

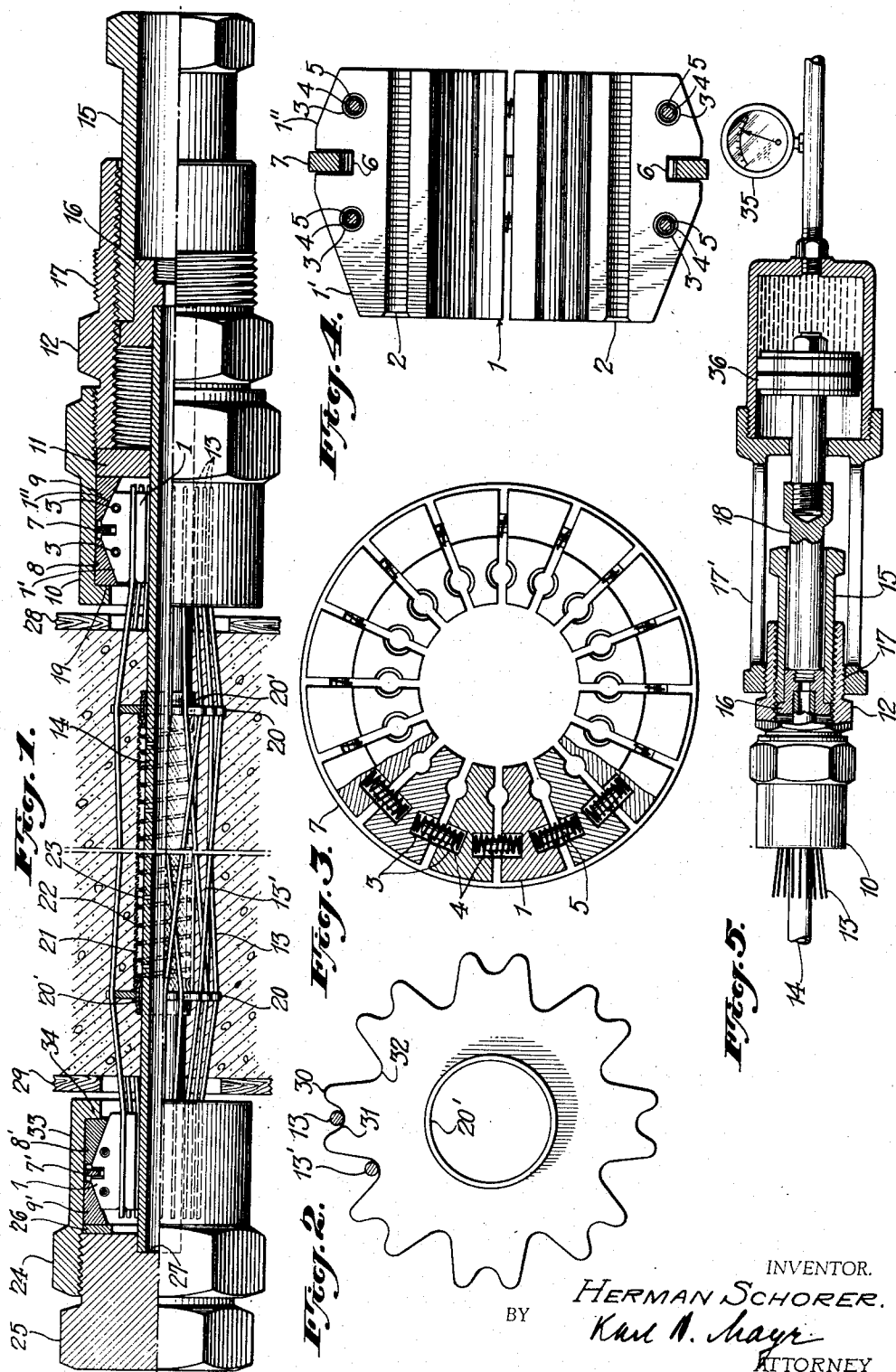
Aug. 31, 1943.

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2,328,033

PRESTRESSING REINFORCING DEVICE FOR CONCRETE

Original Filed Aug. 14, 1941



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2,328,033

PRESTRESSING REINFORCING DEVICE FOR CONCRETE

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Application August 14, 1941, Serial No. 406,806

13 Claims. (Cl. 72-71)

The present invention relates to improvements in a prestressing reinforcing device for concrete.

