Feb. 4, 1936. R. D. PARKS 2,029,789

YIELDABLE SUPPORT

Filed Feb. 6, 1933

Fig. 1,

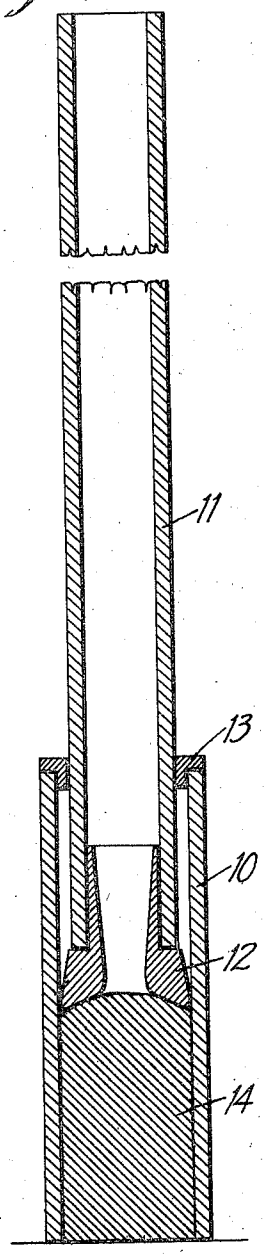


Fig. 2,

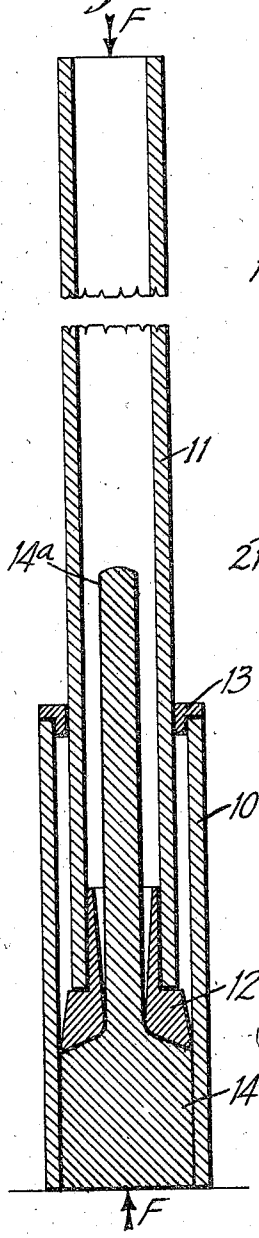


Fig. 3,

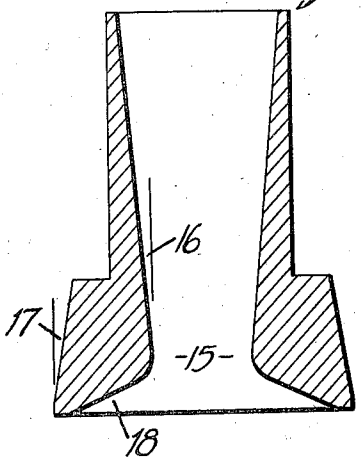


Fig. 4,

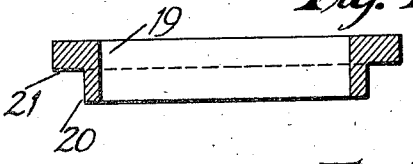
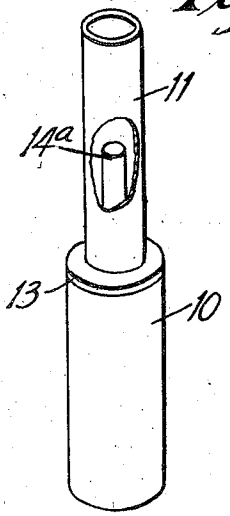


Fig. 5.



WITNESS

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UNITED STATES PATENT OFFICE

2,029,789

YIELDABLE SUPPORT

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Application February 6, 1933, Serial No. 655,414

2 Claims. (Cl. 248—356)

The device of the present invention while capable of a wide field of utility, is primarily designed for withstanding subsidence pressures in subterranean mining operations.

The principal object of the invention is to provide an all-metal support or column adapted to take the place of the supporting timbers usually employed.

Another object of the invention is to provide a yielding support of this character embodying a yieldable element of "plastic" metal or metallic alloy which becomes "strained" under excessive pressures without distorting the main body of the column.

