SPRING ASSEMBLIES HAVING PARTICULAR APPLICATION TO FORMING DIES

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ABSTRACT

The invention features a spring assembly the construction of which lends it particular advantage for use in forming dies, to replace conventional stripper springs. Preferred embodiments feature a spring receptacle and an interrelated cap formed to center and contain therebetween a coil spring. The cap and the receptacle are interconnected by a screw, the adjustment of which enables the adjustment in the contained length and the pre-load on the spring. In its preferred application, to replace a conventional stripper spring in a die set, the spring assembly of the invention can be so applied as to insure zero stress on the related stripper plate in the open condition of the die. The spring receptacle features a simple means to facilitate that this zero stress condition may be maintained as and when the die tools require sharpening or adjustment, which in turn requires an adjustment of the related stripper plate.

10 Claims, 3 Drawing Figures
SPRING ASSEMBLIES HAVING PARTICULAR APPLICATION TO FORMING DIES

BACKGROUND OF THE INVENTION

This invention relates to a spring assembly. Its construction is such that it has particular advantage in application as a biasing means for a stripper plate in a forming die and it will be so described. It will be obvious, however, that its application is not so limited and such is not intended by the present disclosure. A forming die is installed in a punch press or like equipment. Use thereof is particularly distinguished by a demand for a variable depth in its closing stroke. This is a consequence of the fact that it may be applied to either flat or formed stock portions. It is most frequently applied to formed stock, the conditions of which provide that there may be considerable variation in the location or position of the stock portion to be worked. It follows, then, that for optimal use the stripper plate of a forming die should have a relatively wide range of adjustability while providing means enabling it to preserve its capability for normal function. In addition to the above noted requirements, the stripper plate of any die, including a forming die, should serve several functions. These functions should include a firm and precise positioning of stock to which the forming tools are applied, prior to their impact. This is essential since lateral or vertical movement of the stock during impact can cause damage to both the die tools and the stock.

A further desired function of the stripper plate is to strip stock from the die tools, as a die is moved from its closed to its open position. It has proven to be particularly difficult to provide, in a simple but effective manner, a stripper plate assembly having the character, flexibility and functional capabilities above noted.

Further, in prior art efforts to achieve the desired functions of a stripper plate in a forming die, it has been the practice to back the stripper plate with a large number of biasing springs, the nature and character of which has been less than optimal to achieve the desired results. One of the problems which has been continuously evidenced in the prior art practice is the difficulty of achieving a uniform holding pressure on stock in the closing of a die and during a forming operation. Another problem has been to provide springs which will properly function, for an extended period of time, to uniformly store energy in a closing of a die in a manner to maintain a balanced stripping pressure on the related stripper plate. Moreover, it has been conventional practice to mount and preload a stripper plate, by way of its backing springs, such that the stripper plate is under continuous stress, even in the open position of the die in which it is embodied. This has resulted in pressure points which have tended in a relatively short period of time to distort the stripper plate. A particularly serious problem has been the fact that the prior art stripper springs have had a limited range of application, thereby necessitating a considerable stock of springs of different size in order that they may be interchanged to meet the various requirements found in respect to the adjustment of a stripper plate in its use in a forming die.

SUMMARY OF THE INVENTION

The present invention obviates the above noted problems as well as others which are inherent in the prior art practice referenced to the subject matter at hand. It provides an improved spring assembly which in preferred embodiment features a cup-like receptacle and an interrelated cap connected to center and contain therebetween a coil spring. The connection between the cap and the receptacle is provided by a screw, the adjustment of which enables, in a simple and quick fashion, an adjustment in the contained length and the preload on the spring.

In its use to replace a conventional stripper spring in a die set, the spring assembly of the invention is so constructed that it may be applied as to insure zero stress on the related stripper plate in the open condition of the die. Means are provided so the zero stress condition may be maintained as and when the tools of the related die require sharpening or adjustment, which in turn requires an adjustment of the related stripper plate. Added benefit achieved by the spring assemblies of the invention is that the construction thereof lends safety in their application and use. In use of a plurality of the spring assemblies to back the stripper plate, the spring assemblies are so designed that damage to one thereof will not materially affect the function of the related stripper plate.

As noted, it is contemplated that the invention spring assemblies are ideally suited for use in forming dies to provide for their application and efficient use so there will be no pressure on a stripper plate or its hangers in an open position of the die in which the same are embodied.

