March 6, 1945. J. M. CROM 2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

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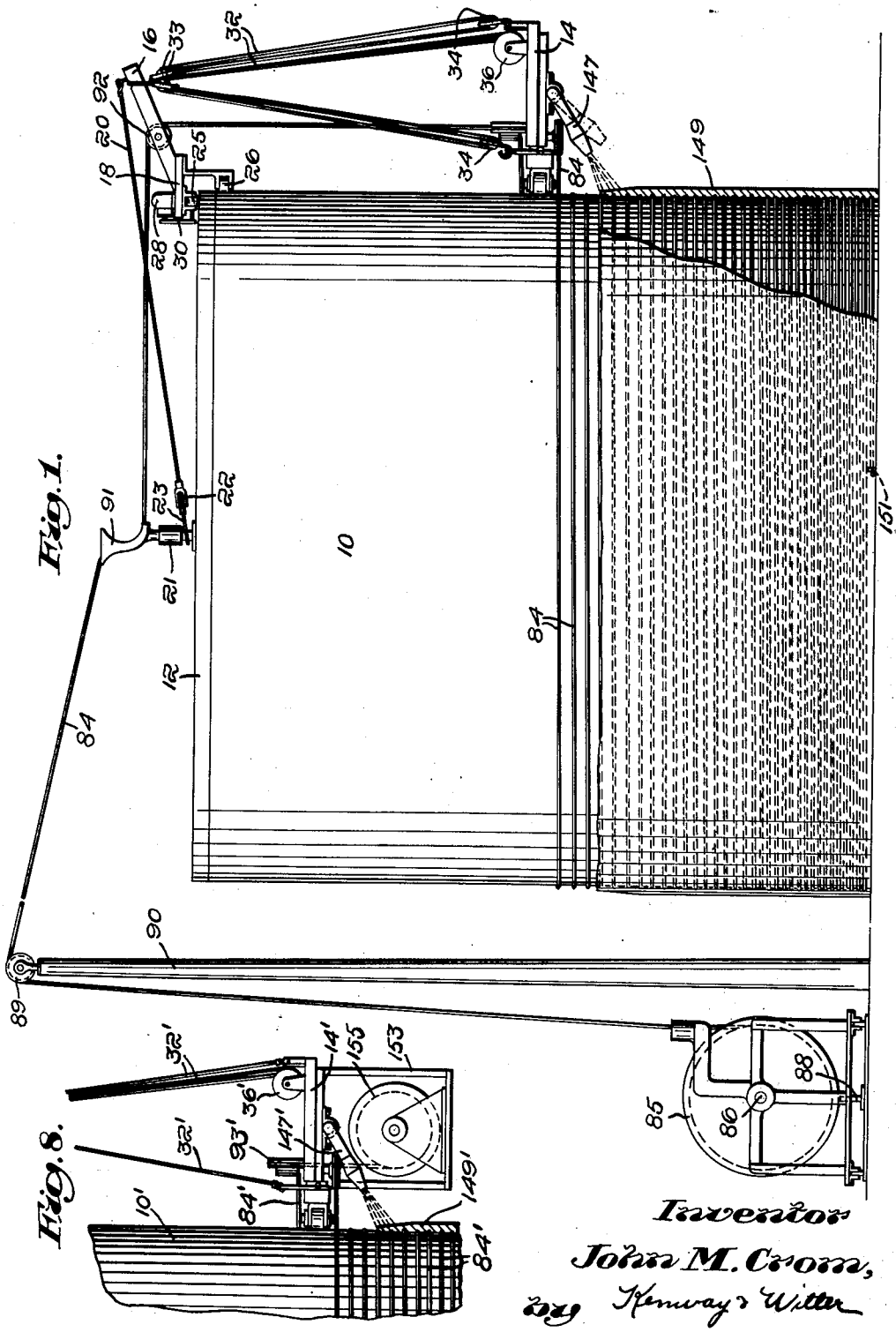

Fig. 1.

Fig. 8.

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METHOD AND APPARATUS FOR BANDING TANKS

Filed Nov. 4, 1942 6 Sheets-Sheet 2

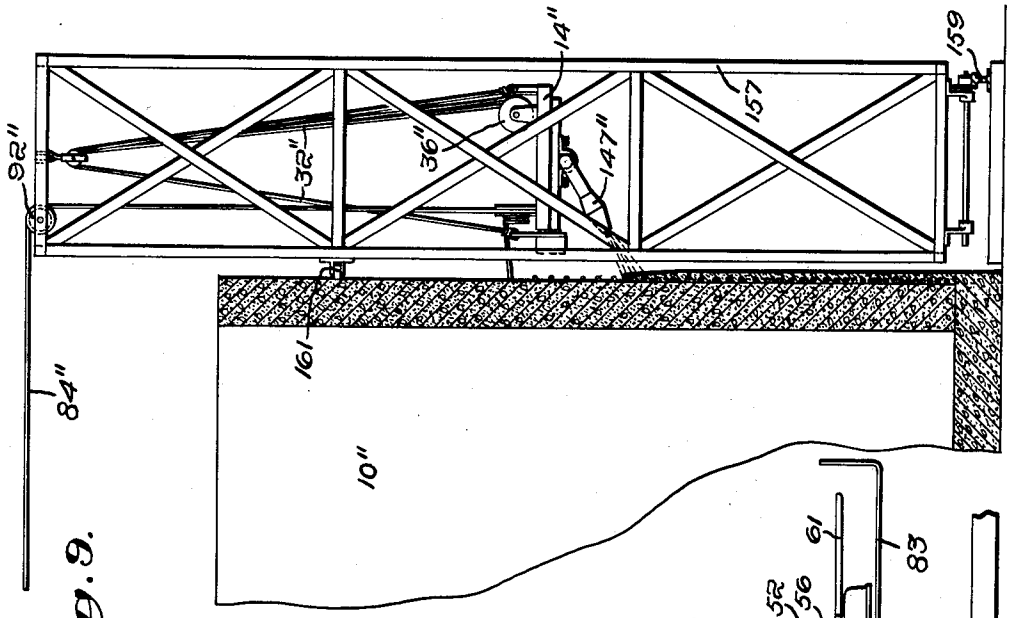

Fig. 9.

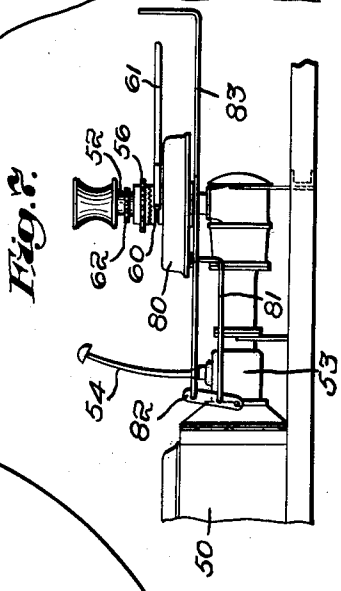

Fig. 1.

