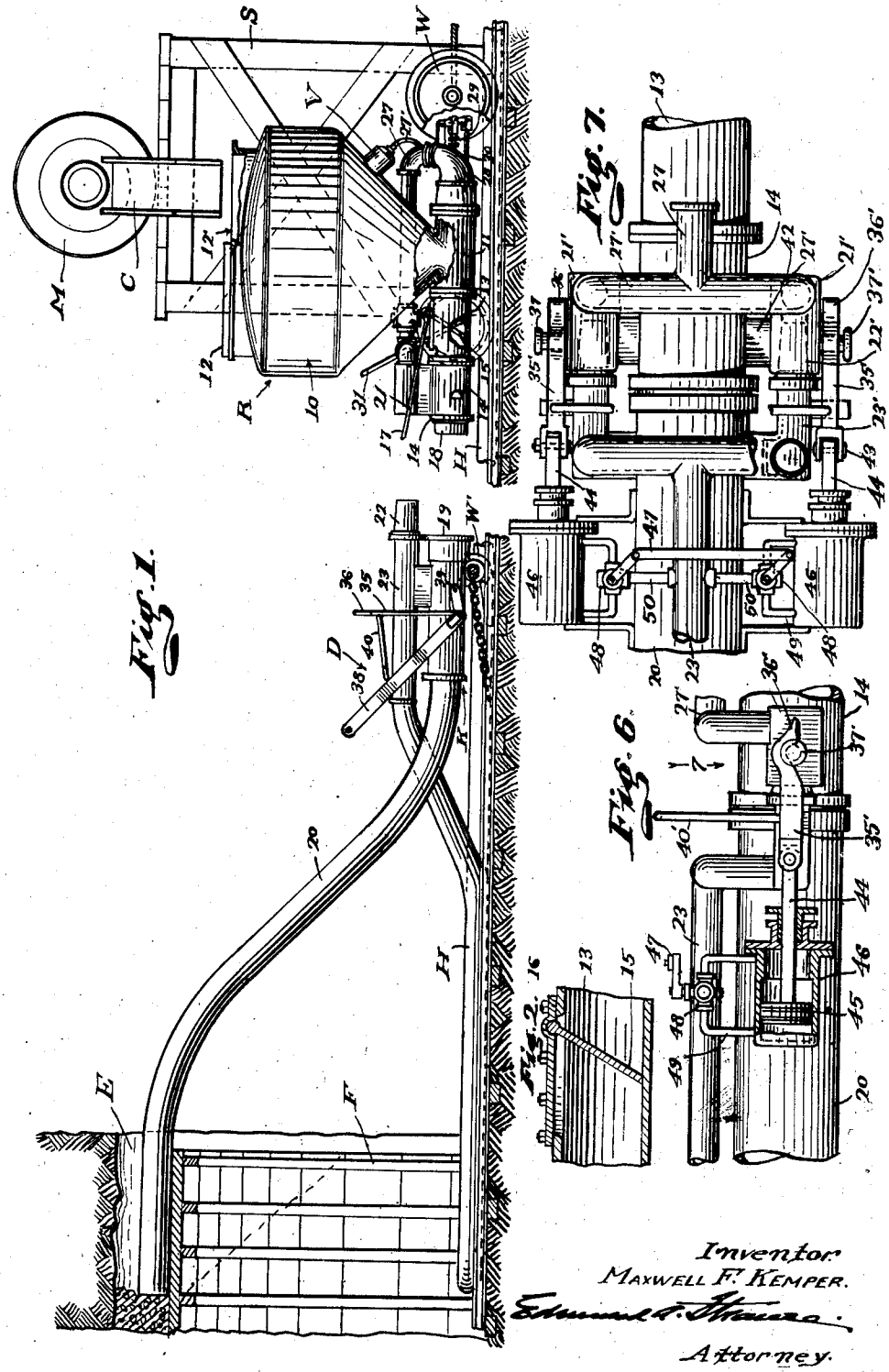
March 16, 1943. M. F. KEMPER 2,313,826

TUNNEL CEMENTING APPARATUS

Filed Sept. 17, 1940 2 Sheets-Sheet 1



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Fig. 3.