The present application is a continuation in part of my copending application Ser. No. 320,028, filed February 21, 1940.

An object of the invention is the provision of a prestressing mechanism comprising a central compression member, a plurality of tension members disposed therearound and spaced therefrom by means of a plurality of spacer members, and a device for holding one end of said tension members, for stretching said tension members, and for transmitting the tension force reaction to said compression member whereby all tension members are stressed uniformly and simultaneously and stability of the compression member is assured. To achieve this, the device according to the invention simultaneously grips with equal force and firmly holds the ends of all tension members which members preferably consist of high strength steel wire, such as spring wire, music wire, etc., or braided and rope-like combinations thereof. With the device according to the invention, no relative slipping of the individual tension members can take place under any stress conditions. The entire stretching mechanism according to the invention is confined within a comparatively small space in order to permit close placing of a plurality of precompressing mechanisms in a mass of concrete. The device according to the present invention is also adapted to accurately control and measure the applied stretching force and to provide simple means for its release after the concrete has reached the desired compressive strength. Instead of steel, the tension members may be made of other materials of high tensile strength and qualified to bind with concrete, such as glass, fibre-glass, and the like.

The improved prestressing mechanism according to the invention consists essentially of a ring wedge device which firmly holds and simultaneously grips the ends of the tension members, of means for the application and release of the gripping force, and of means for the application and release of the stretching force in the tension members.

A further object of the present invention is the provision of an improved anchorage device for holding the other ends of the tension members which are not engaged by the aforesaid stretching and tension reaction transmission device. This device also makes use of a ring wedge construction which simultaneously grips with equal force and holds the far ends of all tension members and

also holds the far end of the compression member in definite central position with respect to the tension members.

Another object of the present invention is the provision of an improved compression member arrangement which permits drawing off of excess water and air from the plastic concrete mass which surrounds the compression member.

An object of the present invention resides in the provision of simplified spacer members for holding the tension members in desired position relatively to the compression member.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawing which, by way of illustration, shows what I now consider to be a preferred embodiment of my invention.

In the drawing:

Fig. 1 is a longitudinal part sectional view of a prestressing unit according to the invention.

Fig. 2 shows a spacer member according to the invention in large scale.

Fig. 3 is a large scale part sectional view of a ring wedge device according to the invention.

Fig. 4 is a longitudinal sectional view of the device shown in Fig. 3.

Fig. 5 is a diagrammatic showing of a hydraulic mechanism for operating the tensioning and tensioning reaction force transmitting device shown in Fig. 1.

Like parts are designated by like numerals in all figures of the drawing.

Referring particularly to the drawing, the stressing and tension force transmitting device shown on the right side of Fig. 1 comprises a ring wedge device for simultaneously gripping and holding one end of all tension members 13 and 13'. This device is also separately shown in Figures 3 and 4. It consists of a plurality of conical wedge members 1 having annulus-sector-like cross sectional configuration and being disposed symmetrically about the center line of the compression or stay member 14. The outside wedge surfaces 1' and 1'' are parts of a double cone and the inside surfaces form a cylindrical cavity. The radial faces of members 1 are provided with longitudinal, groove-like depressions 2, the groove surfaces being made rough, for instance by means of knurling or threading. The groove surfaces are of sufficient hardness to "bite" into the tension members 13 upon application of the gripping force.

The radial faces of members 1 are further provided with pockets 3, which receive compression

springs 4 and internal spring guides 5. A circumferential groove 6 permits assembly of the wedges inside the holding ring 7 whereby relative movement of the individual wedges in a longitudinal direction is prevented. The compression springs 4 have the tendency to widen the space between adjacent wedges. The resulting radial, outward movement of the wedges is limited by the holding ring 7. In this position the tension wires 13 and 13' can then be conveniently inserted in the space formed by opposite grooves 2.

The wedge assembly is located between two rings or counter members 8 and 9, which have conical inside surfaces corresponding to the outside wedge surfaces. The outside surfaces of rings 8 and 9 are cylindrical. Ring 8 is fixed in a sleeve 10, for instance by means of a press fit, and abuts shoulder 19 provided on said sleeve. Ring 9 is movable in a longitudinal direction, such movement being limited by a washer 11 disposed between ring 9 and a cylindrical and threaded member 12 screwed in member 10.