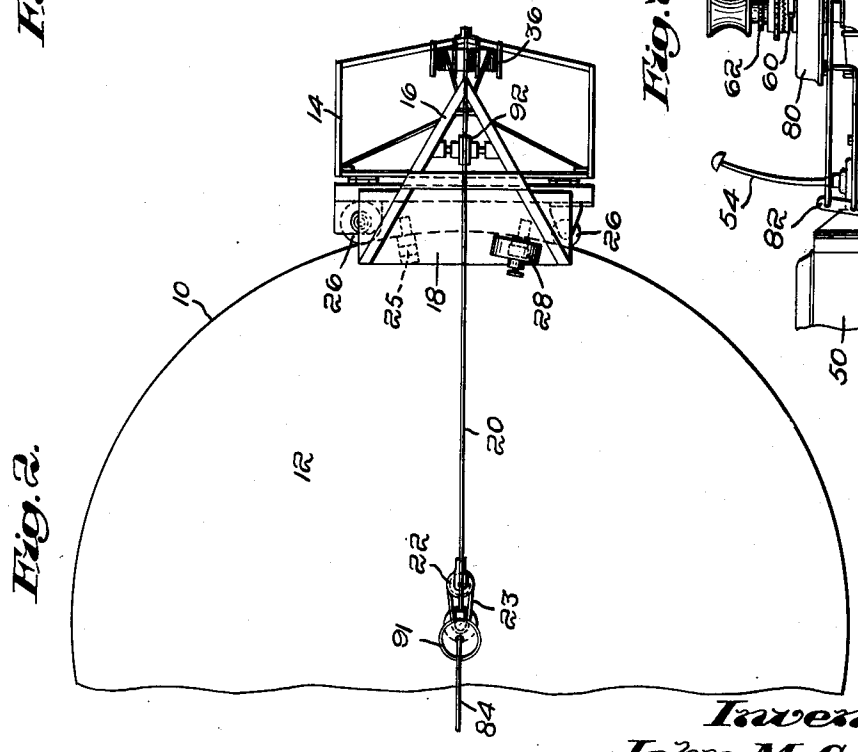

Fig. 2.

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March 6, 1945. J. M. CROM 2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

Filed Nov. 4, 1942 6 Sheets-Sheet 3

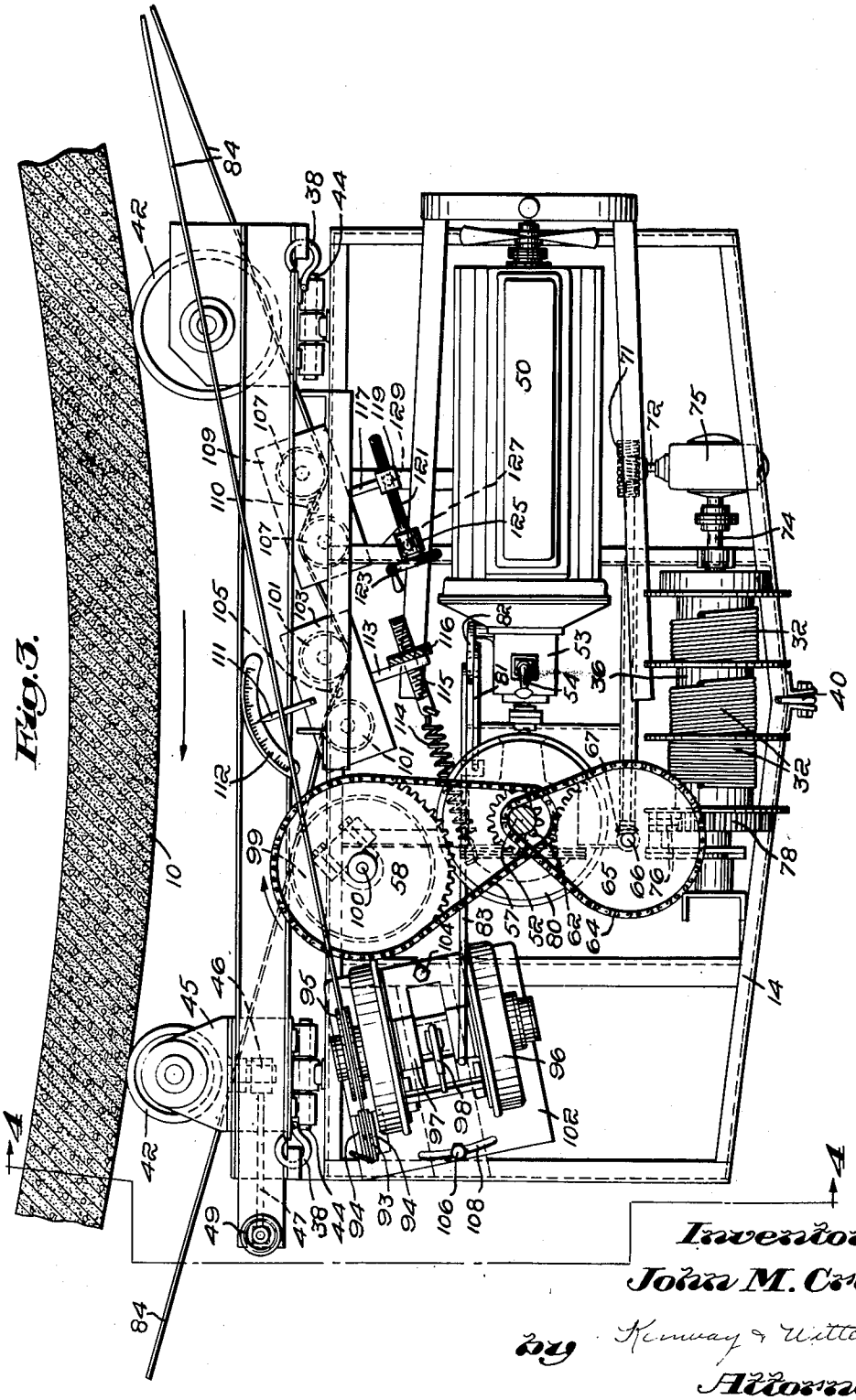

Fig. 3.

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March 6, 1945. J. M. CROM 2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

Filed Nov. 4, 1942 6 Sheets-Sheet 4

Fig. 4.