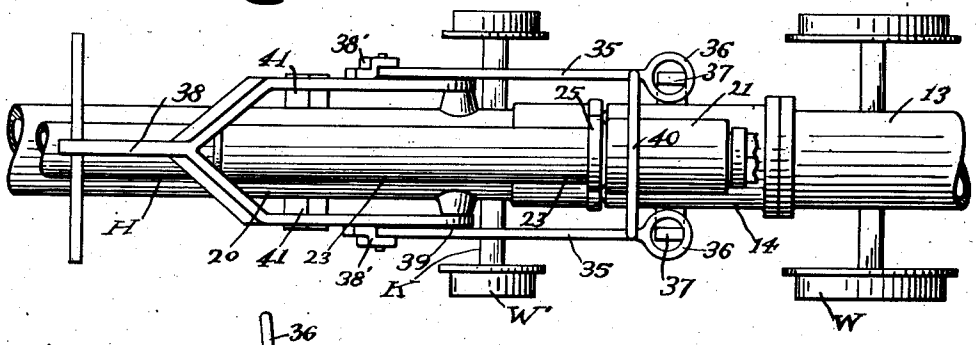


Fig. 4.

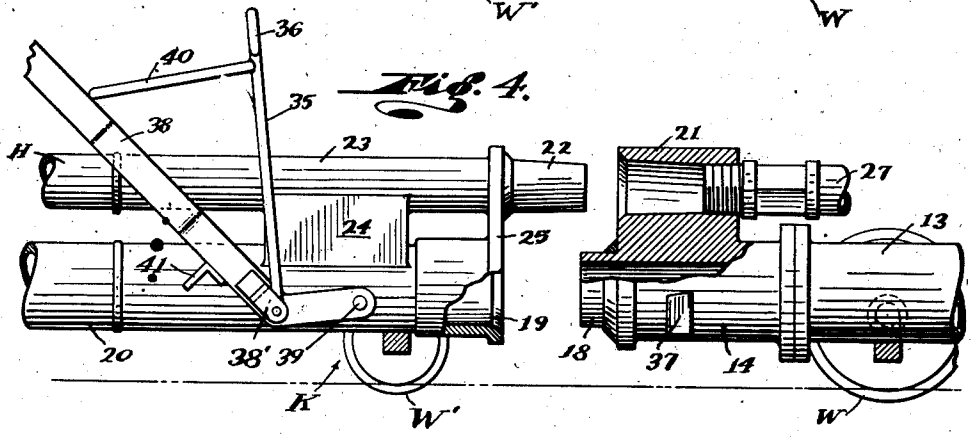
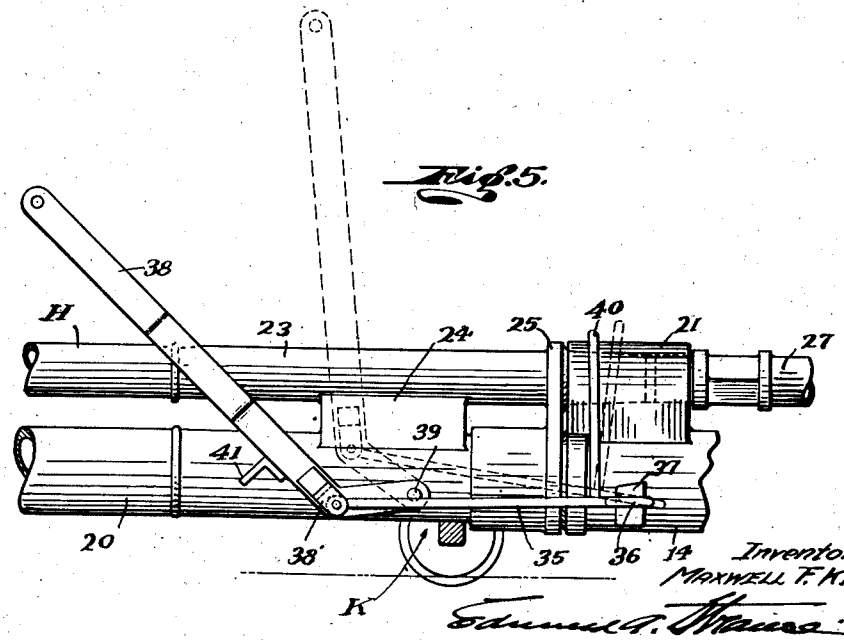


Fig. 5.



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TUNNEL CEMENTING APPARATUS

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Application September 17, 1940, Serial No. 357,121

5 Claims. (Cl. 302—17)

This invention relates to apparatus for placing concrete in tunnels in the lining thereof after completion of the boring operation as is common with tunnels used for roadways, aqueducts and the like.

The principal object of the invention is to facilitate the transportation and handling of the concrete used in such linings, and to provide comparatively simple apparatus for the purpose.