After insertion of the tension members 13 and 13' in the groove spaces 2, the threaded member 12 is turned so as to force ring 9 toward ring 8. Due to the conical contact surfaces a radial force component is exerted on wedge members 1 which force counteracts the spreading force of springs 4 thereby reducing the radial space between the wedges and exerting a gripping force on the tension member 13 and 13' disposed in grooves 2.

The magnitude of the gripping force is mainly determined by the cone angles of the rings 8 and 9, the frictional resistance on the conical contact surfaces, and by the angle formed by the radial faces of the wedge members. The result is a powerful double wedge action which permits the simultaneous and uniform gripping of all tension members within a very confined space.

The gripping force reaction is transmitted directly through the narrowest wedge part to the adjacent groove face and tension member, whereby a definite system of identical gripping forces is obtained. As shown by tests, reasonable variations in the dimensions of individual wedges and tension members do not affect the efficiency of this device.

The stretching of the tension members is accomplished as follows:

A hollow ram member 15 is screwed into the threaded member 12, thereby forcing a cap 16 toward the compression or stay member 14. The reaction of this compression force is transmitted through the sleeve 10, ring 8 and wedges 1 to the ends of the tension members 13 which are subjected to the desired tensile stress. As may be readily seen, tensioning of members 13 has the tendency to increase the gripping effect of wedges 1. The stretching operation is facilitated by the application of a hydraulic ram, which also permits accurate control of the stretching force by simply reading a pressure gauge 35 which may be connected to the actuating fluid space. For this purpose a yoke 17 is attached to member 12 by means of threads 17. A pusher pin 18 extending from the ram plunger 36 is inserted into the hollow bolt member 15. When the ram plunger moves to the left as seen in Fig. 5 the pusher pin 18 presses against cap 16 and the reaction is transmitted through the yoke to member 12 and to the ends of the tension members as described above. The bolt member 15 can then be turned freely to follow the movement of cap 16, holding said cap in position when the hydraulic ram is re-

moved. The hydraulic mechanism is shown in Fig. 5.

The release of the stretching force and the release of the gripping force on the tension members are carried out in reverse order.

In the proposed prestressing mechanism the stay or compression member consists of a tube 14 on which are disposed spacers 20 at suitable intervals. Between the spacers the tube is surrounded by a sheathlike member 21 made of filter fabric and separated from the tube 14 and supported by a helically wound wire 22 which has the shape of a compression spring. The ends of the filter 21 are extended and fastened over the projections 20' of adjacent spacers so as to prevent cement mortar from entering the inside space of the filter fabric. The wall of the compression member 14 is provided with small perforations 23 at suitable intervals. The end caps 16 are provided with a suction hose connection.

The compression member 14 is adapted to fulfill its primary function as an efficient column, and, in addition, can also be utilized as a conduit for drawing off excess water and air from the surrounding plastic concrete mass.

After the prestressing mechanism has been embedded in fresh concrete and before the latter has set, a suction hose is attached to cap 16, whereby the air inside the tubular member 14 and filter tube 21 is exhausted. The resulting pressure difference between the outside and inside of the filter fabric forces excess water and embedded air from the surrounding plastic concrete through the filter fabric, whereupon it flows along the helical space and through the perforations 23 into the tubular conduit and suction hose.

Due to the outside atmospheric pressure the space around the compression member 14 and the tension members 13 and 13', is thoroughly filled with a very compact concrete mixture, completely embedding the tension members over their entire length. The removal of excess water and air thus improves the compressive strength and texture of the concrete at the most desirable location, namely along the zones of maximum stress upon release of the stretching force. At the same time it is assured, as experience has shown, that the compression member 14 can be removed without difficulty. If desired the resulting cavity may then be filled with cement grout under pressure.

The spacer members 20 shown separately in Fig. 2 are of star-like configuration having prongs 30 provided with recesses 31 over which one set of tension wires, namely wires 13 are laid. In the recesses 32 between the prongs rests the other set of the tension wires which are designated by numeral 13'.

