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REINFORCED CONCRETE POLE

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This invention relates to a reinforced concrete pole composed of building elements; the individual building element is a hollow body formed of a tubular metal envelope which is covered on the inner and outer side with concrete or the like.

This invention consists in making the metal envelope conical and in that in certain elements it projects from the concrete cover so that the several elements can be placed on the other by means of the conical metal envelopes and thereby alone a solid sit at the joints is obtained.

A further feature of the invention is that the outer concrete cover and preferably also the built up metal envelopes and the inner concrete cover have elliptical or oval cross section form. The invention provides further on the exposed portions of the metal envelope of the several elements reinforcements and special simple and practical means for a more solid connecting of the projecting metal envelope pieces the ones with the others and with the concrete, the latter being subsequently poured on to the joints for the connection of the elements, and further means for connecting the metal envelope with the concrete cover on each element.

Several embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

Fig. 2 is a cross section through the pole on enlarged scale.
Fig. 3 shows the metal envelope for this pole prior to the covering with concrete.
Fig. 4 is a cross section through Fig. 3 on enlarged scale.
Fig. 5 shows a form of construction of the pole at a joint between two elements.
Fig. 6 is a cross section on line VI—VI of Fig. 5.
Figs. 7, 9, 11 and 13 show each one another form of construction of the connection of the elements of the pole.

The pole according to the invention is built up from conical concrete elements and and of an inner and outer concrete cover. The metal wall possesses a slight conicity and its cross sectional form is preferably elliptic or oval. The concrete cover a is preferably of similar thickness on the inner side as well as on the outer side and also of elliptical or oval cross section form.

In order to ensure a good adhering of the concrete on the metal wall, the metal wall has a number of uniformly distributed straight longitudinal slits (Fig. 5) and these slits are widened at certain points so that lens-shaped apertures are formed through which the concrete on the upper side of the metal wall can combine with the concrete on the inner side of the same, and barbs are formed which penetrate into the inner and outer concrete covers. The slits do not weaken the metal wall as they are formed by straight vertical cuts and not by a horizontal incision as required for bent off tongues and flaps. The concrete cover is not applied on the inner side and outer side over the whole length of the metal wall, but in each element, except the lowermost element of the pole, the metal wall is without inner and outer concrete cover for a short distance at the lower end, and in each element except the uppermost element of the pole the metal wall is without outer concrete cover for the same distance at the upper end, as shown in Figs. 5 and 7. Where the outer concrete cover is lacking at the upper end, the inner concrete cover e is thicker. The exposed portions of the metal walls of the elements serve for slipping the elements the one on the other. The conicity of the metal walls is such that the element to be place on fits with its lower uncovered wall portion accurately over the upper uncovered metal portion of the preceding element, so that already by placing the elements the one on the other a connection is produced, which is not easily detachable. The connection may be subsequently strengthened by other means.

In the form of construction shown in Figs. 5 and 6 the ends of the metal walls e, e of the elements to be connected project from their concrete cover a distance similar to the outer concrete diameter at this point. The naked portion c of the metal wall at the lower end of the element b to be placed on is reenforced by a conical ring g engaging over one half of its length into the concrete cover. This portion of the metal wall has further several annular grooves on the inner side forming bulges on the outer side. The metal wall of each element
projecting at the upper end, with the exception of that of the uppermost element, possesses at corresponding points on the outer side forming inwardly directed ribs \( P \), so that after the elements \( b^1 \) and \( b^2 \) have been placed the one on the other, the annular grooves \( P \) and \( \bar{P} \) stand the one opposite the other and form together annular chambers \( \mathbf{h} \). The walls of these grooves have slots \( m \). The outer concrete cover, lacking on the projecting portions of the metal walls, is completed after the elements have been placed the one on the other by concrete cover from the aid of a mould or casing. The concrete mass penetrates through the slots \( m \) of the grooves \( b^1 \) and \( \bar{P} \) into the annular channels \( \mathbf{n} \) and to the inner concrete cover \( e \). The cones of the metal walls placed the one on the other are such that the concrete cover \( a \) of the element placed on does not rest completely upon the thickened portion \( e \) of the inner concrete cover of the lower element, but leaves free a narrow gap. At the height of this gap several holes \( v \) are provided in the metal wall of the upper element and in the reinforcing ring \( g^1 \), through which holes concrete can penetrate during the pouring on and also fill the gap between the end faces of the two inner concrete covers of the superposed elements. In order to prevent this concrete from flowing into the interior of the elements, the thickened portion \( e \) of the inner concrete cover engages by means of a conical extension into the inner space of the upper element \( b^1 \) and forms a vertical gap \( k \), which is also filled with concrete during the pouring.