Briefly, the invention comprises a concrete or cement carrying hopper unit mounted on a truck which can be run in and out of the tunnel to receive loads of concrete or cement from a mixer at the mouth of the tunnel, and having a concrete discharge conduit and an air-receiving line, each of which carries one portion of the separable connections, the other of which is in turn carried by a second or discharge unit comprising a mounting for a concrete-discharge pipe or nozzle and air supply line, which second unit and mounting remain at the location in the tunnel which is currently being cemented or lined with concrete. The invention also comprises the specific constructions and arrangements of such separable connections or couplings, as well as the combination of a vibrator for insuring descent of the concrete in the hopper, and other features herein described.

In the accompanying drawings wherein certain embodiments of the invention are illustrated:

Fig. 1 is chiefly a side elevation showing the two principal units of the present invention in disconnected relation;

Fig. 2 is a vertical sectional detail of a valve in the concrete discharge of the hopper unit;

Fig. 3 is a plan view showing the separable coupling in joined and locked position on an enlarged scale;

Fig. 4 is a side elevation thereof in disconnected relation with portions in section;

Fig. 5 is a side elevation thereof in connected position; and

Figs. 6 and 7 are respectively a side elevation and a plan view of a modified form of coupling, minor portions being broken away.

In Fig. 1, the apparatus as a whole is shown with the concrete receiving and carrying unit R disconnected from the concrete discharging or applying unit. Here a concrete-receiving hopper 10 has a conical bottom which feeds to a horizontal throat section 11 disposed longitudinally of the direction of travel of the device along tracks which are engaged by the wheels W upon which the hopper is mounted. Any suitable cover 12 is employed to seal the mouth 12' of the hopper 10 which thereby becomes a pressure chamber after it has been filled with concrete as from a mixer M carried on an elevated structure S whereby the concrete is fed through a chute C or the like.

The concrete is adapted to be passed from throat 11 to a connecting section 13 connecting the throat section 11 with a coupler section 14. To prevent loss of concrete when the receiver unit R is being moved with its charge from the mouth of the tunnel back into the tunnel to operative position, a gate valve 15 adapted to swing within section 13 is pivotally mounted in a cover plate 16 and adapted to be held in the closed position shown in both Figs. 1 and 2 by means of a weighted lever arm 17. The gate valve 15 is sufficiently narrow at its widest point to enable it to be swung up against the cover plate 16 and clear the main channel during operations; at the same time this plate will retain the concrete from flowing out when the valve is closed.

When the filled hopper 10 has been moved along the tracks into the tunnel, an inner annular coupling element 18 which may be an integral extension of section 14 comes into alinement with an outer annular coupling element 19 of the discharge unit into which the element 18 telescopes and makes a sealing fit. The element 19 may constitute one end of a section of the concrete discharge pipe or duct 20 which is shaped somewhat as indicated to discharge concrete on the top of forms F which have been built in properly spaced relation with respect to the walls of the tunnel bored in the earth E so that the concrete works down around the forms and is packed on top thereof to form the desired concrete or cement lining. According to the usual practice, the discharge pipe 20 is drawn forward as the work progresses, and for this purpose the element 19 is mounted on a carriage member K provided with wheels W' traveling on the tracks running into the tunnel.

The concrete is pneumatically discharged through pipe 20 by means of high pressure air supplied by air hose H. This hose leads from an air compressor at the mouth of the tunnel along the side of the tracks and then loops back behind the carriage K as the latter is drawn forward toward the tunnel mouth as the operations proceed. To make the air connection, a coupler element 21 is carried on the coupler section 14 of the concrete carrier R. Element 21 may be integral with section 14 as shown, and has an internally tapered bore to receive an externally tapered coupler element 22 carried by a section 23 connected with the air hose H. To insure alinement of coupler elements 21 and 22 so that they may properly couple when the elements 18 and 19 of the concrete-discharge coupling device aline and couple, the section 23 is mounted upon the element 19 and properly alined by means of a connecting block or web 24 at a median point and by means of a plate or integral casting 25 at the forward end of element 19.

When the parts are coupled and air from the hose H is passed through coupling 21, 22, 23, it

passes from element 21 to an air line 27 leading around the conical lower end of the hopper 10 and thence to a connection 28 containing an air control valve whose spring-controlled valve stem 29 projects from the member 28 and is operated through a rod and lever linkage 30 by means of a hand-operable lever 31. A small air line 27' may lead from air line 27 to a pneumatic vibrator V mounted on the wall of the conical bottom of hopper 10 to insure continuous descent of the concrete during the blowing or discharge of the concrete.