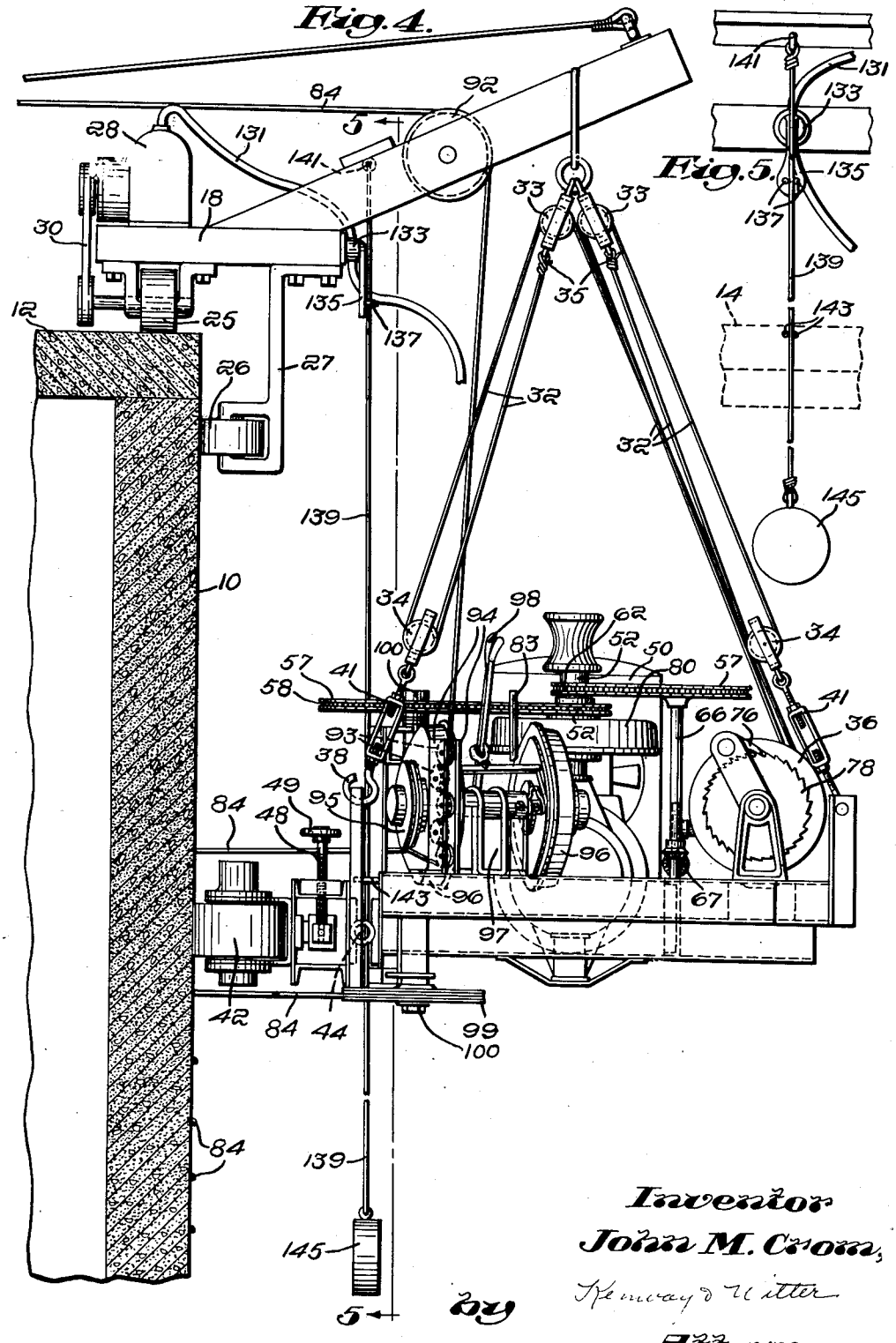

Fig. 5.

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March 6, 1945. J. M. CROM 2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

Filed Nov. 4, 1942 6 Sheets-Sheet 5

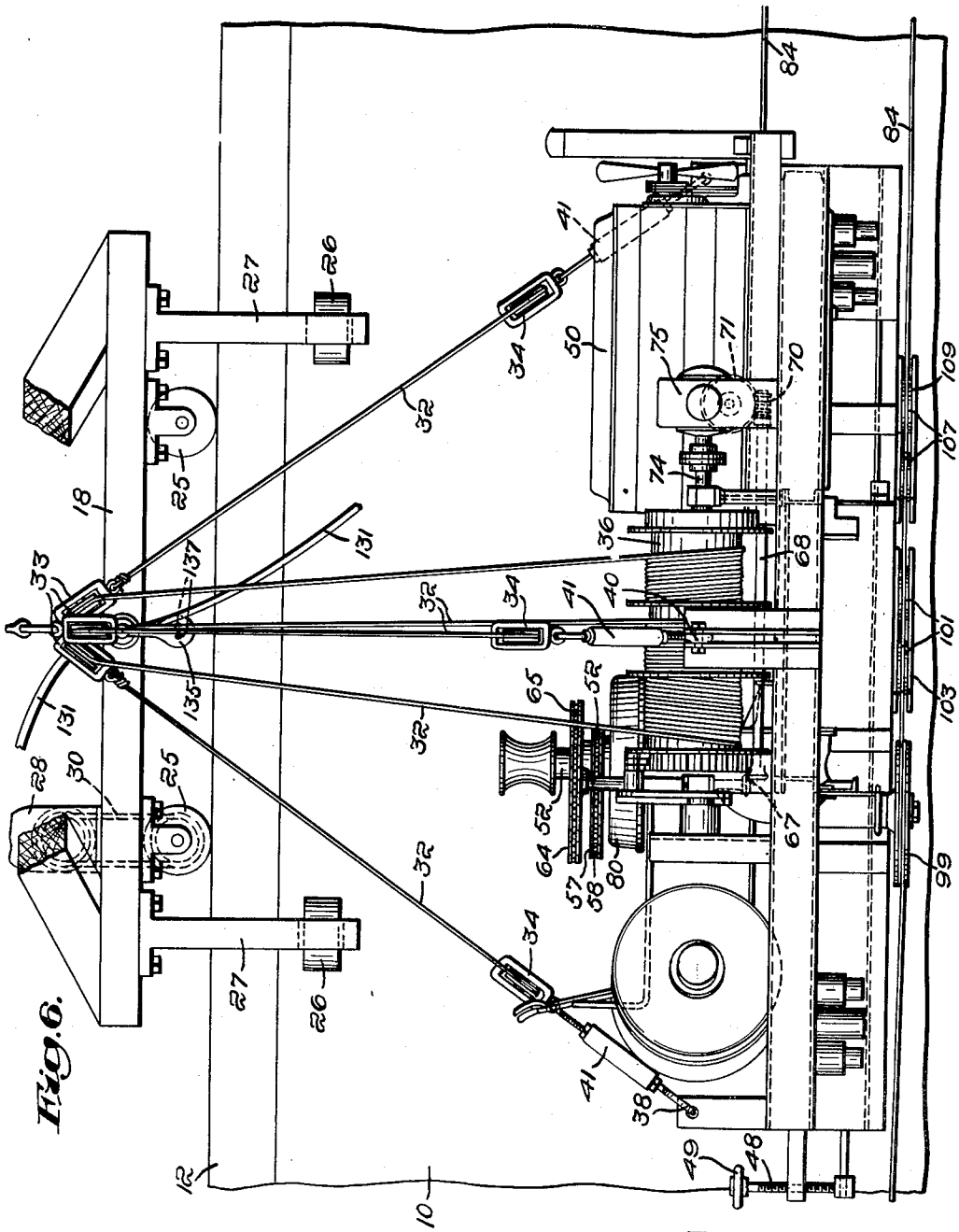

Fig. 6.

