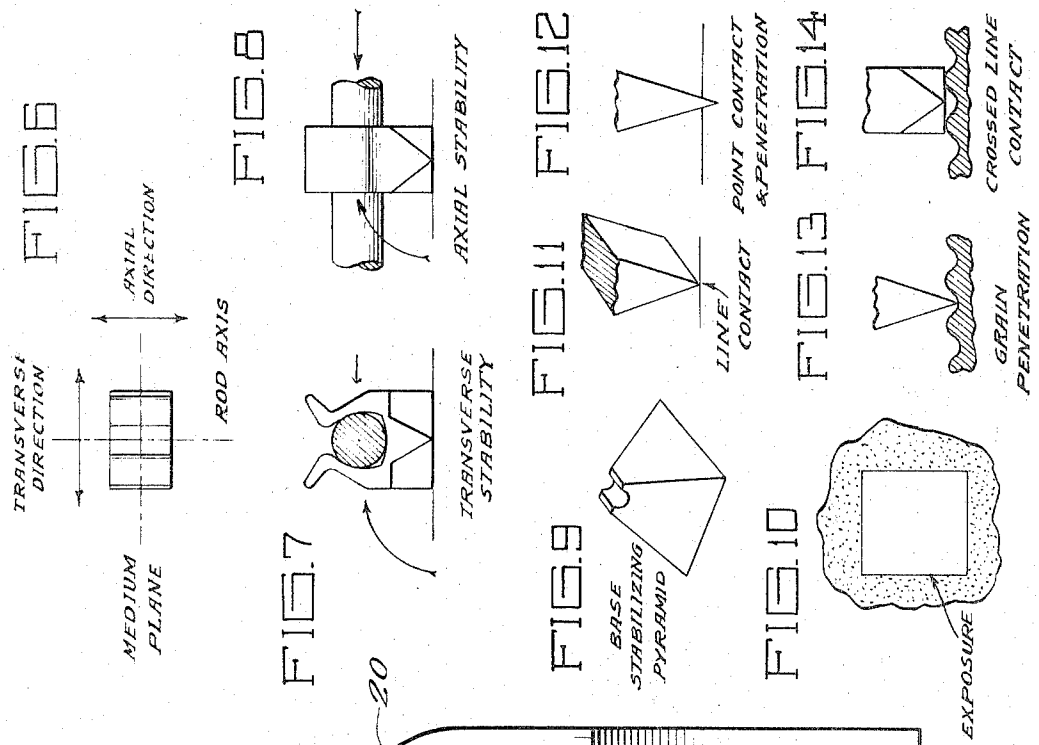


FIG. 3

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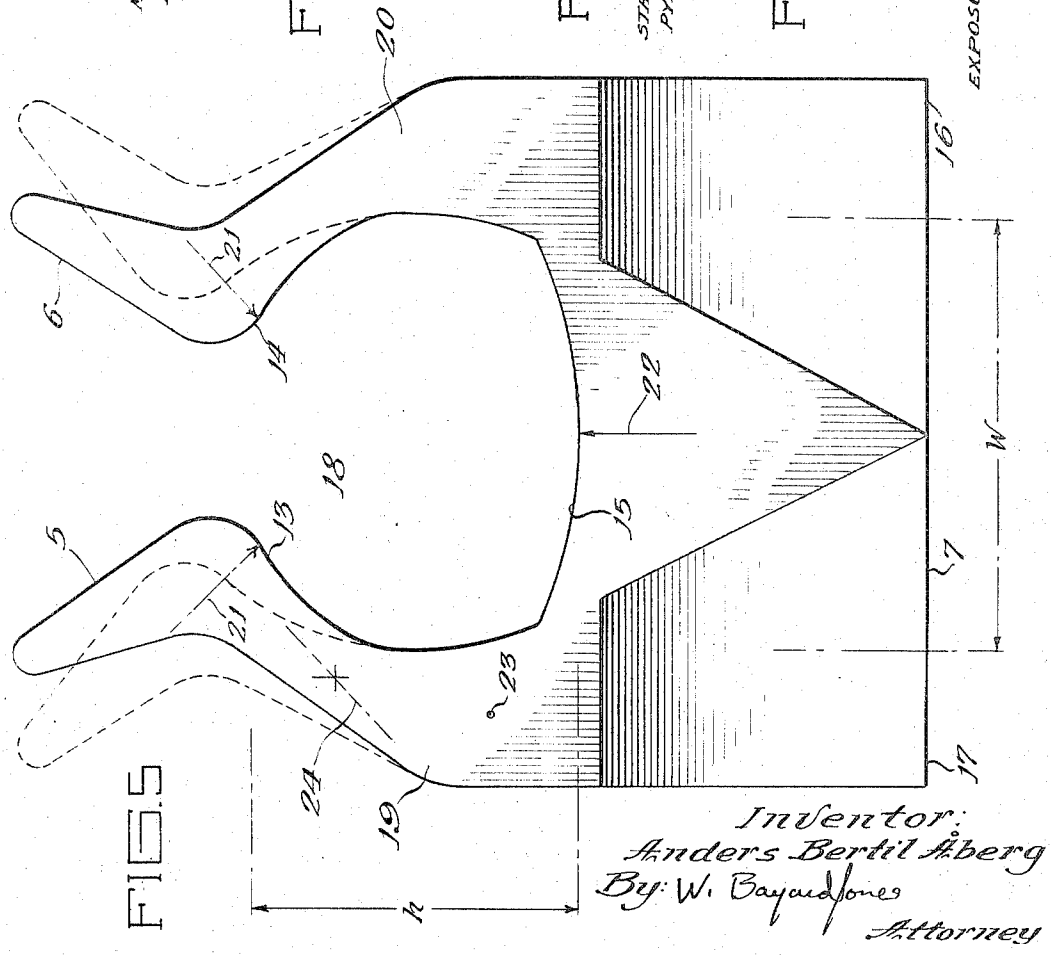


FIG.5

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FIG. 15

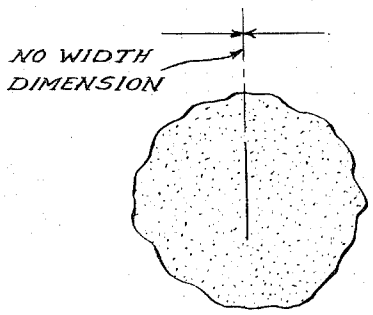
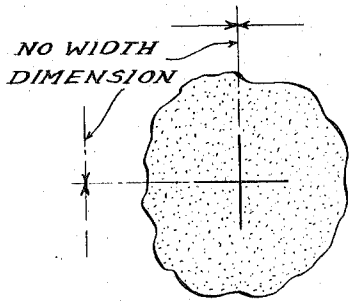
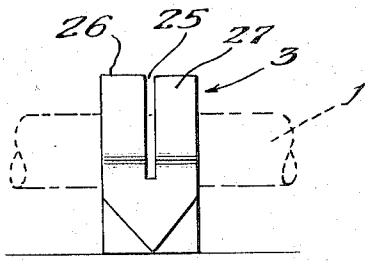


FIG. 16



DIMENSIONLESS CHARACTISTIC

FIG. 17



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3,290,842
DISTANCE PIECE FOR CONCRETE-REINFORCING RODS

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9 Claims. (Cl. 52—309)

This application is a continuation-in-part of my copending application, Serial No. 778,348, filed December 5, 1958, and now abandoned.

This invention relates to improved distance pieces for concrete reinforcing rods. The purpose of such distance pieces or "chairs," as they are sometimes called in the trade, is to maintain horizontally disposed reinforcing rods at a predetermined distance from the form when pouring floors, slabs and the like, this distance being called the "cover."

It is an object of my invention to provide a chair which can be firmly attached to a rod and which cooperates with the rod to provide a stable support therefor, so that the chair and rod assembly is able to withstand the forces encountered in normal usage, such as in pouring, or in tamping, or in men walking on the rod, or in the placing of other rods on the first mentioned rods crosswise.

Another object is to provide a chair which is easily applied, as by a snap-on type of operation, and also a chair which is of light weight and small bulk, is nonbleeding, and which provides negligible exposure area (FIG. 10) after the form has been removed, and which avoids form penetration (FIG. 12).