It is therefore a primary object of the invention to provide improvements in spring assemblies which render them more efficient and satisfactory in use, adaptable to a wide variety of applications and unlikely to malfunction.

Another object of the invention is to provide an improved spring assembly having a particularly advantageous application as a means for biasing a stripper plate in a forming die.

Another object of the invention is to provide a spring assembly particularly advantageous in application to a forming die which is characterized by means facilitating an adjustment as to the length of the contained spring means.

An additional object of the invention is to provide a simple and inexpensive means for a compensating adjustment in the position of a stripper plate in a die.

A further object of the invention is to provide a caged spring assembly having a wide range of flexibility in its application and having, in particular, a most efficient use in backing of a stripper plate in a die.

Another object of the invention is to provide a caged spring assembly wherein the spring means thereof may be variably pre-loaded and the spring load, once established, will remain constant.

An additional object of the invention is to provide an improved spring assembly possessing the advantageous structural features, the inherent meritorious characteristics and the means and mode of use herein described.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.
Referring to the accompanying drawings wherein is shown one but obviously not necessarily the only form of embodiment of the invention;

FIG. 1 is an elevation view of a spring assembly in accordance with the invention;

FIG. 2 is a cross sectional view of a forming die in its open position, the die being shown in fragmentary form and embodying the spring assembly of FIG. 1; and

FIG. 3 is a view similar to FIG. 2 illustrating the forming die in a closed condition.

With reference to the accompanying drawings, a preferred embodiment of the spring assembly of the invention there shown includes a receptacle forming a cup for one end of a coil spring 50. The receptacle is an integrated structure comprised of a sleeve 48 and a plug P. The latter consists of an intermediate portion 44 of dislike form welded in closing relation to one end of the sleeve 48 and oppositely directed, axially projected, reduced diameter portions 45 and 46. The portions 45 and 46 each have a generally cylindrical shape but differ in length and diameter. The plug portion 45 is the longest of the plug portions and smallest in diameter. It projects axially of and in concentrically spaced relation to the inner wall of sleeve 48. About the root of the axially projected plug portion 45, the plug portion 44 forms a shoulder providing a base for the contained end of the spring 50. So seated, the coil spring 50 projects from the plug portion 44 in a concentric spaced relation to both the plug portion 45 and the inner wall of the sleeve 48.

In the embodiment illustrated, the sleeve 48 is shown to have more than one-half the axial length of the spring 50. It does not extend the full length of the spring. Further, as designed, the plug portion 45 is of lesser length than the sleeve 48 but has a sufficient axial extent that a substantial portion of the one end of the spring is housed between and guided by both the plug and the sleeve. This insures that, in the course of its movement, whether in compression or expansion, the spring 50 will be fully controlled and maintained in a balanced condition in an axial sense, a major extent thereof.

As to the portion of the spring 50 which projects axially and beyond the limit of the sleeve 48, the projected extremity thereof is capped by the flange 54 of a cup-shaped element 52. The flange 54 is an external flange at the lip of and projecting radially outward from the cup 52 and the body of the cup nests fully within the projected extremity of the spring 50, in close concentric spaced relation thereto. The base of the cup-shaped element 52 has a central aperture which is in coaxial alignment with a counterbore in the adjacent end of the plug portion 45, the wall of which counterbore is internally threaded. It will be seen from the drawings that the cup-shaped element 52 and the plug P which is welded or otherwise suitably connected to be integral with the sleeve 48 are interconnected by a screw 56. The head of the screw is disposed in the cup 52 while the threaded body portion thereof passes freely through the central aperture in the base of the cup 52 to threadedly engage in the counterbore provided in the adjacent end of the plug portion 45. Viewing FIG. 2 of the drawings, which illustrate the invention spring assembly in a forming die, in the open condition of the die the relatively expanded head of the screw 56 will seat to the base of the cup-shaped element 52 about the aperture therein and dependent on the extent to which the screw is engaged in the plug portion 45, one can establish a desired contained length of the spring 50. Of course, this provides that a preload may be readily applied to the spring 50 to the extent desired, simply by turning the screw in or out of the plug portion 45.