At the far end of the device, on the left side of Fig. 1, an end anchorage mechanism is provided comprising a ring-wedge device which is alike the one used at the right side. This device uniformly and simultaneously grips the far end of the tension members 13 and 13'. It is placed within a sleeve member 33 having a shoulder 34 which the cone ring member 8' abuts in the same way as member 8 abuts shoulder 19. Member 33 has a nutlike portion 24 into which a bolt member 25 is screwed which has a recessed portion 27 for abutting and holding compression member 14 in place. Between bolt member 25 and cone ring member 8' a washer 26 is inserted which corresponds to the annular member 11 of the stretching mechanism. Members 7' and 1' correspond to mem-

bers 7 and 1 of the ring wedge mechanism used in the stretching mechanism on the right side of Fig. 1. The stretching mechanism shown on the right side as well as the anchorage mechanism shown on the left side of Fig. 1 is disposed outside of boards 28 and 29 respectively which form the concrete mould. Both mechanisms can be removed after they have fulfilled their duty and reused.

While I believe the above described embodiment of my invention to be a preferred embodiment, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. A prestressing and reinforcing device for concrete comprising a compression member, a plurality of tension members spaced from and disposed around said compression member, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, and an anchorage mechanism disposed at the other end of said device and interconnecting the other end of said tension members and of said compression member, each of said mechanisms comprising a ring wedge device simultaneously gripping with equal force and firmly holding the ends of all of said tension members, said ring wedge device including a plurality of wedge members disposed between and clampingly engaging the ends of said reinforcing members and having an annulus-sector like cross section and forming together a substantially cone shaped outer surface disposed coaxially with said device, a counter member having a substantially cone shaped inner surface disposed coaxially with and engaging said outer surface, and tightening means engaging said wedge members and said counter member and forcing them in axial direction toward one another whereby said wedge members are moved radially and toward one another and toward said tension members.

2. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a ring wedge device comprising a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between said tension members and having an outer surface inclined to the longitudinal axis of said wedge device, said inclined surfaces forming together a cone surface, and an annular member having a cone shaped interior surface corresponding to and slidably engaging said outer surfaces of said wedge members and forcing said wedge members together and toward said tension members upon relative axial movement of said ring member and said wedge members.

3. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a ring wedge device comprising a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between

said tension members and having outer surfaces inclined to the longitudinal axis of said wedge device and forming together a double cone surface, and two annular members each having a cone shaped interior surface corresponding to and slidably engaging one of the said outer surfaces of said wedge members and forcing said wedge members together and toward said tension members upon relative axial movement of said ring members and said wedge members.

4. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a ring wedge device comprising a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between said tension members and having an outer surface inclined to the longitudinal axis of said wedge device, said surfaces forming together a cone surface, an annular member having a cone shaped interior surface corresponding to and slidably engaging said outer surfaces of said wedge members and forcing said wedge members together and toward said tension members upon relative axial movement of said ring member and said wedge members, a ring member holding said wedge members together, and resilient members disposed between said wedge members and forcing said members apart and toward said ring member.

5. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a ring wedge device comprising a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between said tension members and having an outer surface inclined to the longitudinal axis of said wedge device, said outer surfaces forming together a cone surface, and an annular member having a cone shaped interior surface corresponding to and slidably engaging said outer surfaces of said wedge members and forcing said wedge members together and toward said tension members upon relative axial movement of said ring member and said wedge members, said wedge members having rough surfaced longitudinal recesses on their radial surfaces receiving and firmly engaging said tension members.

6. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a tensioning and tensioning force transmitting mechanism comprising a ring wedge device having a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between said tension members and having outer surfaces inclined to the longitudinal axis of said wedge device and forming together a double cone surface, and two annular members each having a cone shaped interior surface corresponding to and slidably engaging one of the said outer surfaces of said wedge members, a cylindrical member disposed around said wedge device and having an interior shoulder abutting one of said annular members, substantially cylindrical means longitudinally movably inserted in said cylindrical member and abutting the other of said annular members, said cylindrical member

and said cylindrical means, upon axial movement toward one another, forcing said annular members together and said wedge members simultaneously toward said tension members for firmly gripping the latter, a ram means in said cylindrical means abutting one end of said compression member, and a holding member holding said ram means in desired position relatively to said cylindrical means.