The criteria of a stable support for the rod is that the chair must have both transverse and axial stability. According to my invention, my improved chair provides that which I call grip stabilizing for axial stability and base stabilizing for transverse stability.

Other objects, features and advantages will become apparent as the description proceeds.

With reference now to the drawings in which like reference numerals designate like parts:

FIG. 1 is a perspective view of a preferred embodiment of my invention as applied to a reinforcing rod and in which the arms are stressed.

FIG. 2 is a side elevation thereof;

FIG. 3 is an end view;

FIG. 4 is a perspective view showing a modification;

FIG. 5 is an enlarged view, similar to FIG. 2, but showing the arms in their unstressed position, and showing a stressed position in dotted lines;

FIG. 6 is a plan view of FIG. 2 without the rod, identifying the terminology used herein; and

FIGS. 7 to 16 are largely self-explanatory diagrams illustrating pictorially the meaning of certain terms used herein. The curved arrow in FIGS. 7 and 8 represents the stability or resistance of the chair to tipping under external horizontal forces, as indicated by the straight arrow. FIG. 15 is a bottom view of FIG. 11 after removal of the form; and

FIG. 17 is an elevation showing a further modification.

In FIGS. 1 and 3, the distance piece or chair comprises a base part 2 having a pair of curved arms 3 and 4 which are molded integrally with the base part 2 from a suitable synthetic resin, such as nylon.

These arms 3 and 4 provide a recess 18, adapted to receive a reinforcing rod 1. The upper ends of the arms 3 and 4 are provided with cam portions 5 and 6 to facilitate the insertion of the reinforcing rod between the arms, and into the recess 18.

The base part 2 has an upper rod supporting surface 15, and the arms 3 and 4 are provided with inwardly projecting rod contacting portions 13 and 14. The lower arm portions 19, 20 are preferably upwardly tapered.

As shown in FIG. 3, the elements 13, 14 and 15 have a substantial length in the axial direction of the rod which in some instances may approach in magnitude the diameter of the rod.

In FIG. 5 the solid line position of the arms 3, 4 is the relaxed position, and the dotted line position is the stressed position after a rod 1 has been inserted. The vectors 21 represent the force developed by the resilience of the arms, and the vector 22 is the reaction of the rod supporting surface 15. The rod engaging portions 13 and 14 engage the rod 1 at about the 45° point; the exact position varies with the rod size. The fact the arms 3 and 4 are curved so as to provide a recess 18 of which the width w is greater than the height h causes the direction of the vectors 21 to have a greater vertical component than would otherwise be the case.

The fact that the arms 3 and 4 are upwardly tapered over at least a portion of their length elevates the effective center of flexure above the point 23 to a point along the locus line 24. The point 23 represents the approximate center of flexure if the arms were of uniform cross-section throughout their length. The tapering construction further increases the vertical force component, with the result that the gripping forces involved are sufficient to provide the required axial stability. Furthermore, this superior gripping characteristic is obtained with rods of different diameters.

It can be pointed out that grip stabilizing can be obtained only when the chair is fabricated from a synthetic resin; metals do not have the elastic properties which provide the proper combination of stress and flexural deformation which result in the development of a substantial gripping force which is not materially affected by variations in rod diameter within the relatively large tolerances encountered in the manufacture of reinforcing rods. Furthermore, according to my invention a given chair provides grip stabilizing for a range of rod sizes, as will be apparent from FIG. 5.

I am enabled to obtain grip stabilizing by providing first, an arm which is integrally molded with the base portion, secondly by making the arm of substantial thickness in the radial direction of the rod, and third by tapering the arm thickness so that the effective center of flexure is elevated to a point such that the force 21 is exerted in substantially the 45° direction from the vertical.

In the FIG. 4 embodiment, a single arm 3′ is provided which enables me to carry out the foregoing principles to an even greater degree. Here, the rod contacting portion 13′ exerts a force in the direction 21′ which has a greater vertical component, and the effective center of flexure lies approximately along the line 24′. The greater length of arm 3′ provides a tapering portion 19′ of greater length so that the elevation of the effective center of flexure above the plane of the rod supporting surface 15′ is more accentuated.