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March 6, 1945. J. M. CROM 2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

Filed Nov. 4, 1942 6 Sheets-Sheet 6

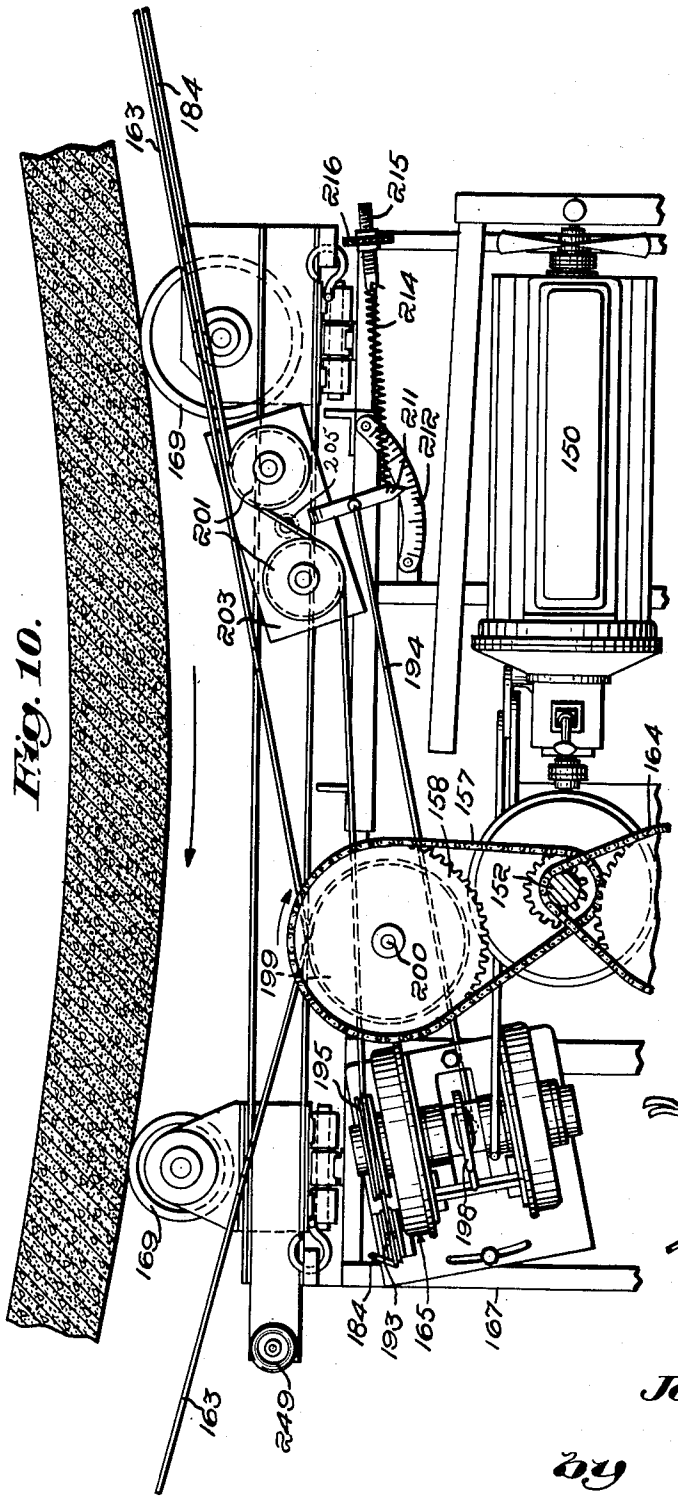

Fig. 10.

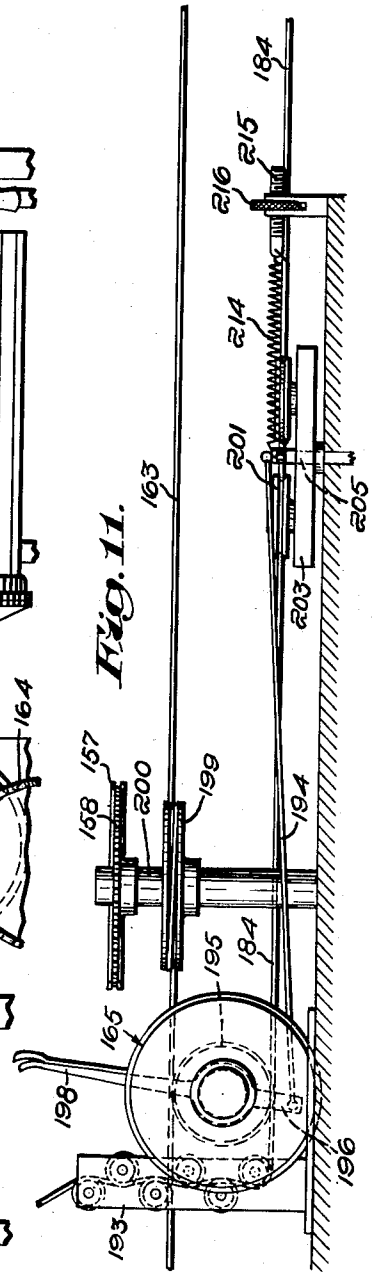

Fig. 11.

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Patented Mar. 6, 1945

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UNITED STATES PATENT OFFICE

2,370,780

METHOD AND APPARATUS FOR BANDING TANKS

John M. Crom, Washington, D. C.

Application November 4, 1942, Serial No. 464,508

15 Claims. (Cl. 242—7)

This invention relates to a novel method and apparatus for banding tanks with steel reinforcement. Large tanks are ordinarily reinforced by steel bands or rods extending annularly or spirally therearound and the application of these rods to the tanks is a considerable task since it requires not only extensive scaffolding but also a substantial amount of manual labor in threading rod lengths through the scaffolding, raising them to the necessary elevation and connecting, laying and tensioning the rods in continuous length on the vertical tank wall. The primary object of my invention is the production of an improved method and apparatus for banding tanks more efficiently and with less expenditure of time, labor and materials, the invention relating more especially to the application of continuous steel wire circumferentially and spirally of the tanks and in taut condition placing the tanks under compression.

The invention contemplates the employment of a wire carrying and placing vehicle supported for movement around and adjacent to the outer face of the tank to be banded. An end of the wire reinforcement is anchored at a starting point adjacent to the base or top of the tank and the vehicle carries the free portion thereof and winds it into taut contact with the tank as the vehicle proceeds therearound. The vehicle is movable horizontally and circumferentially around the tank and means is provided for trailing the wire onto the tank and placing the succeeding convolutions progressively higher or lower and in predetermined proximity.