It will be seen therefore that the projected extremity of the spring 50 is capped by the flange 54 and inwardly therefrom the spring is maintained about the wall of the cup-shaped element 52. Since the cup-shaped element 52, as shown, originally will nest to a certain extent in the open end of the sleeve 48, the cup-shaped element 52 serves also as a guide for the spring 50 in its contracting and expanding movements in conjunction with the wall of the sleeve 48, at its outer end, within which it is concentrically spaced.

The plug portion 46 which projects in a sense outwardly from the plug portion 44 and from the base end of the sleeve 48, as will be further described, provides a ready means for adjustment of the operative length of the spring assembly, above and separate from the capability of adjustment enabled by connection of the cup-shaped element 52 and the plug portion 45 through the medium of the screw 56.

FIGS. 2 and 3 of the drawings show the spring assembly of the invention as applied to a stripper plate in a forming die, which is a preferred application, as indicated previously. Only so much of the die structure is shown as may be necessary for an understanding of the invention.

As shown, the elements of the die include a tool retainer plate 10, a matrix or die retainer plate 12 and an interposing stripper plate 14. Plate 10 is backed by and releasably attached to an upper die shoe 16. The latter is suitably fixed to the ram of a press (not shown) and screws are applied to hold the plate 10 in a fixed relation to the die shoe in a conventional manner. As installed, the die retainer plate will have a fixed mount to the lower die shoe (not shown) and forms a work surface over which a piece of stock W is positioned for performance of work thereon by suitable tools fixed to and projected from the plate 10.

Plate 10 has a plurality of apertures 32, the upper end of each of which is expanded adjacent the die shoe 16 by a counterbore 34. Each aperture of passage 32 accommodates the shank of a tool which is to operate on the stock W. For purposes of the present disclosure only one forming tool 30 is illustrated though several tools of various nature may be simultaneously employed, as will be obvious. The head of the tool 30 is expanded to provide thereon an external flange which seats to the annular shoulder provided by the counterbore 34. The surface defining the head extremity of each tool 30 will be so positioned that it is flush with the uppermost surface of the plate 10. The working extremity of the tool 30 which projects through and beyond the plate 10 is comprised of a reduced work engaging and forming portion 31. In the case illustrated the work extremity is contoured to achieve the desired bonding operation on an edge of the work piece W in a manner believed obvious.

Plate 10 has a further series of apertures 18, each of which accommodates the projection therethrough of a hanger device 20. Each device 20 as illustrated includes a cylindrical sleeve 22 which has a sliding fit with respect to the wall defining its aperture or passage 18. At what might be considered its upper end, each
sleeve 22 projects through and beyond its passage 18 and has an external flange 23. The latter has an anular configuration and is adapted to seat to the upper surface of the plate 10 about the aperture 18 in which the sleeve is inserted. The opposite end of sleeve 22 projects, in each case, through and beyond its passage 18 to orient in a substantially parallel relation to the tool elements such as the tool 30 illustrated. Each hanger device further includes a socket head cap screw 24. The threaded shank of the screw 24 is projected through the sleeve 22 to have its lower extremity project through and beyond what might be regarded as the lower or outer end of the sleeve. This projection is limited as the relatively enlarged head of the screw seats on the flange 23. The screw head is provided with a socket so it may be manipulated by an Allen type wrench.

Pertinent to the application of the present invention retainer plate 10 is provided with a plurality of additional passages or bores 38, each of which accommodates the insert therein of a caged spring assembly which as previously described is comprised of the generally cylindrical cup-like receptacle including the elements 44, 45, 46 and 48 which seats one end of the coil spring 50 and has the spring contained thereto by the cap 52, 54 through the medium of the screw 56 and the portion 45 of the receptacle. It may be seen from FIGS. 2 and 3 of the accompanying drawings that each spring assembly when installed has a generally parallel relation to the included tools such as 30 and the hanger devices 20.