In the arrangement of the type described it will therefore be seen that the chairs cooperate with the rod 1 to form in essence a rigid structural assembly which is stable with respect to axially directed forces, even though the chair provides only line contact (FIG. 11) with the form.

In such an arrangement, it is possible to obtain transverse stability by the configuration of the base without running into the disadvantage of large exposure area.

As shown in FIGS. 1 to 3, the base part 2 has downwardly tapering walls 8, 9 terminating in transversely spaced abutments 16 and 17, each of which provide line contact with the form. In the particular arrangement shown, the downwardly tapering base portion 2 terminates in a single transversely oriented form abutting port 7 which is relatively narrow in the axial direction

to provide substantially line contact with the form. The transverse dimension of the form abutting portion 7 is greater than the rod diameter and is sufficiently great with respect to the cover distance *d* over rod weight as to impart transverse stability with respect to normally encountered forces. The cover distance *d* is the distance between the rod supporting surface 15 and the form abutting portion 7.

Obviously, the shape of the base part 2 can be varied from those shown in the drawings. All that is essential is that the base part 2 of the distance piece shall have a rod supporting surface or line 15 for engagement by the reinforcing rod when inserted in the particular gripping means shown herein, and at least two abutments 16 and 17 which are spaced from each other in the transverse direction, each of which provides substantially line contact with the form.

Thus, according to my invention, axial stability is obtained by the gripping arrangement, and transverse stability is provided by the base configuration, and the combination of the two is obtained without increasing the exposure area above that negligible amount which is provided by line contact.

In the FIG. 1 embodiment the base is provided with an additional form abutting portion 10 which is disposed parallel to the rod axis. In some instances, where the form abutting portion 7 is parallel to the grain of a wooden form, the likelihood of exposure is increased; the axially oriented portions 10 in such instances prevent grain penetration without materially interfering with the transverse stability. Compare FIGS. 13 and 14. Since these parts 10 also provide line contact with the form, they provide negligible exposure area.

In the particular arrangement shown, the portions 7 and 10 are cross-shaped. With this shape, practically no part of the distance piece will be visible in the surface of the cast concrete. Furthermore, there will be no bleeding at the surface because the synthetic resin does not rust or corrode.

The characteristic of line contact which contributes to the object of the present invention is that a line has no width, and therefore line contact has a dimensionless characteristic, even though the base is extended in a direction perpendicular to what would be the width dimension were it not a nullity or negligible. Thus if the exposure has a dimensionless characteristic which renders it either negligible or a nullity with respect to one rectangular coordinate, the exposure as a whole, being an area function, is either negligible or a nullity with respect to both coordinates. The very important practical advantage of this feature is that in many, if not all, instances the tamping of the concrete causes a thin layer of the slurry to work its way beneath the tapering side surfaces 8, 9 and the form abutting portion 7 with the result that the distance piece itself is invisible after the form has been removed. Therefore, although it could be stated as a theoretical proposition that the difference between negligible width and absence of width (nullity) may depend upon the radius, within certain small limits, of the form abutting portion 7 and also upon the deformability of the spacer and of the form, from the practical viewpoint there is no difference due to the unexpected result of invisibility.

FIG. 15 illustrates this principle with respect to the line contact shown in FIG. 11, and FIG. 16 illustrates it with respect to the cross shaped base contacting portions 7, 10 of FIG. 1. The exposure area in each instance is negligible, or a nullity due to the dimensionless characteristic of the line contact.

As shown in FIG. 17, the gripping action may be improved where the surface of rod 1 is irregular by slitting the arms 3 and 4 at 25 to provide separate upwardly tapering finger portions 26 and 27, each of which exerts an independent gripping effect. Thus a firm gripping engagement of the rod is provided even though it is provided with embossings, as is sometimes the case.

As a result of the foregoing, the distance pieces according to my invention provide improved stability, and at the same time they damage neither the surface of concrete slab, nor the surface of the form.

Due to their light weight and small bulk, a workman can carry several hundred small size distance pieces in his apron pocket, and due to the ease of application, they can be attached to the rods at the rate of several per minute, thus providing an exceedingly low labor cost of installation without sacrifice of stability.