The end faces of the outer concrete cover of each element may have cavities \( j \) in which the concrete to be poured in at the joint can combine with the end faces of the elements.

In the form of construction shown in Figs. 7 and 8 the lower end of the metal wall projecting from the element is also reinforced by a ring \( d^1 \) of corresponding conicity. The rings \( g^1 \) and \( d^1 \) may also form a conical sleeve covering the whole portion of the metal wall projecting from the lower end of the element. By the rings \( g^1 \) and \( d^1 \), weakening of the pole caused by the interruption of the concrete covering between two successive elements is overcome so that the pole can break above these joints. The thickness of the metal wall in the elements decreases in upward direction from one element to the other so that the resistance of the elements from below upwards is graduated according to the wind pressure on the joints decreasing from below upwards so that actually only the uppermost element can break, i.e., shortly above the joint, all lower elements remaining undamaged. For obtaining a more solid connection of the metal walls overlapping one another, notches \( f \) may be cut into the metal walls after the elements have been placed the one on the other so that the material displaced by the cutting of the notches penetrates into the internal concrete sleeve \( e \). The wires \( k \) (Fig. 7) may further be wound around the joint prior to the pouring in of the concrete.

The connection of the elements at the projecting metal wall pieces can also be ensured by clamping rings. Figs. 9, 11, 13 show three such forms of construction according to Figs. 9 and 10. The metal walls \( c^1 \), \( c^2 \) project only a short piece from the concrete cover and they have grooves \( o \) fitting the one into the other. In order that the conical metal walls \( c^1 \) and \( c^2 \) can be placed the one over the other, the wooden elements \( n \) notwithstanding these grooves, the outer wall \( c^1 \) is slit at several points. A section ring \( \varphi \) is placed around the joint, this ring being of such shape that it fits into the grooves \( o \). The ring has extensions at the end, by means of which it can be tightened and held together with the aid of a screw bolt \( q \). The gap on the outer side of the joint is filled with concrete. As shown in Figs. 11 and 12 only the one projecting end of the metal wall has a groove \( o^1 \) filled on the inner side with a section ring \( \tau \). The metal wall projecting from the lower end of the element \( b^1 \) has no groove. A clamping ring \( \delta \) is placed around the overlapping portion of the metal walls and then tightened so strongly that the smooth metal wall \( c^1 \) is pressed into the groove \( o^1 \). A four-cornered plate \( t \), which has a suitable hole, is pushed over the two connecting extensions of the clamping ring and securely clamped by means of wedges \( \varpi \), whereupon the joint is filled with concrete.

As shown in Figs. 13 and 14 the edges of the projecting portions of the metal walls are folded over to form cornered or unround beads \( \gamma \), which may have a metal insert. A U-shaped clamping ring \( \chi \) of corresponding section is placed over the two beads and its ends are held together by means of a plate \( f \) with suitable hole pushed over said ends. U-shaped pins \( \sigma \) may be used for such purpose. The joint is then filled with concrete. In order to reinforce the concrete ring to be poured in, the outer concrete cover of each element may be thickened at the upper end (Fig. 13). As the elements are securely held the one on the other already by the conical overlapping metal walls, it is not necessary to wait till the poured in concrete has solidified at a joint and dried, but the pole may be put together up to the top or upper end without delay. This is effected by the fact that a man mounts the pole by means of climbing irons when the third elements has to be fitted. When this element has been fitted he immediately climbs same and fits the fourth element and so forth. The elements are held in place by means of lifting tackles on a jib which is always fixed on the top of the uppermost element by the man who climbs the pole. The joints may be filled with cement immediately or subsequently. A scaffolding is not required for erecting the pole.

