UNDERNEATH DETAILING OF Q.R. WAGONS.

INTRODUCTION:

Modelling the underneath of your near-finished wagon can be just as rewarding as finishing a good paint job. The fact that while on the layout most people can't, won't and don't care to see the detail is irrelevant. What is important is that handbrakes and brake equipment are in place on real wagons for a reason; mainly to help with train handling and braking of trains, and should therefore be represented in scale form to complete your model. If you leave the brake cylinders and auxiliary reservoirs off your wagons, you may as well exclude bogies and wheels also, because when painted black, they can't be seen either.

So, why do modellers usually disregard the underside of their models? Probably because most people do not realise what components are underneath a basic wagon, or where they go, and how easy they are to make. Others put a completely incorrect brake system under their wagons, and while they look good, they are not correct. Hopefully by the end of this paper, you will have some idea of the equipment the railways use under their trains, how to model them, and more importantly, where they go.

WAGON FRAMES & BRACING:

All of Q.R wagons except the 4 wheel hopper wagons have a central bracing or a centre sill. This centre sill varies in depth and width, although the average width is 400mm across the underneath to facilitate a standard draft pack, either draw hook or auto. The centre sill runs the entire length on most vehicles, but there are exceptions and is the backbone of the wagon, so to speak. Secured to the centre sill is the bolsters, bogies, and other support bracing. Support bracing of 100mm thickness is welded between the centre sill and the frame on steel underframed wagons to give overall support and strength to the wagon. On timber underframes the bracing is usually 150mm thick. I haven't given any depth measurements as this also can vary from wagon class to wagon class. Also underneath the wagon can be found, stiffeners and bracing, which is used to hang the braking equipment. The wagon diagrams give a good idea of how the centre sill and bracing are placed on the wagons and what bracings the brake gear is attached to.

HANDBRAKES:

Q.R. has three basic types of handbrakes, and they can be found on most of Q.R's freight rolling stock, with a small minority as the exception. They are: the hand lever brake; the screw brake; and the wheel ratchet brake.

The hand lever brake is as old as Q. R. itself. They are mainly found on wagons whose construction dates are pre 1965. They consist of two welded "V" brackets. One is bolted

to the side of the wagon, and the other to the brake cylinder side of the centre sill, near the middle of each wagon. Both brackets are joined by a piece of 35mm bar, which is also connected to the piston brake lever. The piston brake lever moves when the hand lever is placed in the down position, which applies the brakes on the bogie or wheel nearest the piston brake lever (refer diagram K for clarity). The final pieces of the brake lever are in fact the hand lever itself and the frame. The frame is for the hand lever to slide into, and is used to pin and secure the hand lever. The frame is always on the right hand side of the "V" bracket, with the lever handle placed in it. The hand lever hinges on the "V" bracket and is supported by the frame. Once pinned, the hand lever cannot rise up and release the handbrake. There is only one hand lever per wagon, on one side only, and is always on the opposite side to the brake cylinder (refer diagram K).

The screw brake, or "BLC" brake, needs no introduction as to what is involved. The most common wagon to use the screw brake is of course the BLC class, and all of its derivatives. The screw brake was also used on several tank wagon classes, with construction dating between the late 1960's and 1970's. Most of these wagons, however, have now been placed on QLX class underframes. The PE class flat wagons also are screw braked, but this wagon differs from the remainder as it is headstock mounted, and only consists of a single hand wheel at one end (refer wagon diagrams, PE class, for clarity). The screw brake can still be found on trains today, although its numbers are quite diminished. However, most Guard's vans, including the suburban and mail vans, still use the screw brake, but to a different design from the freight vehicles. The brake on a "BLC" type design consists of two handwheels, one on either side of the wagon, which work in conjunction with each other. These are connected to a threaded bar which runs longitudinally with the wagon on the brake cylinder side only (see diagram L). The threaded bar stops at a down support bracket which is adjacent to the brake cylinder. This bar rotates when the handbrake is turned. The piston brake lever is connected to this threaded bar via a triangular weight and nut section, which moves along the bar to release or apply the handbrake, (according to direction of travel), on the bogie closest to the handbrake.

Technical difficulties, the amount of effort, and the time taken to apply and release this type of brake are the major reasons why this brake was passed over for the more common and reliable wheel ratchet brake.