In the preferred construction the vehicle is pulled by and along a cable extending around and in frictional contact with the tank, this cable being either an independent and closed or complete annulus or a continuous part of the wire reinforcement trailed into tight engagement with the tank, all as hereinafter described. Means is also provided for holding and placing the reinforcement wire under a constant and uniform tension and for elevating the vehicle as it travels around the tank whereby to place the reinforcement convolutions at progressively higher elevations. The operations are substantially continuous and mechanical, involving little manual labor and resulting in a strong, uniform and superior reinforcement. The provision of my novel method and apparatus, all hereinafter more specifically described, for producing these results comprises a further object of the invention.

It is common practice to cover tank reinforcement with a cementitious composition bonded thereto and to the adjacent tank wall, this being heretofore an independent operation following the application of the reinforcement to the tank. A further feature of my invention contemplates the projecting of a suitable coating material from the wire wrapping vehicle onto and into bonding engagement with the previously placed wire convolutions beneath or above the vehicle as the vehicle passes the same in its wire wrapping travel. The placing of this coating material and thereby completing the entire operation all simultaneously and from the same vehicle comprises a further object of the invention.

These and other features of the invention will be best understood and appreciated from the following description of preferred embodiments thereof selected for purposes of illustration and shown in the accompanying drawings in which,

Fig. 1 is an elevation of a concrete tank being banded and treated in accordance with my invention,

Fig. 2 is a fragmentary plan view thereof,

Fig. 3 is an enlarged plan view of the wire banding vehicle shown in Fig. 1,

Fig. 4 is an end elevation thereof together with other cooperating mechanism, taken on line 4—4 of Fig. 3,

Fig. 5 is a detail view taken on line 5—5 of Fig. 4,

Fig. 6 is a front elevation of the vehicle,

Fig. 7 is a fragmentary view of the engine and the interlocked clutch-brake control,

Fig. 8 is a fragmentary view showing the banding wire supply being carried by the vehicle,

Fig. 9 is a fragmentary view showing a modified form of vehicle,

Fig. 10 is a plan view corresponding to Fig. 3 but showing a modified form of the invention,

Fig. 11 is a fragmentary front elevation thereof.

In the drawings, 10 indicates the cylindrical side wall of a concrete tank having a dome or cover 12 thereon. My improved method and apparatus are herein illustrated and described in connection with the banding of this tank with steel wire wound circumferentially around and into tensioned contact with the side wall whereby placing the tank under predetermined compression.

The invention contemplates the employment of a vehicle for conducting the wire around the tank and laying it in contact with the side wall. The vehicle can be supported and driven in any convenient and desirable manner for performing this function, as by suspending the vehicle from above as illustrated in Figs. 1–6 or by sup-

porting it on tracks at the base of the tank as illustrated in Fig. 9. In any event the vehicle is mounted to move around the tank and trail the banding wire therefrom and into predetermined tensioned contact with the tank.

Referring first to Figs. 1–7 of the drawings, 14 indicates a vehicle or platform suspended from a boom 16 to a position overhanging the outer face of the side wall 10 (Fig. 1). The boom is supported on a carriage 18 in rolling contact with the top of the tank and anchored by a cable 20 for swivelling movement about a fixed post 21 at the central vertical axis of the tank, the cable being connected to a pulley 22 engaging an endless band 23 looped around the post (Fig. 2). The carriage 18 is supported on wheels 25 resting on the tank cover 12 and rotatable on horizontal axes and also by wheels 26 carried on brackets 27 (Fig. 6), the wheels 26 being rotatable on vertical axes and in contact with the side wall 10. The carriage is adapted to be driven by a motor 28 through a belt 30 to one of the wheels 25 as hereinafter more specifically described. The carriage 18 is adapted to ride on the top of an open tank of the type illustrated in Fig. 9 as well as on the closed tank shown in Fig. 4.

The vehicle or platform 14 is suspended from the boom 16 by three cables 32 and sheaf blocks 33 and 34. One end of each cable is secured to its fixed block 33 at 35 and the other ends of the cables are in wrapped contact with a drum 36. The movable blocks 34 are secured to the vehicle at two inner corners 38 and at an outer intermediate point 40, providing a three-point support. Turnbuckles 41 in the connections serve to permit leveling of the vehicle which is also provided with wheels 42 rotatable on vertical axes and located to engage the side wall 10, the wheels providing rolling contact with the side wall in the direction of travel around the tank.

Both wheel supports are pivotally connected to the vehicle on horizontal axes at 44 whereby permitting the wheels to adjust themselves into flat contact with the side wall. The vehicle travels in the direction indicated by the arrow in Fig. 3 and the front wheel is mounted in a yoke 45 adjustable on a stud 46 (Figs. 3 and 4). An arm 47 fixed to the stud has its outer end engaged by a screw 48 carrying a handwheel 49 by which the yoke and wheel can be adjusted to guide and steer the vehicle along the desired path.

An engine 50 mounted on the vehicle is arranged (1) to drive the vehicle around the tank and (2) to elevate or lower the vehicle (Fig. 3). The engine shaft is operatively connected to a vertical shaft 52 through transmission gearing at 53 controlled by a gear shifting lever 54. A sprocket 56 loose on the shaft 52 is operatively connected by a chain 57 to a large sprocket wheel 58 hereinafter described. A clutch 60 splined to the shaft 52 can be shifted by a lever 61 into and out of engagement with the sprocket 56 (Fig. 7). A sprocket 62 fixed to the shaft 52 is operatively connected by a chain 64 to a large sprocket wheel 65 on a shaft 66 (Fig. 4).

In this form of the invention, the chain 57 is adapted to drive the vehicle around the tank in the manner hereinafter described, this drive being operative when the clutch 60 is engaged and being inoperative when the clutch is disengaged. The chain 64 is adapted to rotate the drum 36 which, because of the clutch 60, can be operated with or independently of the vehicle movement. The shaft 66 is connected by bevel gears 67 to a shaft 68 having a worm 70 thereon in mesh with a large worm wheel 71 on a shaft 72. The shaft 72 is connected to the drum shaft 74 through reduction and change speed gearing in a box 75. This gearing further reduces the drum speed relative to the speed of the worm wheel 71 and the gearing within the box is such that by changing gears in well known manner the ratio of the speed reduction can be varied, all for purposes hereinafter described. Retrograde rotation of the drum is prevented by pawls 76 engaging the teeth of a ratchet wheel 78 fixed to the drum.

A brake drum 80 is fixed to the shaft 52 adjacent to the clutch 60 (Fig. 7) and an interlocking connection including a rod 81 is provided between the clutch lever 82 and the brake shoes cooperating with the drum. The clutch lever is operated by a hand rod 83. When the clutch is in closed position the brake shoes are disengaged through the rod 81 and when the clutch is moved to open position the shoes are automatically engaged with the drum through the same connection. Thus when the shaft 52 is disengaged from the engine shaft the brake automatically prevents rotation of the shaft 52.