Noting further the FIGS. 2 and 3 of the drawings, the upper die shoe 16 is provided with apertures or recesses forming extensions of the apertures or passages 18 and 38 provided in the tool retainer plate 10, to accommodate its variously related components. For example, openings 26 are formed in the die shoe which position in correspondence with the apertures or passages 18 and form axial extensions thereof. In each case the opening 26 is enlarged in diameter with respect to the diameter of the related passage in the plate 10. This enables the opening 26 to accommodate the flange 23 on a sleeve 22 which seats within the boundaries thereof to the upper surface of the plate 10 and the head of the related screw 24 which seats in turn to the flange 23. The die shoe also has a series of cylindrical recesses 40 formed in the bottom thereof, each of which is of diameter and forms an axial extension of a related passage 36 in the plate 10. In the case illustrated the upper end of each spring assembly of the invention, as shown in FIG. 2, will in the open position of the die assume a position so the flange 54 on its upwardly disposed cup portion 52 is in closely spaced relation to what may be considered the base of a recess 40 while the lower end of the spring assembly seats to the stripper plate 14. In the assembly of the tool retainer plate and its related components to the shoe 16 the upper die shoe provides for an abutting engagement therewith of the heads of the forming tools such as 30.

Referring now to the stripper plate 14, it will be seen that this plate has a passage 36 aligning with each tool accommodating aperture 32, adapted to freely receive and accommodate the projection therethrough of the working extremity of the tool 30. The stripper plate also includes an internally threaded aperture 28 arranged to align with each passage 18 in the plate 10. Thus, the dependent extremity of each screw 24 can be threaded into an aperture 28 and the stripper plate 14 is thereby suspended from the plate 10. In the example illustrated the stripper plate also has a cylindrical recess in its upper surface having a form and size to accommodate the nesting therein of the projection 46 from the bottom of each cup-shaped receptacle forming a partial housing and base for a stripper spring 50. As a matter of fact this cylindrical recess has a diameter so that, where required, it may nest a lower end portion of the sleeve 48. It is here noted that the stripper plate in another instance may be formed without a complementary recess for the portions 46 of the included spring assemblies, in which event the portions 46 will merely base on the upper surface of the stripper plate 14. The desirability of this will depend on the application.

The matrix or die retainer plate 12 also has a plurality of apertures. In this case apertures 58 are shown to align with and accommodate the projection therein of the working extremity of the related tools 30, in a manner clearly obvious from the illustration showing a die in accordance with the invention in its open and closed position in FIGS. 2 and 3 of the accompanying drawings. In the case illustrated, it may be seen from FIG. 3 that the working extremity of the forming die will be in a closed position of the die effect a bending operation on a leading edge of a work piece W. It is for this reason that the upper surface of the die plate 12 is provided with a channel or channels 60 in the path of the forming tools 30 to facilitate the movement of the work piece W across the die plate once the bending operation has taken place.

Thus, with reference to FIG. 2 of the drawings, a forming die is illustrated in fragmentary fashion to show one of the invention spring assemblies as installed therein in the open position of the die. As installed the spring assembly obviously provides for a caging of the spring 50 in a manner that a desired preload may be applied to the spring simply by an adjustment of the screw 56. That a preload of a definite predetermined character may be readily determined is obvious since a spring of rated capacity may be utilized and the predetermined compression, easily effected, will introduce the critical preload. In using plural caged spring assemblies in accordance with the invention, as will be the case in any forming die such as illustrated, it may thus be seen that each caged spring unit may be individually established in accordance with the required preload. Note that the fact the spring 50 is not fully contained within a housing facilitates a wide range of adjustment of the preload. This insures that the spring assembly will have an equally wide range of application. While the spring 50 is not fully contained, in the vertical orientation shown, or any other orientation, it will be seen that the base of the spring which seats within the sleeve housing 48 is not only contained and guided by the inner wall of the housing but by the plug portion 45 which has a significant length. In respect to the upper or projected end of the spring 50, the extended cup-shaped housing 52 provides a wall within the spring which also forms a guide the alignment of which is assured by the application of the screw 56. Thus, the spring assemblies as applied in an application such as illustrated will have an insured axial contraction and expansion in operation of the die. This means that as and when pressure is applied to the stripper plate 14 through the medium of the spring assemblies, the pressure will be balanced and any stress in the course of the die operation will be uni-
formly distributed so that there will be no pressure points which would tend to warp or bend the stripper plate.

In the example illustrated, it will be seen that in the open position of the die the flanges 54 of the spring assemblies will have a spacing from the bottom of the recesses 40 in which they are received so that there will be no load or stress placed upon the stripper plate 14. It is noted at this point that the springs can be inverted and function similarly. As seen in FIG. 2, the stripper plate 14 is effectively suspended from the retainer plate 10 by the hanger devices 20 and the lower extremities of the sleeves 22 will seat to the top of the stripper plate while their flange portions 23 will seat to the upper surface of the plate 10, abutted in turn by the heads of screws 24. At the same time the forming tools are backed by the die shoe 16 and the lead portions of their working extremities 31 project through the passages 36 in the stripper plate 14.