The wheel ratchet brake would have to be the most commonly used handbrake used in Queensland, especially in the modern era. It is the most efficient and reliable system QR has to date, and is easy to use and maintain. This simple system first made its appearance from around the 1960's, under the WHE class. The wheel ratchet brake consists of two handwheels that work in conjunction with each other; two ratchet handles, which also work in conjunction with each other to prevent the handbrake from releasing; and a chain, which is attached to the piston brake lever, and is tightened or slackened (to apply or release the brake) around the handwheel joining bar.

BRAKE CYLINDERS: (please refer to diagram I for brake cylinder detail)

Q.R. has quite a variety of different brake cylinders, but they all can be broken up into 4 main types. They are: The combined brake apparatus,
the A.F type,
the horizontal, and
the lightweight.
Q.R. has now gone into bogie mounted brake cylinders with their modern rollingstock, but for the majority of wagons, it is the basic four cylinders types.

Of an important note, Q.R. freight wagons have only one brake cylinder per wagon on one side; or on one end only, but there are exceptions!

The combined brake apparatus is all three systems on one; that is, the brake cylinder, the auxiliary reservoir and the triple valve. This type of system is common on most types of bogie rollingstock dating back to the pre 1980's, especially on those wagons equipped with lever hand brakes. This is a very simple brake cylinder to make, with very little extra detail to add. For the correct placement under the wagon of this system, please refer to wagon detail diagrams.

The A.F. type brake cylinder is also an old system, and as the name suggests, is used with an A.F. triple valve mounted on the cylinder end (some wagons now however have had the A.F. triple valve replaced by the more modern W.F. type triple valve, explained later). Above the triple valve is bolted the cylinder brake lever, which works in conjunction wit6h the piston brake lever. Metal ¾ inch pipes from the brake cylinder to the auxiliary reservoir and the brake pipe completes the system.

The horizontal and lightweight brake cylinders are, of course, brake cylinders for the more modern wagons. Both of these brake cylinders do the same job, the only difference being that the lightweight is used where weight saving measures are required, such as in the case of the PCO class container wagons. The triple valve is not part of the brake cylinder and is therefore bolted somewhere else on the wagon, along with the auxiliary reservoir. The brake cylinder receives its air from the auxiliary reservoir via pipes, which join at the triple valve, thus connecting all three systems. In some cases these brake cylinders may have automatic slack adjusters bolted to them (refer diagram F & J)

AUXILIARY RESERVOIRS:

All wagons with brake cylinders carry one auxiliary reservoir or more. They are simply a tank for storing compressed air, which is released into the brake cylinder via the triple valve for applying the brakes. On most of the simple system wagons, the auxiliary reservoir is a standard cylinder of 610mm x 250mm and is joined to the triple valve by a ¾ inch pipe. The more modern and complex wagons (see diagram G) have extra cylinders such as supplementary and accelerated release reservoirs, which work with modern triple

valves. Supplementary reservoirs are around 800mm x 400mm with the accelerated release reservoirs around 460mm x 280mm. The more modern wagons such as the PCO, BRM, VBO, BCZY, and the new mineral wagons have what is called a four-compartment reservoir (see diagram H) which, as the mane suggests, is all the different reservoirs combined into one. The dimensions for this reservoir are around 1240mm x 420mm.

TRIPLE VALVES:

The most important pieces of the brake equipment are the triple valve. Without it, the brake system cannot apply the brakes, release the brakes or recharge the auxiliary reservoir with air, hence its name, triple valve. Q.R. has four main types of triple valves, though difference in sizes in each group can be found. I have found, for ease of modelling, to standardise on the largest size in each group. The four groups are:

The 3 1/2 inch triple;
The AF triple;
The WF triple and
The Davies & Metcalf triple.

The 3-½ inch triple valve is the oldest triple valve Q.R. has in operation. Most have been discarded in preference to the AF triple, but some still exist mainly on heritage wagons and on older style cattle wagons.

I am unsure when the AF triple valves would have been introduced, but they would have been predominant from the 1960's onwards. In any case, when you scale both triple valves down for models, they are virtually identical, with no distinguishing features. Only the bulb at the base and the interior differ in real life. The dimensions for the 3-½ inch and the AF triple valves can be found in diagram (M).

The W.F type triple valves began appearing on freight vehicles from around the mid 1960's (see diagram N). They were predominantly placed on the new coal vehicles, but from around the early 1970's, began to appear on general freight vehicles. Looking at today's wagons, the WF triple can be found on most of Q.R.'s freight and coal wagons, as well as the long distance passenger carriages.