The invention is not limited to the forms of constructions described. The elements might be analogously constructed in the reverse order in that the portion of the metal wall on the lower end of the element has no concrete cover on the inner side and is filled with concrete after the elements have been pushed the one over the other. The metal walls may be of circular cross section, the concrete cover being of elliptic cross section, or the surface of the metal walls may be roughened or fluted to better unite with the concrete. Instead of concrete any other suitable mass solidifying after the application may be used. Other building elements than poles may be produced from the materials according to the invention, for instance pillars, columns and the like.

I claim:

1. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section with internal and external concrete cover the metal wall projecting at the lower end of the element which is without internal and external concrete cover and at the upper end of the metal wall without external concrete cover and with thickened internal concrete cover, the wide
lower projecting portion of the tapered metal wall adapted to be slipped over the upper narrower end of the next lower element of the pole.

2. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section with internal and external concrete cover, said metal wall projecting at the lower end of the element which is without internal and external concrete cover and at the upper end which is without external concrete cover and with thickened internal concrete cover, the wide lower projecting portion of the metal wall adapted to be slipped over the upper narrower end of the next lower element, and means for connecting the engaging portion of the elements slipped the one over the other.

3. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section covered on the inner side and on the outer side with concrete, said metal having straight incisions extending in the longitudinal direction of the same, the edges of these incisions being forced the one outwards and the other inwards and forming linteliform apertures for the connecting of the external with the internal concrete cover, and barbs for securing the concrete on the metal wall, said metal wall projecting at the lower end of the element which is without internal and external concrete cover and at the upper end which is without external concrete cover and with thickened internal concrete cover, the wider lower projecting portion of the metal wall adapted to be slipped over the upper narrower end of the next lower element of the pole.

4. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section with internal and external concrete cover, said metal wall projecting at the lower end of the element which is without internal and external concrete cover and at the upper end which is without external concrete cover and with thickened internal concrete cover, the lower wide projecting portion of the metal wall adapted to be slipped over the narrower upper end of the next lower element of the pole, conical metal sleeves placed onto the outer of the engaging metal walls slipped the one over the other and engaging partly into the concrete cover at the lower end of the upper element and strengthening the joints of the elements, and means for connecting the metal cones placed the one on the other of the elements.

5. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section with internal and external concrete cover said metal wall projecting at the lower end of the element which is without internal and external concrete cover and at the upper end which is without external concrete cover, the wider lower projecting portion of metal wall adapted to be slipped onto the upper narrower projecting portion of the next lower element of the pole, ribs and grooves formed in the projecting portions of the wall the ribs and grooves of one element registering with the ribs and grooves of the adjacent element to form annular chambers having slits, the joints of the elements around the exposed metal wall covered with concrete, the concrete penetrating through the slits into said annular chambers and uniting the outer concrete cover with the metal walls and with the internal concrete cover on the upper end of the lower elements.

6. A concrete pole composed of pole elements each comprising a tapering sheet metal wall of elliptical cross section with internal and external concrete cover the metal wall projecting at the lower end of the elements which is without internal and external concrete cover and at the upper end which is without external concrete cover, circumferential ribs on both projecting portions of the tapered metal walls the ribs of one element fitting the ribs of the adjacent element, a clamping ring placed around the joint between two elements, having a part fitting into said ribs, means for tightening said ring and for pressing the same into the ribs of the metal wall, and a concrete filling in the joint between the elements.

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