As the die closes, the base of each recess 40 will move to contact the flange 54 of the related spring assembly, whereupon the spring assemblies, hanger devices and stripper plate move unitarily with shoe 16 and tool retainer 10 until stripper plate 14 limits against the work W. With firm seating of the plate 14 to the work W, the shoe 16 moves downwardly relatively to stripper plate 14 to carry the working extremity of the forming tools into their related passages 58 in the die plate. In the process the work piece is formed by the tools and cap 52 of each spring assembly is telescoped in receptacle sleeve 48 compressing and storing energy in the spring 50. With the die completely closed, the construction and arrangement provided dictates that the tool retainer plate 10 is at this point displaced from the flanges 23 on the sleeves 22 of hanger devices 20. Similarly, the base of the cup elements 52 of the spring assemblies is in each case displaced from the head of the related control screw 56. At this time the stripper plate 14 is substantially stressed. However, due to the uniformity of preload enabled by the construction of the spring assemblies, there is a uniform distribution of the applied pressure. Due further to the uniformity of the applied pressure, the work piece W is firmly and positively fixed to insure a precise and accurate forming operation.

In an opening stroke of the press in which the die illustrated is incorporated, the tool retainer plate 10 and die shoe 16 are retracted from the die plate 12, retracting the forming tools 30 from the work piece. A smooth and uniform opening of the die is facilitated by the uniform pressure load of the invention spring assemblies which hold the stripper plate 14 to the work piece W. As the press continues to open, the movement of the tool retainer plate 10 will continue relative the stripper plate 14 until the heads of screws 56 seat to respective bases of cap elements 52, at which time the compressive load applied to springs 50 is substantially fully removed. At about the same time, or immediately thereafter, the plate 10 abuts the hanger sleeve flanges 23. Upon continued retraction of the upper die shoe and retainer plate 10, the stripper plate 14 will be lifted directly therewith. Of course, in the interval in which the press is open, the work piece W may be advanced to clear the die or to bring a new section thereof in the path of the closing stroke of the die.

It will be seen from the foregoing that not only are the invention spring assemblies capable of easy and precise adjustment but the spring movements within the spring assemblies are fully controlled. The advantages thereof, particularly in forming dies as described are believed obvious. The nature of the construction of the described spring assemblies make them admirably suited for use in dies where there are variables in the depth of set in the operation of the die. A feature of the invention construction is that once a preload is simply set, it will remain constant for a particular application.

Added benefits are inherent in the invention assemblies, particularly as used in dies, considering the projection 46 of the plug P. As may be seen with reference to FIG. 1 of the drawings, the plug P is designed so portions thereof may be readily trimmed to establish a desired length of the spring assembly in its free position. With the adjustment of the projection 46 of a plug P, it will be obvious that the accommodating recess in the related stripper plate can then nest, as required, a lower end portion of the sleeve 48 of the spring assembly.

This lends greater flexibility in use of the invention spring assemblies. For example, in use of a die the tools thereof will wear and their operating portions must be re-formed and re-sharpened. This naturally has the effect of shortening the overall length of the tools and unless adjustments are made will alter the relationship between the tools and the stripper plate, with possible loss of working effectiveness unless the position of the stripper plate is adjusted. The invention spring assemblies may be readily adapted to any adjustment that is required, as indicated, merely by grinding or otherwise trimming the plug portion 46 in a manner believed obvious. This enables, for example, that where the die is optimally installed in the first instance so that, as illustrated in FIG. 1 of the drawings, there is zero stress on the stripper plates from the spring assemblies, by the simple adjustment indicated, this zero stress condition can be maintained when the die tools are required to be adjusted as to their working length. Of course, the hanger devices will be appropriately adjusted in a manner now known to the art to also compensate for the adjustment of the operative length of the die tools. Details of this are not discussed since in and of themselves they form no part of the present invention.

Due to the nature of the containment of the spring 50 by the relatively telescoped cups in the preferred embodiment illustrated, it will be obvious that safety is inherent in use thereof.