7. In a prestressing and reinforcing device for concrete comprising a compression member and a plurality of tension members spaced from and disposed around said compression member, a tensioning and tensioning force transmitting mechanism comprising a ring wedge device including a plurality of individual wedge members having an annulus-sector-like cross sectional configuration and being disposed around said compression member and between said tension members and having outer surfaces inclined to the longitudinal axis of said wedge device and forming together a double cone surface, and two annular members each having a cone shaped interior surface corresponding to and slidably engaging one of the said outer surfaces of said wedge members, a nut member disposed around said wedge device and having an interior shoulder abutting one of said annular members and having an internal thread, and nut means having an external thread engaging the thread of said nut member and abutting the other of said annular members and having an internal thread, said nut member and said nut means, upon axial movement toward one another, forcing said annular members together and said wedge members simultaneously toward said tension members for firmly gripping the latter, ram means in said nut means abutting one end of said compression member and comprising externally threaded means screwed into the internal thread of said nut means, said ram means upon longitudinal relative movement with respect to said nut means pulling and tensioning said tension members and transmitting the tension reaction force to said compression members.

8. A prestressing and reinforcing device for concrete comprising a tubular compression member having lateral perforations, a plurality of tension members disposed around said compression member, spacer members disposed on said compression member and spaced from one another and spacing said tension members from said compression member, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, an anchorage mechanism disposed at the other end of said device and interconnecting the other end of said tension members and the other end of said compression member, and tubular members permeable to water and air disposed around said compression member and between said spacer members.

9. A prestressing and reinforcing device for concrete comprising a tubular compression member having lateral perforations, a plurality of tension members disposed around said compression member, spacer members disposed on said compression member and spaced from one another and spacing said tension members from said compression member, said tubular members, and a tensioning and tensioning force transmitting mechanism disposed at one end of said device and

interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, an anchorage mechanism disposed at the other end of said device and interconnecting the other end of said tension members and the other end of said compression member, tubular members permeable to water and air disposed around said compression member and between said spacer members, and helical spacing means disposed between said compression member and said tubular members.

10. A prestressing and reinforcing device for concrete comprising a tubular compression member having lateral perforations, a plurality of tension members disposed around said compression member, spacer members disposed on said compression member and spaced from one another and spacing said tension members from said compression member, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, an anchorage mechanism disposed at the other end of said device and interconnecting the other end of said tension members and the other end of said compression member, and tubular members permeable to water and air disposed around said compression member and between said spacer members, said spacer members having tubular projections disposed around said compression member and extending into said tubular members.

11. A prestressing and reinforcing device for concrete comprising a longitudinal compression member, two sets of tension members disposed around said compression member, spacer members disposed on said compression member and spaced from one another, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, and an anchorage mechanism disposed at the other end of said device and interconnecting the other ends of said tension members and the other end of said compression member, said spacer members having prong portions engaging one set of said tension members and recesses between said prong portions accommodating the other set of said tension members.

12. A prestressing and reinforcing device for concrete comprising a compression member, a plurality of tension members spaced from and disposed around said compression member, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, and an end mechanism disposed at the other end of said device and interconnecting the other end of said tension members and the other end of said compression member, said end mechanism comprising a ring wedge device including a plurality of wedge members disposed around said compression member and between said tension members and having annulus-sector-like cross sectional configuration and two outer

surfaces inclined in opposite direction with respect to the longitudinal axis of said device and forming together a double cone outer surface, two annular members having internal conical surfaces corresponding to and individually slidingly engaging the outer surfaces of said double cone, a nut member disposed around said wedge device and having an internally projecting shoulder abutting one of said annular members, and bolt means screwed into said nut member and abutting the other of said annular members and said other end of said compression member.

13. A prestressing and reinforcing device for concrete comprising a compression member, a plurality of tension members spaced from and disposed around said compression member, a tensioning and tensioning force transmitting mechanism disposed at one end of said device and interconnecting one end of said tension members and one end of said compression member and tensioning said tension members and transmitting the tension reaction force to said compression member, and an end mechanism disposed

at the other end of said device and interconnecting the other end of said tension members and the other end of said compression member, said end mechanism comprising a ring wedge device including a plurality of wedge members disposed around said compression member and between said tension members and having annulus-sector-like cross sectional configuration and two outer surfaces inclined in opposite direction with respect to the longitudinal axis of said device and forming together a double cone outer surface, two annular members having internal conical surfaces corresponding to and individually slidingly engaging the outer surfaces of said double cone, a nut member disposed around said wedge device and having an internally projecting shoulder abutting one of said annular members, a bolt member screwed into said nut member and abutting said other end of said compression member, and an annular member disposed between and axially abutting said bolt member and the other of said annular members.

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