The Davies & Metcalf triple valves are a more modern triple valve again, and although not used anywhere as near as much as the WF or AF type, are still found on several types of wagons such as BR's, BM's, OVAO's and the SX suburban sets. The Davies & Metcalf perform pretty much the same sort of job as the WF triple valves, but they have some added features. (diagram O).

In most cases, unless a wagon has had its triple valve exchanged (i.e. and AF exchanged for a WF type), the WF or Davies & Metcalf triple valves will be found on the wagon along with dummy brake cylinders, supplementary reservoirs and accelerated release reservoirs, in any one of those combinations.

SLACK ADJUSTERS:

Q.R has two types of automatic slack adjuster. They are found on modern rollingstock and their function is to adjust any excess brake travel. Modellers need not concern themselves with one of the two types, as it forms part of the pull rods to the brake rigging. The second, however, is the early design of the two, and is quite noticeable on wagons. A drawing and dimensions are found in diagram (D). This type of slack adjuster can be found attached to horizontal brake cylinders on some wagons, and on the opposite end to the brake gear on QGA class grain hoppers.

BRAKE RIGGING:

The final part of the brake gear is of course the brake rigging itself. Connected to the brake cylinder is the piston and the cylinder brake levers. Braking effort by the levers to the brake shoes is attained via pull rods (one connected to each brake lever and its associated bogie or axle). Diagram (D) gives a fairly standard design for all eras of how the brake rigging is fixed to the bogies. Diagram (D) also gives bogie detail for modellers who wish to embark on such a project as equipping their bogies with full brake rigging. I personally do not believe that brake rigging is necessary on bogie rollingstock as it is hard to fit and see the detail between the wheels and side frames anyway.

So now that we know what is under a wagon, how do we go about making the gear for it?

Firstly, actually seeing the wagon up close and taking a quick sketch and measurements of what is there and where everything goes, is always a good start, but not essential. It is a safe bet that what is under one wagon of a class, would be under the remainder in exactly the same place unless alterations have occurred. If you intend to scratch build your brake gear, you will need the following equipment:

A very sharp craft knife or scalpel blade for cutting and shaping styrene.

Evergreen strip styrene, rod and tube item 217, for auxiliary reservoirs, brake cylinders and the AF triple valves.

Strip styrene for the remainder of the brake gear.

Thin piano or electrical wire for the pull rods.

Scale chain if required for the handbrake chain.

Handbrake wheels are available commercially or constructed using wire, soldering iron and a jig to hold the assembly in place.

For where and how to position your brake gear, I have included some of my own sketches, of some of the different types of wagons. From these sketches you should be able to position most of the gear. Exact positioning of the brake gear I feel, is important. You can determine this position by photographs, which is recommended you have to build the wagon of your choice.