I claim:

1. A distance piece for holding concrete reinforcing rods at a predetermined distance from the form consisting of an integral shaped body formed of a resilient synthetic resin material, said body comprising a base part having a dimension in the vertical direction which determines the desired cover, said body including an upwardly facing rod supporting surface, gripping means extending from said base part and comprising a pair of curved resilient arms which, when in relaxed position, provide a recess having a greater width than height, said arms having inwardly extending rod engaging portions for exerting a downward force on a reinforcing rod to urge the same against said rod supporting surface so that the transverse median plane of said distance piece will be maintained perpendicular to the axis of the rod supported thereby to provide axial stability, said base part having form abutting portions which include two abutments transversely spaced from each other on opposite sides of said rod axis, and each providing narrow line contact with said form.

2. A distance piece as claimed in claim 1 in which said arms include upwardly tapering portions at their lower parts.

3. A distance piece as claimed in claim 1 in which said rod engaging portions engage said rod at substantially the 45° points of said rod surface.

4. A distance piece for holding concrete reinforcing rods at a predetermined distance from the form consisting of an integral shaped body formed of a resilient synthetic resin material, said body comprising a base part having a dimension in the vertical direction which determines the desired cover, said body including an upwardly facing rod supporting surface, resilient gripping means extending from said base part and cooperating therewith to provide, when in relaxed position, a recess having a greater width than height, said gripping means including a curved resilient arm of substantial thickness and being upwardly tapering at its lower portion and including an integral rod engaging portion having freedom of movement in a direction such that the vertical component of the force exerted by said rod contacting portion, when stressed by a rod located in said recess, is greater than the horizontal component thereof, the thickness dimension of said base part in the axial direction being downwardly tapering, said base part having at its lower end an elongate form abutting portion which is of substantial length in the transverse direction to provide transverse stability for said rod and distance piece assembly, and which is relatively narrow in the axial direction and provides narrow line contact with said form.

5. A distance piece for holding concrete reinforcing rods at a predetermined distance from the form consisting of an integral shaped body formed of a resilient synthetic resin material, said body comprising a base part having a dimension in the vertical direction which determines the desired cover, said body including an upwardly facing rod supporting surface, gripping means extending from said base part and comprising a pair of curved resilient arms which, when in relaxed position, provide a recess having a greater width than height for receiving rods of different diameters, said arms having inwardly extending rod engaging portions for exerting a downward

force on a reinforcing rod to urge the same against said rod supporting surface so that the transverse median plane of said distance piece will be maintained perpendicular to the axis of the rod supported thereby to provide axial stability, the thickness dimension of said base part in the axial direction being downwardly tapering, said base part having at its lower end an elongate form abutting portion which is of substantial length in the transverse direction to provide transverse stability for said rod and distance piece assembly, and which is relatively narrow in the axial direction and provides narrow line contact with said form.

6. A distance piece for holding concrete reinforcing rods at a predetermined distance from the form consisting of an integral shaped body formed of a resilient synthetic resin material, said body comprising a downwardly tapering solid base part having a dimension in the vertical direction which determines the desired cover, said body including an upwardly facing rod supporting surface, gripping means integrally formed with and extending upwardly from said base part and comprising a pair of curved resilient arms which, when in relaxed position, provide a recess having a greater width than height for receiving rods of different diameters, said arms having inwardly extending rod engaging portions for exerting a downward force on a reinforcing rod to urge the same against said rod supporting surface so that the transverse median plane of said distance piece will be maintained perpendicular to the axis of the rod supported thereby to provide stability in the axial direction, the lower portion of said tapering base part being cross shaped and narrow and providing crossed line contact for abutting the form.

7. A distance piece as claimed in claim 6 in which said resilient arms terminate at their upper ends in upwardly diverging cam portions to facilitate the insertion of a reinforcing rod therebetween.

8. A distance piece as claimed in claim 1 in which said arms are slit to provide for each arm a plurality of separate finger portions having upwardly tapering portions at their lower parts.

9. A distance piece as claimed in claim 1 in which said arms are upwardly tapering at their lower portions, said inwardly extending rod engaging portions being located beyond said tapering portions and having freedom of movement in a direction substantially 45° from the vertical, whereby rods of different diameter can be received within said recess and be resiliently engaged by said rod engaging portions, the force exerted by said rod engaging portions having a substantial vertical component.

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