As illustrated in Fig. 1 the banding wire 84 is drawn from a reel 85 supported on the ground at the base of the tank and mounted to rotate about a horizontal axis 86 to unwind the wire and to revolve about a vertical axis 88 to take the twist out of the wire as hereafter described. The wire passes from the reel upwardly over a sheave 89 supported on a pole 90 above the tank. From thence the wire passes downwardly and into and through a funnel-like guide 91 mounted to swivel on the post 21, and from thence to the vehicle 14. It will be apparent that the travel of the vehicle around the tank, carrying the wire therewith, puts a twist in the wire. The reel 85 can occasionally be rotated on its vertical axis in a direction and to an extent removing this twist.

From the guide 91 (Fig. 1) the wire 84 passes over a sheave 92 supported on the boom 16 and from thence to and through a series of grooved rolls 93 supported in lateral alignment between two plates 94 on the vehicle 14 (Fig. 4). The wire continues therefrom around a grooved wheel 95, fixed to the shaft of a brake comprising two brake drums 96 supported in a block 97, and from thence into contact with the tank wall 12. The base 102 of the brake rests flatly on the frame 14 (Fig. 3) and is adjustable about a center clamping bolt 104, a clamping bolt 106 extending through an arcuate slot 108 permitting this adjustment. As the vehicle travels in the direction of the arrow (Fig. 3) the wire trails from the wheel 95 into contact with the tank. The rolls 93 serve to hold the wire tensioned on and about the wheel 95 and the tension of the wire as it is wrapped on the tank is determined by the brake under the control of a brake lever 98.

The wire passes from the wheel 95 around and in frictional contact with the tank and back to the vehicle where it passes around a grooved wheel 99 fixed to the bottom end of a vertical shaft 100, the sprocket 58 being fixed to the top end of this shaft (Fig. 3). From the wheel 99 the wire passes between and in contact with two grooved rolls 101 on a block 103 pivotally mounted on the frame at 105, from thence between and in contact with two grooved rolls 107 on a block 109 pivoted to the frame at 110, and from thence the wire trails into contact with the tank. The block 103 carries an index pointer 111 movable over a graduated scale 112 and also carries an arm 113. A spring 114 has one end anchored

to the frame 14 and its other end connected to a bolt 115 extending loosely through the arm and provided with a nut 116. The spring is arranged to pivot the block 103 in the wire tightening direction.

An arm 117 carried by the block 109 supports a nut 119 at its free end. A screw 121, having an operating wheel 123, is journaled for rotation in a bearing 125 secured to the frame on a vertical pivot 127. The screw is threaded through the nut which is mounted for pivotal movement on a vertical axis 129 on the arm. Rotation of the screw is adapted to rock the block 109 about its pivotal mounting 111, rotation in one direction being adapted to increase the tension on the wire and rotation in the opposite direction being adapted to decrease the tension on the wire. The purpose and operation of the blocks 103 and 109 are hereinafter described.

In the wire banding operation, the engine 50 drives the vehicle around the tank through its connection with the sprocket 58 and grooved wheel 99, the latter having a loop of the wire 84 extending therearound and holding the vehicle in traveling contact with the tank and from thence around and in frictional contact with the tank. It is desirable that the carriage 18 shall travel synchronously with the vehicle 14 and the following means, illustrated in Figs. 4 and 5, is provided for effecting this function. The carriage is driven by the engine 28 which can be of the internal combustion type if desired but, as illustrated, it is driven from compressed air received through a hose 131 which passes through a controlling valve 133. The valve has a controlling arm 135 extending downwardly and carrying two spaced pins 137. A cable 139 hung from the boom at 141 extends downwardly between these pins and from thence downwardly between two spaced pins 143 on the vehicle 14, the cable being held taut by a weight 145. When the arm and cable are in vertical position the valve is closed. Movement of the vehicle 14 forwardly swings the cable forwardly and opens the valve whereby driving the carriage 18 forwardly, whereas any lagging of the vehicle behind the carriage swings the cable rearwardly and closes the valve. Thus the movement of the carriage is synchronized with the movement of the vehicle.

Concrete tanks preloaded by rod reinforcement are usually finished by placing a coating of cementitious composition on and bonded to the reinforcement and to the tank wall. Heretofore this finishing operation has been performed independently of and following completion of the banding operation. A further feature of my invention herein contemplates the placing of this coating on the tank from the vehicle 14 simultaneously with the banding operation, the cementitious composition being projected onto the banded portion of the tank following and progressing with the banding thereof. The composition is projected from a cement gun 147 illustrated as mounted for pivotal movement on the vehicle 14 in position to project the composition onto the previously placed wire 84 (Fig. 1). As the vehicle travels around the tank the cement gun can be operated continuously or at such time periods as is necessary to provide a coating 149 of the desired thickness. This banding-coating combination of operations completes the tank wall at one passage of the vehicle thereover as will be apparent.

I shall describe the banding-coating operations as being performed from the bottom of the tank upwardly, as illustrated in the drawings, although they can be performed from the top downwardly. The mechanism is initially placed on and about the tank as illustrated in Fig. 1 with the vehicle 14 at its base. The wire 84 is carried from the reel 85 to the vehicle 14 and is threaded through the rolls 93, around the wheel 95, around the tank and back to the vehicle, around the wheel 99, through the blocks 103 and 109, and back to the tank where its end is anchored at 151. Before anchoring the wire at 151, it is drawn up substantially to the desired and necessary tension for effecting the banding operation. The tensions employed will vary with the gauge of wire used, its spacing on the tank, and the amount of tank compression desired. I have placed wire of gauge No. 8 on the tank under a tension of 3,000 lbs.

It is desirable that the tensioning of the wire as it is placed permanently on the tank shall remain constant and the blocks 103 and 109 (Fig. 3) are employed for this purpose. The wire is brought up to the approximate tension required before its end is anchored at 151. That portion of the wire which is to be wrapped permanently into contact with the tank is then brought up to the exact tension required by adjusting the nut 116 to give a spring pull on the block 103 that will tension the wire to this degree. The corresponding position of the pointer 111 on the scale 112 is noted. Thereafter, during the wire banding operation, this tension is maintained constant. The operator observes the position of the pointer and, should it move one way or the other from the required tension position noted, he rotates the hand wheel 123 in one direction or the other to bring the pointer back to and maintain it in said position. Use of the tensioning mechanism 109 is preferred since it acts directly on the wire portion being laid permanently on the tank, but it will be understood that such mechanism can be eliminated and the tension controlled by the brake lever 98 if desired.

When the banding operation is to be started the clutch 60 is closed whereby establishing a driving connection between the shaft 52 and the sprocket 58. When the engine clutch is closed by shifting the rod 83 the sprocket 58 is driven in a direction moving the vehicle in the direction of the arrow shown in Fig. 3. The vehicle thereupon draws the wire from the reel 85, wraps the wire onto the tank from the wheel 95 and wraps the wire permanently onto the tank from the wheel 99, the convolution of wire extending from and between these wheels into frictional contact with the tank serving as a pulling cable for the vehicle.