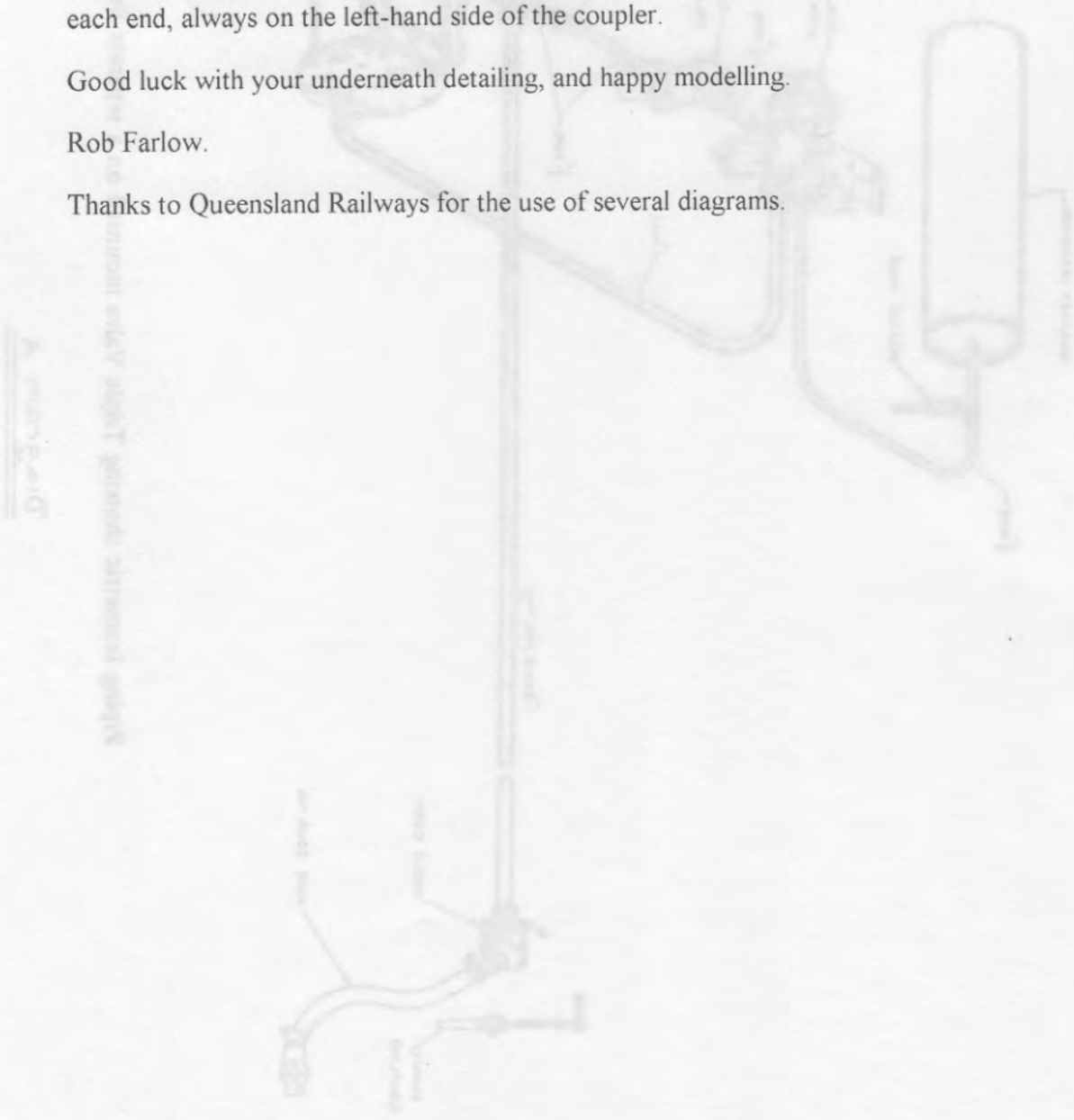
Scratch building your own brake gear can be fun, and as I said at the beginning, with the right drawings, photos and equipment are not that hard to make. However, if it does seem a bit daunting, don't despair, as some commercial modellers have in fact brake gear and parts in any scale for sale as extras (you just have to look in the right places. Talk to me after.) Some gear, though, will still have to be hand made, especially in the case of the BLC screw brake. Time and practice will eventually produce very good results, and you will wonder why you never started modelling brake gear earlier. There is nothing like a model wagon with brake gear that looks as though it might actual work!