It will be understood from the fragmentary illustration of the die in FIGS. 2 and 3, by those versed in the art, that a plurality of spring assemblies will be employed in a backing relation to the stripper plate and, as indicated previously, that there will be a plurality of forming tools and hangers. A point in interest is that due to the control possible and the balance inherent in the spring assemblies of the invention, much fewer spring assemblies need be employed in an application such as illustrated than have previously been employed with prior art constructions.

It will be evident also that the spring assemblies illustrated can have a utility apart from the specific embodiment shown where safety, constant preload and simple adjustment mechanism are important and necessary aspects.

In the embodiment of the spring assemblies in accordance with the invention it is believed self-evident that the length of the cup 52 as well as the other elements
of the assembly may be varied to suit the nature and ex-
pected extent of their application.

From the above description it will be apparent that
there is thus provided a device of the character de-
scribed possessing the particular features of advantage
before enumerated as desirable, but which obviously is
susceptible of modification in its form, proportions, de-
tail construction and arrangement of parts without de-
parting from the principle involved or sacrificing any of
its advantages.

While in order to comply with the statute the inven-
tion has been described in language more or less spe-
cific as to structural features, it is to be understood that
the invention is not limited to the specific features
shown, but that the means and construction herein dis-
closed comprise but one of several modes of putting the
invention into effect and the invention is therefore
claimed in any of its forms or modifications within the
legitimate and valid scope of the appended claims.

Having thus described our invention we claim:

1. A caged spring assembly particularly advantageous
for use in a die to be interposed between movable die
means and a suspended stripper plate as a stripper plate
biasing means independent of means to suspend the
stripper plate, said assembly comprising spring means,
means cupping one end portion of said spring means,
means cupping the opposite end portion of said spring
means and means interrelating said cupping means and
said spring means to contain said spring means, said
interrelating means including a part adjustable relative
to said cupping and cupping means, rotatively mounted
in one thereof and having means providing a motion
limiting engagement thereof with the other of said cup-
ning or cupping means to achieve a selected operative
length of said spring means.

2. A spring assembly as in claim 1 wherein said cup-
ping means includes a portion axially projected in a di-
rection away from said cupping means which is modifi-
able as to its length to vary the effective length of the
spring assembly without changing the selected opera-
tive length of said spring means.

3. A spring assembly as in claim 1 wherein said cup-
ping means is a receptacle including a base seating said
one end portion of said spring means and an axially ex-
tended wall closely containing said one portion of said
spring means.

4. A spring assembly as in claim 3 characterized by
said cupping means including means on the base of said
receptacle projected inwardly of said one end portion
of said spring means to form a portion of said interrelat-
ing means which is adjustably engaged by said part.

5. A spring assembly as in claim 4 wherein said cap-
ping means includes means projected inwardly of said
opposite end portion of said spring means to form a
portion of said interrelating means in which said part is
rotatively mounted and with which said part has a mo-
tion limiting engagement.

6. A spring assembly as in claim 1 characterized by
said cupping and said cupping means both having a cup
form and being adjustable, one relative the other,
through the medium of said part.

7. A spring assembly as in claim 3 wherein said recep-
tacle wall has an axially extended length which is less
than the length of said spring means and said cupping
means is spaced therefrom and has an outermost portion
positioning transverse to the end portion of said
spring means remote from said one end portion and
said interrelating means.

8. A spring assembly useful as a biasing means for a
stripper plate in a forming die, said plate being adjust-
able as to its position to conform to the sharpening or
the like of die components, said spring assembly includ-
ing a compressible spring means and separate means
applied to opposite ends thereof, means independent of
said stripper plate adjustably interconnecting said sepa-
rate means, one of said separate means having a porti-
ton to bear upon the stripper plate, said portion being
projected away from the other one of said separate
means and being physically reducible in length to ac-
commodate adjustment of the position of the stripper
plate without compression of said spring means.

9. A spring assembly according to claim 8, character-
ized in that said one separate means includes a cupping
member and means providing a bottom for said cup-
ning member to which said spring means seats, said
means providing a bottom including a reduced diame-
ter portion projecting from said bottom inwardly of
said cupping member toward the other of said separate
means and further including an oppositely projecting
plug constituting said physically reducible portion.

10. A spring assembly according to claim 9, wherein
said interconnecting means includes an adjustable
screw a head of which is in limiting abutting relation to
said other separate means and a shank of which is in
threaded engagement with said reduced diameter in-
wardly projecting portion.