Each convolution of wire wrapped permanently onto the tank from the wheel 99 is at an elevation higher than the previously placed convolution, this being effected by elevating the vehicle which, as illustrated in Figs. 1–7, is performed automatically and synchronously with the travel of the vehicle around the tank. The drive from the shaft 52 through the chain 64 and speed reducing connections to the drum 36 rotates the drum very slowly in a direction automatically elevating the vehicle synchronously with the vehicle travel as will be understood. It will also be noted that the convolutions are spaced further apart as the operation proceeds upwardly and such further spacing can be effected by any convenient and suitable mechanism. Means can be provided for effecting this increase in vehicle elevating speed by change gears in the box 75

or by suitable means giving a continued and gradual increase of vehicle elevation as the operation proceeds, or the vehicle can be elevated by means other than the engine 60. The engine can be employed to elevate or lower the vehicle independently of its movement around the tank by opening the clutch 60.

When the vehicle 14 has banded a predetermined portion of the tank therebeneath, the cement gun 147 is placed in operation from the vehicle whereby to project cementitious composition into bonding engagement with the previously placed reinforcing bands. The gun is oscillated to project the composition evenly over the rods and wall to be coated and is operated during such time period as is necessary to build up the coating 149 to the desired thickness.

The maximum length of continuous wire that can be provided in a roll is ordinarily limited to less than that required completely to band a tank and it is therefore necessary either to anchor the ends of the wrapped and tensioned wire to the tank or splice one end of each new roll to the previously placed wire. Such operation can be performed in any convenient and suitable manner. I prefer however to splice the ends either before they pass to the rolls 93 or after they leave the block 109. In the latter case it will be necessary to hold under tension the end portion of the wrapped wire while the splice is being made. Such holding can be effected by an expansion bolt tapped into the tank, similar to the anchoring illustrated at 151, or the wrapped end can be held by the use of a toggle clamp engaging the wire and held by block and tackle.

While wire can be fed to the vehicle from above, as illustrated in Fig. 1, a simpler method of procedure is to carry the wire roll on the vehicle as illustrated in Fig. 8 wherein the parts corresponding to those heretofore described are indicated by the same reference characters primed. Supported on and beneath the vehicle 14' is a frame 153 for rotatably supporting a wire reel 155. The reel is positioned to feed the wire upwardly to the rolls 93' and from thence to a grooved wheel corresponding to the grooved wheel 95. When a roll of wire has been exhausted from the reel, a full roll is raised to the frame 153 and mounted on the reel whereupon the two ends of the wires can be spliced and the banding operation continued. This construction is simpler than the arrangement shown in Fig. 1 and eliminates twisting of the wire as the vehicle passes around the tank.

While the suspending of the vehicle 14 from the carriage riding on the tank has various advantages it will be apparent that the vehicle can be supported on a carriage riding on the ground as illustrated in Fig. 9. In this view the frame or platform 14'' is suspended from the top of a tall carriage 157 riding on a single rail 159 on the ground. The rail is located beneath the outer side of the carriage which therefore tips toward and rides against the tank wall 10'' on wheels 161. The platform is guided for vertical movement on the carriage and the wire banding and coating operations are effected substantially as heretofore described.

The form of invention illustrated in Figs. 10 and 11 employs a completely annular cable 163 extending around and in frictional contact with the tank and about a sheave 199 on the vehicle, the cable holding the vehicle in traveling contact with the tank, as illustrated in Fig. 10, and the banding wire being trailed from the brake 165 into permanent banding engagement with the tank. The vehicle or platform 167 is suspended from above in the manner heretofore described and rides against the side wall of the tank on wheels 169. The engine 150 and its driving connection to the vertical shaft 152 and through the chains 157 and 164 correspond to those parts illustrated in Fig. 3 and heretofore described. The chain 157 drives a sprocket 158 fixed to a vertical shaft 200 also having a grooved wheel 199 fixed thereto. The endless cable 163 is looped around this wheel and serves to drive the vehicle around the tank.

The banding wire 184 passes through the series of grooved rolls 193 and around a grooved wheel 195 on the brake shaft, the brake construction 165 being substantially the same as that heretofore illustrated and described. The wire passes between and in engagement with two grooved rolls 201 supported for rotation on a block 203 pivotally mounted on the frame at 205, and from thence the wire passes into trailing contact with the tank. An index arm 211 carried by the block 203 is movable over a graduated scale 212. The arm 211 is connected by a rod 194 to an arm 196 projecting downwardly from the brake drum lever 198 so that pivotal movement of the block automatically moves the brake drum lever in corresponding directions.

Before starting the banding operation, the free end of the wire is anchored to the tank, as at 151, and during the banding operation the tensioning of the wire on the tank is under the control of the brake 165. A spring 214 is connected to the arm 211 at one end and its other end is connected to a threaded bolt 215 having a nut 216 thereon connecting it to the frame 167. The spring is arranged to rotate the block 203 in a direction tightening the wire and the rod 194 connection to the brake lever is such that such movement of the block also tightens the brake. The brake 165 and nut 216 are initially adjusted to a position at which the wire will be drawn from the brake and wound onto the tank at the desired tension, and the construction and arrangement are such that this tension will be automatically maintained. Any decrease in the tension of the wire will permit the spring to rotate the block 203 anti-clockwise and this movement, through the connection 194, will tighten the brake. Likewise, any increase in tension of the wire will move the block 203 clockwise against the action of the spring whereby releasing the brake. Thus the wire is placed on the tank at a predetermined constant tension which is automatically maintained by the above described mechanism.

While I have herein illustrated and described my invention in connection with tanks it will be understood that the scope of the invention includes equivalent objects such as building structures, large pipes, etc., to which the invention is applicable. It will also be apparent that the invention contemplates the employment of a cable annulus extending horizontally around and in frictional contact with the tank, either as a convolution of the banding wire or as an independent cable, and holding the vehicle in traveling contact with the side wall of the tank, and in the preferred form of the invention the engine is provided with driving connections adapted to pull the vehicle around the tank by and along this cable.

Having thus described and illustrated my in-

vention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A method of banding a tank circumferentially with continuous wire reinforcement, which consists in moving a vehicle around the tank adjacent to its outer face by pulling the vehicle by and along an endless cable annulus extending around and in frictional contact with the tank, and trailing wire reinforcement from the vehicle in tight contact with the tank as the vehicle passes therearound.

2. A method of banding a tank circumferentially with continuous wire reinforcement, which consists in suspending a vehicle from and in rolling contact with the top of the tank to a position adjacent to and in rolling contact with the outer side face of the tank, moving the vehicle around the tank on said rolling contacts by pulling it by and along a cable extending around and in frictional contact with the tank, paying out the cable into said frictional contact rearwardly of the vehicle as the advancing vehicle takes up the cable forwardly thereof, and trailing wire reinforcement from the vehicle in tight contact with the tank as the vehicle passes therearound.