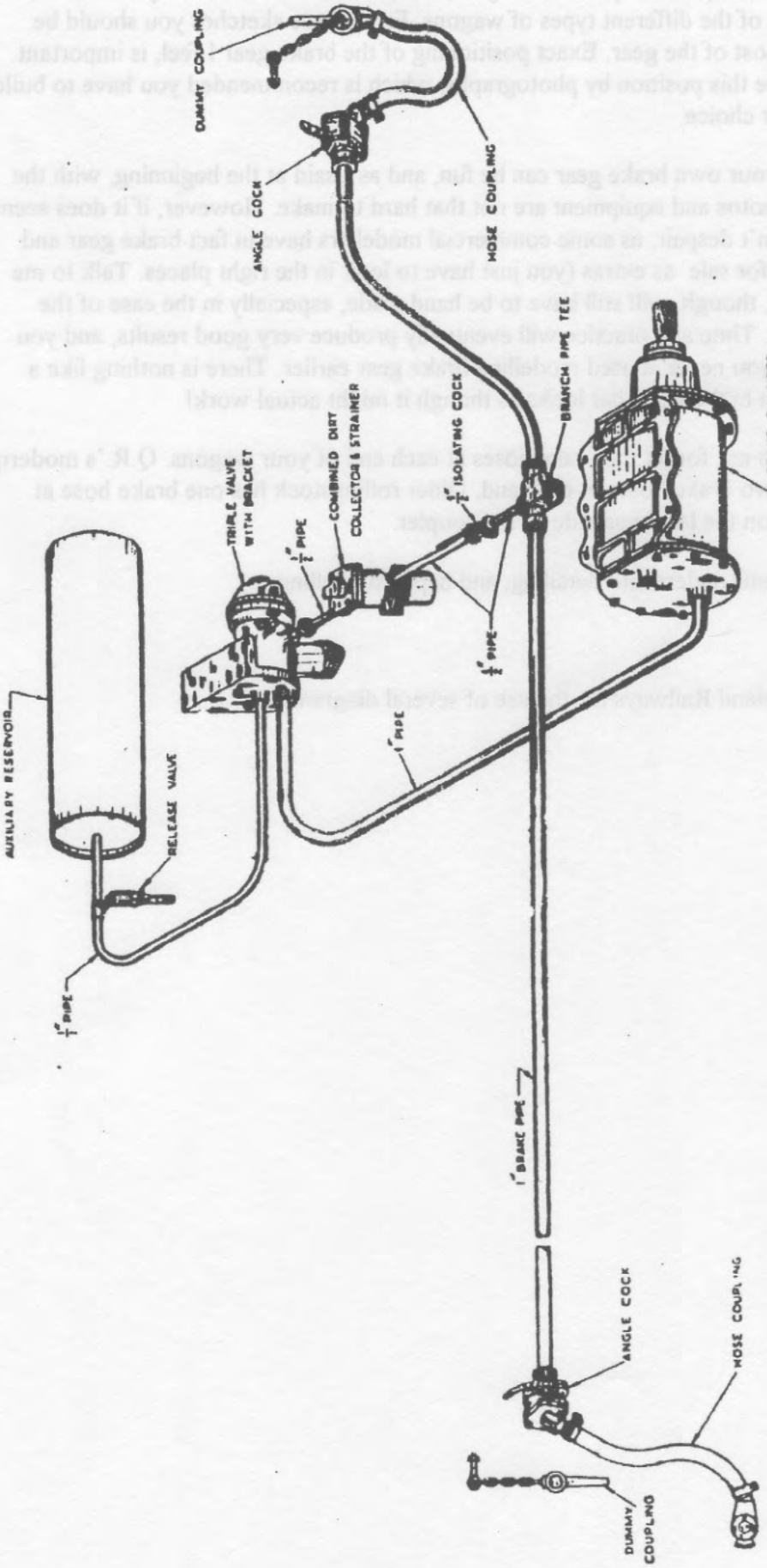
On a final note, do not forget the brake hoses at each end of your wagons. Q.R.'s modern rollingstock has two brake hoses at each end. Older rollingstock has one brake hose at each end, always on the left-hand side of the coupler.

Good luck with your underneath detailing, and happy modelling.

Rob Farlow.

Thanks to Queensland Railways for the use of several diagrams.





Piping Isometric showing Triple Valve mounted on a separate Bracket.

Diagram A

AIR BRAKE SYSTEM - CARRIAGE AND WAGON

GENERAL DESCRIPTION

The locomotive, carriage and wagon brake system is continuous throughout the train, and is dependent for its operation on the compressed air furnished in the first instance by the air compressor on the hauling locomotive. The air compressor charges up the main reservoir, from which the compressed air is admitted by the Driver's brake valve to the brake pipe (which extends the full length of the train) as shown in figure 1.