A further object of the invention is to provide a support of this character in which the yield point does not depend upon frictional clamps of any sort.

A still further object of the invention is to provide a support of this character in which the yield point can be varied by two controlling elements; (*a*) the consistency of the "plastic" metal or metallic alloy which comprises the yieldable element, and (*b*) the relative size of the orifice, orifices, or apertures through which this yieldable element is extruded during the act of yielding under excessive pressures.

A still further object of the invention is to provide a device of the class described which will be of rugged, durable, practical construction, which will be highly efficient, and capable of repeated use, and which may be manufactured with comparative economy.

A "plastic" metal or metallic alloy is one which will flow without showing any other indication of failure such as crushing to a powder, or crumbling to pieces or failing by shear at definite angles under compressive loading.

"Strained" metal is that which has been stressed beyond its elastic limit so as to permanently deform or distort it.

In carrying out the invention I prefer to employ a plurality of metallic elements capable of a relative sliding action when an intermediate yielding member of "plastic" metal or metallic alloy is "strained" by pressures on the relatively movable members.

Preferably the strainable "plastic" element is capable of ready removal and replacement so that undue pressures on the column can result in rendering useless only the strainable "plastic" element without impairing the further usefulness, or in any way injuring the telescoping or relatively slidable members.

With the above noted and other objects in view, the invention consists in certain novel features of construction and combinations and arrangements of parts, as will be more fully hereinafter set forth and pointed out in the claims. The invention may be more fully understood from the following description in connection with the accompanying drawing, wherein

Fig. 1 is a longitudinal section through a supporting column embodying the invention prior to the exertion of excessive lengthwise compressive force upon the column.

Fig. 2 is a longitudinal section (similar to that of Fig. 1) through a supporting column embodying the invention during the yielding action caused by the exertion of excessive lengthwise compressive force upon the column.

Fig. 3 is a section view through the orifice member.

Fig. 4 is a section through the collar used for alignment of the telescoping members.

Fig. 5 is a perspective of the assembled column with a portion of the upper telescoping member cut away to show the distortion of the strainable element during the process of yielding under excessive loading.

While all of the parts used in the assembly of the column shown by the accompanying sketches are circular in cross-section, it is to be understood that other structural shapes of equivalent strength might be used.

The problems involved in withstanding the subsidence pressures in subterranean mining operations are too well recognized to warrant a lengthy discussion, but it may be briefly noted that the only type of support which has heretofore been considered practical, has been a wooden strut which is inherently compressible under pressure. The function of an efficient mine support is not to rigidly support its load, but rather to yield with the load and so keep the passageways open for a long enough period of time in which to effect the necessary operations of mining. The movement of subsiding ground is slow, but irresistible. Hence, the time element is vital and can be furnished only by a support of a yieldable nature which will "give" under excessive loadings, thereby allowing a natural arch to form and carry the greater portion of the subsidence pressure. Relatively non-yielding metallic supports, as they have heretofore been installed with rigidity and strength as the objective, become hopelessly deformed and twisted, block the underground passageways, and are difficult to remove after distortion.

Thus, in the present invention, I provide a yieldable metallic column or strut in which the distortion caused by subsidence pressures acts to telescope the column without distorting any part thereof, except a strainable "plastic" element which may be readily removed and replaced.

The device of the present invention is of simple construction as may be seen from the accompanying drawing wherein I have used the reference numeral 10 to designate a pipe which serves as the base of the column. A pipe 11 of smaller

diameter fits within pipe 10 and is centrally aligned therein by a collar 13 fitted to the top of pipe 10. An orifice member 12, which in this discussion will be hereafter termed a "plug", is fitted to the bottom of pipe 11 and is of such size as to fit smoothly within pipe 10 thereby maintaining the central alignment of pipe 11 within pipe 10. This inner structure comprising pipe 11 and plug 12, rests upon a "plastic" metal or metallic alloy base 14 which occupies the lower portion of pipe 10.