3. A method of banding and finishing a tank, which consists in moving a vehicle around the tank adjacent to its outer face, trailing wire reinforcement from the vehicle in tight contact with the tank as the vehicle passes therearound, moving the vehicle vertically in one direction during the banding operation, and projecting coating material from the vehicle into bonding engagement with the previously placed reinforcement as the vehicle passes the same.

4. Apparatus for banding a tank circumferentially with continuous wire reinforcement, comprising a vehicle mounted for movement around the tank adjacent to its outer face, an endless cable annulus extending around and in frictional contact with the tank, an engine on the vehicle, means driven by the engine and engaging the cable for moving the vehicle around the tank, and means on the vehicle for trailing wire reinforcement therefrom into tight contact with the tank as the vehicle passes therearound.

5. Apparatus for banding a tank circumferentially with continuous wire reinforcement, comprising a vehicle mounted for movement around the tank adjacent to its outer face, a roll of wire, said wire extending from the roll to the vehicle and from thence around and in frictional contact with the tank and back to the vehicle and from thence into trailing contact with the tank, and means including an engine operative on the frictionally contacting wire to pull the vehicle around the tank and trail the wire into tight contact therewith.

6. Apparatus for banding tanks circumferentially with continuous wire reinforcement, comprising a vehicle, means supporting the vehicle for movement around and adjacent to the outer face of a tank, means for driving the vehicle, means for trailing a wire from the vehicle and wrapping it tightly onto the tank, means for moving the vehicle vertically in one direction on the tank at progressively varying elevations in said direction, and means carried by the vehicle for projecting coating material into bonding engagement with the previously placed wire as the vehicle passes the same.

7. A method of banding tanks circumferentially with continuous wire reinforcement, which consists in placing a cable around and in frictional contact with the side wall of a tank except at one segmental portion thereof, supporting said portion of the cable in spaced relation from said wall on a vehicle adjacent to the wall, pulling the vehicle around the tank by and along said cable, paying out the cable into said frictional contact rearwardly of the vehicle as the advancing vehicle takes up the cable forwardly thereof, and trailing a banding wire from the vehicle in taut wrapping contact with the tank as the vehicle passes therearound.

8. A method of banding a tank circumferentially with continuous wire reinforcement, which consists in anchoring one end of the banding wire and wrapping at least one convolution thereof around and in frictional contact with the side wall of the tank, supporting the end portions of said convolution on a vehicle adjacent to said wall, pulling the vehicle around the tank by and along said convolution, and trailing the wire from the vehicle in taut wrapping contact with the tank as the vehicle passes therearound

9. A method of banding tanks circumferentially with continuous wire reinforcement, which consists in placing an elongated and endless member horizontally around and in contact with the side wall of a tank, pulling a vehicle around the tank by and along said member, trailing a banding wire from the vehicle in taut wrapping contact with the tank as the vehicle passes therearound, moving the vehicle vertically in one direction a predetermined amount with each passage of the vehicle around the tank, and moving said member vertically with and by engagement of the vehicle therewith.

10. Apparatus for banding tanks circumferentially with continuous wire reinforcement, comprising a wheeled vehicle adapted to ride on and around the outer vertical face of the side wall of a tank, means supporting the vehicle for movement horizontally and at a predetermined elevation around the tank, means on the vehicle for supporting a wire and wrapping it circumferentially into contact with said face as the vehicle travels around the tank, an elongated member extending horizontally around and in contact with said face of the tank, means including an engine carried by the vehicle and operative on said member for moving the vehicle around the tank and paying out the wire under tension in trailing relation to the vehicle, means for indicating the tension of the paid out wire, and means pivoted to the vehicle and operative on the paid out wire in one direction to increase its tension and in the other direction to decrease its tension.

11. Apparatus for banding tanks circumferentially with continuous wire reinforcement, comprising a wheeled vehicle adapted to ride on and around the outer vertical face of the side wall of a tank, means supporting the vehicle for movement horizontally and at a predetermined elevation around the tank, means on the vehicle for supporting a wire and wrapping it circumferentially into contact with said face as the vehicle travels around the tank, an elongated member extending horizontally around and in contact with said face of the tank, means including an engine carried by the vehicle and operative on said member for moving the vehicle around the tank and paying out the wire under a predetermined tension in trailing relation to the vehicle, and other means directly operative on the paid out wire for automatically maintaining it uniformly at said predetermined tension.

12. Apparatus for laying wire under predeter-

mined tension on and about a tank and the like, comprising a vehicle, means for driving the vehicle in a horizontal path around and adjacent to the tank, means for paying out a wire under predetermined tension in trailing relation to the vehicle and into contact with the tank, two rolls engaging the paid out wire at spaced points, means on the vehicle supporting the two rolls and movable upon a pivotal axis in two directions for respectively increasing and decreasing the tension of the wire, and means including a connection to and between the second and third named means for automatically maintaining the wire in uniform tension by moving the third named means about said axis in accordance with the tension pull on the second named means.

13. Apparatus for banding tanks circumferentially with continuous wire reinforcement, comprising a wheeled vehicle adapted to ride on and around the top margin of a tank, a second wheeled vehicle adapted to ride on and around the vertical side wall of the tank, means suspending the second vehicle from the first vehicle, means on the second vehicle for supporting a wire and wrapping it circumferentially into contact with said wall as the vehicles travel around the tank, means including an engine carried by the second vehicle for moving the vehicles around the tank and holding the wire taut as it is wrapped onto said wall, the last named means including a second engine carried by the first vehicle and operative thereon to drive the first vehicle around the tank, and means so controlling the driving of the first vehicle that it is kept in predetermined position relative to the second vehicle.

14. A method of banding tanks or the like circumferentially with continuous wire reinforcement, which comprises effecting movement of a vehicle around and in contact with the outer face of a tank through the medium of frictional contact of a complete annulus with said face, and trailing wire reinforcement from the vehicle in tight contact with the tank as the vehicle passes therearound and holds the wire taut through said frictional contact.

15. Apparatus for banding tanks circumferentially with continuous wire reinforcement, comprising a wheeled vehicle adapted to ride on and around the outer vertical face of the side wall of a tank, means supporting the vehicle for movement around the tank about a vertical axis located centrally of the tank, means on the vehicle for supporting a wire and wrapping it circumferentially into contact with said face as the vehicle travels around the tank, means including a sheave on the vehicle and a cable extending horizontally and endlessly about the sheave and around and in contact with said face of the tank and holding the vehicle in traveling contact with said side wall, and means including an engine and driving connections carried by the vehicle for moving the vehicle along the cable and around the tank and holding the wire taut as it is trailed from the vehicle and wrapped onto said face.

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