In preparing to operate this form of the device, the filled hopper unit or receiver R is moved into the tunnel to bring the coupling elements 18, 19 and 21, 22 into alinement as in Fig. 4, and then into actual operative or telescoped engagement as in Figs. 3 and 5. In order to lock the parts in this position, rods or links 35 carrying eyes 36 on each side of the discharge element 19, are swung down so that the eyes 36 engage over lugs or ears 37 on the sides of the section 14. The ends of rods 35 are pivotally connected to a forged bent lever 38 at 38', the two forks being fulcrumed at 39 on the sides of section 19. A bail 40 connected with rods 35 permits easy manipulation of the latter and stops 41 limit the movement of lever 38 into locking positions. When the coupling elements 18, 19 and 21, 22 are brought together, lever 38 is raised to the dotted line position of Fig. 5, the eyes 36 are dropped over ears 37, and lever 38 is then moved to the full line position, thereby moving the pivots 38' past dead center with respect to fulcrum 39 and locking the parts.

The discharge pipe 20 will have already had its discharge end placed in desired position, and cover 12 will have been sealed in closed position. Thereupon air will be supplied to connection 21, 22, 23 from hose H through any suitable valve means, not shown, and lever 17 will be elevated to open valve 15. Vibrator V will now be in operation to insure continued descent of the concrete from hopper 10 into throat 11, and as handle 31 is manipulated by the operator to move valve stem 29 to open its valve, the air pressure will force descending concrete from throat 11, out through section 13 and 14 and through coupling 18, 19 and pipe 20 into place above and at the sides of forms F. As the operation proceeds, the hopper unit 10 and the discharge unit D will be moved forward along the tracks to keep pace with the concrete placement. A tie chain connected with carriage K may be used to anchor the units to the tracks as indicated if desirable.

Where unevenness of tracks is apt to interfere with proper sealing of the couplers 18, 19 and 21, 22, the air connection may be horizontally alined with the concrete connection as in Figs. 6 and 7 instead of in vertical alinement as in the form of the other figures. Here the air pipes 23 and 27 are divided and branches are run down at the sides of the concrete discharge connections so that the center lines of all are in horizontal alinement. Thus, there will be two air line couplings 21', 22', one at each side of the concrete coupler. It may also be desirable to provide for pneumatic operation of the locking means, and for this purpose the locking rods 35' are provided with hooked ends 36' to engage over ears 37', while their opposite ends are pivoted to the outer ends of piston rods 44 connected with pistons 45 working in cylinders 46 at the sides of pipe section 20. Manually operated levers 47 control valves 48 to supply air selectively to opposite ends of the pistons by branches 49, the valves 48 receiving their supply from nipples let into the sides of the air pipe section 23. Thus the locking rods 35' may be moved to and from locking position by manipulation of air valves 48. A bail 40' permits both rods 35' to be raised or lowered manually as may be desired.

I claim:

1. In pneumatic materials-handling apparatus the combination of an air supply line, a materials discharge line, a container adapted to be connected to said lines, coupling elements operatively connected to said container and pointing in the same direction, a unit supporting coupling elements in position for mating with the first mentioned coupling elements, the second mentioned coupling elements pointing in the same direction, and being operatively connected to said lines, and guide means for limiting the relative movement between the first mentioned coupling elements and the second mentioned coupling elements to a direction axial of the coupling elements.

2. The device of claim 1 in which the container and its coupling elements are guided along a line longitudinally of the axes of the coupling elements.

3. The device of claim 1 in which the axes of the coupling elements are disposed in a substantially horizontal plane.

4. In pneumatic materials-handling apparatus the combination of an air supply line, a materials discharge line, a container adapted to be connected to said lines, coupling elements operatively connected to said container and pointing in the same direction, a unit supporting coupling elements in position for mating with the first mentioned coupling elements, the second mentioned coupling elements pointing in the same direction and being operatively connected to said lines, at least one of said elements being tapered to thereby guide the respective mating elements together, and guide means limiting movement of the first mentioned coupling elements to a direction axially with respect to the second mentioned coupling elements.

5. In pneumatic materials-handling apparatus the combination of an air supply line, a materials discharge line, a container adapted to be connected to said lines, coupling elements operatively connected to said container and pointing in the same direction, a unit supporting coupling elements in position for mating with the first mentioned coupling elements, the second mentioned coupling elements pointing in the same direction and being operatively connected to said lines, the axes of all the coupling elements being disposed in a substantially vertical plane, and one of said coupling elements being tapered to thereby guide the respective elements together, and guide means limiting the relative movement between the first mentioned and second mentioned coupling elements to a direction axially of the coupling elements.

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