When the column has been set up in an underground opening, and subsidence pressures become great enough to overcome the resistance of the yield member 14, the plastic metal or metallic alloy comprising this member will flow through the orifice of member 12 and thus permit a relative intersliding action of members 10 and 11. Thus, in Fig. 2, when the structure is acted upon by a longitudinal force F of sufficient magnitude to stress the yield member 14 beyond its elastic limit, this plastic metal or metallic alloy will be forced through the orifice of the plug 12 and be so distorted as to exude beyond the orifice in the form of a bar 14a of strained metal or metallic alloy. It is apparent that the structure as a whole must be so designed that its strength as a column is greater than the resistance of the yieldable element 14 and likewise pipe 10 must be of such strength that it will not expand from internal pressures lower than the yield point of the yieldable element 14.

In this column I have provided for a definite control of resistance through the coordination of two variables; the relative size of the orifice of member 12 with respect to the cross-sectional area of the strainable element 14, and the consistency of the "plastic" metal or metallic alloy of member 14.

Thus, it is apparent, in Fig. 2, that changes in the size of the orifice of element 12 and metal composition of element 14 will affect the resistance to yield.

It is essential in the construction of a prop of the type herein described to reduce friction to a minimum because friction, as such, cannot readily be calculated quantitatively, since it is so affected by such items as surface inequalities, rusting, and dirt as to be subject to wide and undesirable fluctuations. In the design of the prop here described, I have, therefore, incorporated no frictional clamps or devices in the resistance elements of the prop and, further, I have so designed the prop as to reduce friction to a minimum at all points where the intersliding elements are in contact with each other.

Thus, in the design of the plug 12 shown in Fig. 3, the central opening is cut on a taper 16 above orifice 15 so as to diverge and prevent frictional contact with the bar of "plastic" metal after it has been forced through the orifice. The outside of the lower portion of the plug also has a taper 17 so as to reduce contact friction with the inner surface of pipe 10 as the plug is forced downward by longitudinal pressure. Tapers 17 and 16 may be replaced by recessional shoulders which would produce the same effect in regard to reduction of friction.

The angle of incidence 18 (Fig. 3) of the plug 12 upon the yieldable element 14 has only a slight effect upon the resistance to yield and may, therefore, be varied within considerable limits. To prevent undue stress on the side walls of plug 12 it is preferable to have angle 18 lie between 0° and 45° although it may be increased above 45° by the use of a design which will accommodate the additional forces involved.

Referring to the intersliding pipes 10 and 11 of Figs. 1 or 2, it is apparent that certain pipe sizes will fit smoothly one within the other without the use of an aligning collar 13 whereas others will require a collar of this sort. In Fig. 4, wherein the collar 13 is shown in cross-section the central opening 19 is of such diameter as to give a smoothly sliding fit around pipe 11, the outer diameter 20 is such as to fit firmly within the top of pipe 10, and the flange 21 rests upon the top of pipe 10 so as to hold the collar in its proper place.

From the foregoing description it will be evident that I have provided for considerable yielding of the column without injury to any portion thereof, except the member 14, so that there is no danger of distorting the body of the column. Upon removing the column from its position of installation, the intersliding elements of the column may be disassembled and the strained member 14 may be readily removed and replaced and the column reused.

In the present invention I have shown a strainable element subject to distortion under compression, but it will be obvious that this element might be arranged for distortion when the column is placed under tension, that it might in some instances be distorted by excessive torque exerted on relatively rotating members. It is also obvious that the device of the present invention could be used in groups as well as single columns and thus permit of standardization of unit construction, and it is likewise obvious that various types of supports embodying the principle of the present invention may prove useful in other fields than underground mining operations. In fact, devices embodying the invention are suitable for use wherever yielding struts, trusses or braces are desirable.

As many changes could be made in the above construction without departing from the scope of the invention, it is intended that all design details contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim—

1. A support including intersliding metal pipes, a deformable element of lead or lead alloy normally blocking telescopic movement of the intersliding pipes, and one or more orifices or apertures carried by the inner pipe acting on the deformable element so as to extrude the same through said orifice, orifices or apertures to permit the column as a whole to yield when excessive loads are imposed on the intersliding members.

2. In a support of the class described, two intersliding metal pipes aligned for relative telescopic movement, a "plastic" metallic element of lead or lead alloy contained or cast within the outer of the above mentioned pipes, an orifice so associated with the inner of the above mentioned pipes that excessive pressures along the intersliding axis will only cause said "plastic" element to be extruded through said orifice to allow telescopic yield without endangering the strength as a column of the support as a whole.

ROLAND DANE PARKS.