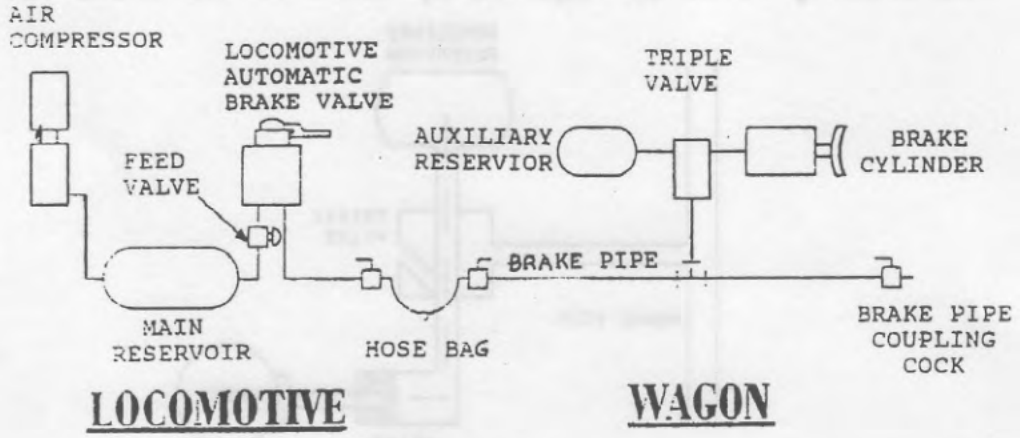


Figure 1

On individual vehicles the air is passed through a triple valve into an auxiliary reservoir as shown in Figure 2. The particular triple valve that is fitted is dependant on the size of the brake cylinder or the size of the dummy volume on relayed equipped wagons.

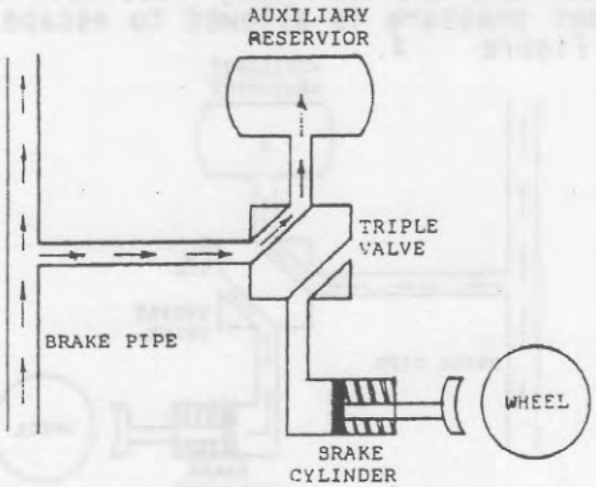


Figure 2

Diagram B

(Cont'd)

The brakes are applied by the reduction of air pressure in the brake pipe, produced either purposely or accidentally. The greater auxiliary reservoir pressure then moves the piston, cutting off the communication between the brake pipe and the auxiliary reservoir to flow into the brake cylinder, the piston of which is forced outwards and through a combination of levers that applies the brake blocks to the wheels as shown in Figure 3. The braking force thus produced is proportional to a reduction in the brake pipe pressure. The driver can graduate the braking force as required by means of the brake valve.

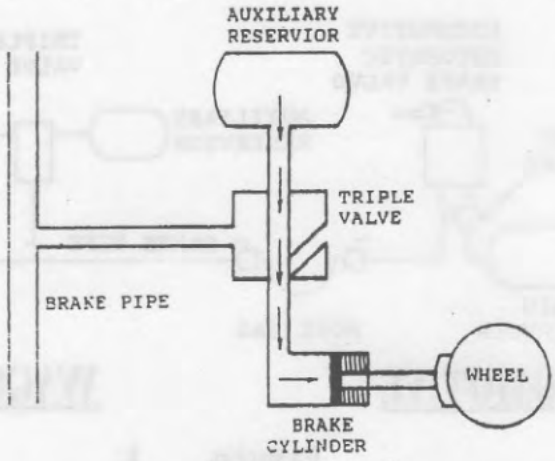
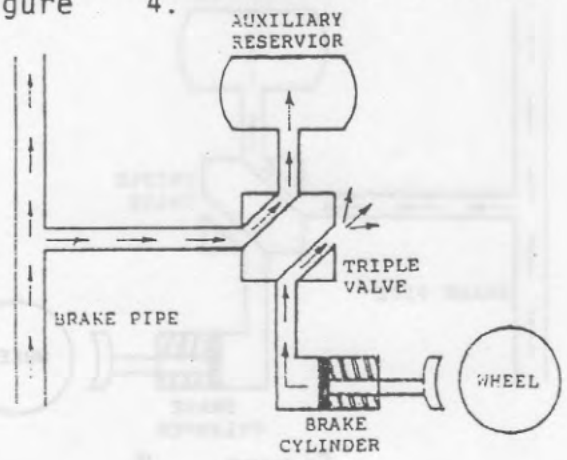


Figure 3

The brakes are released by increasing the pressure in the brake pipe above the pressure in the auxiliary reservoirs, resulting in the triple valve pistons or diaphragms being forced over into release position, whence the communication between the brake cylinder and the auxiliary reservoir is closed, but the brake cylinder pressure is allowed to escape to the atmosphere as shown in Figure 4.



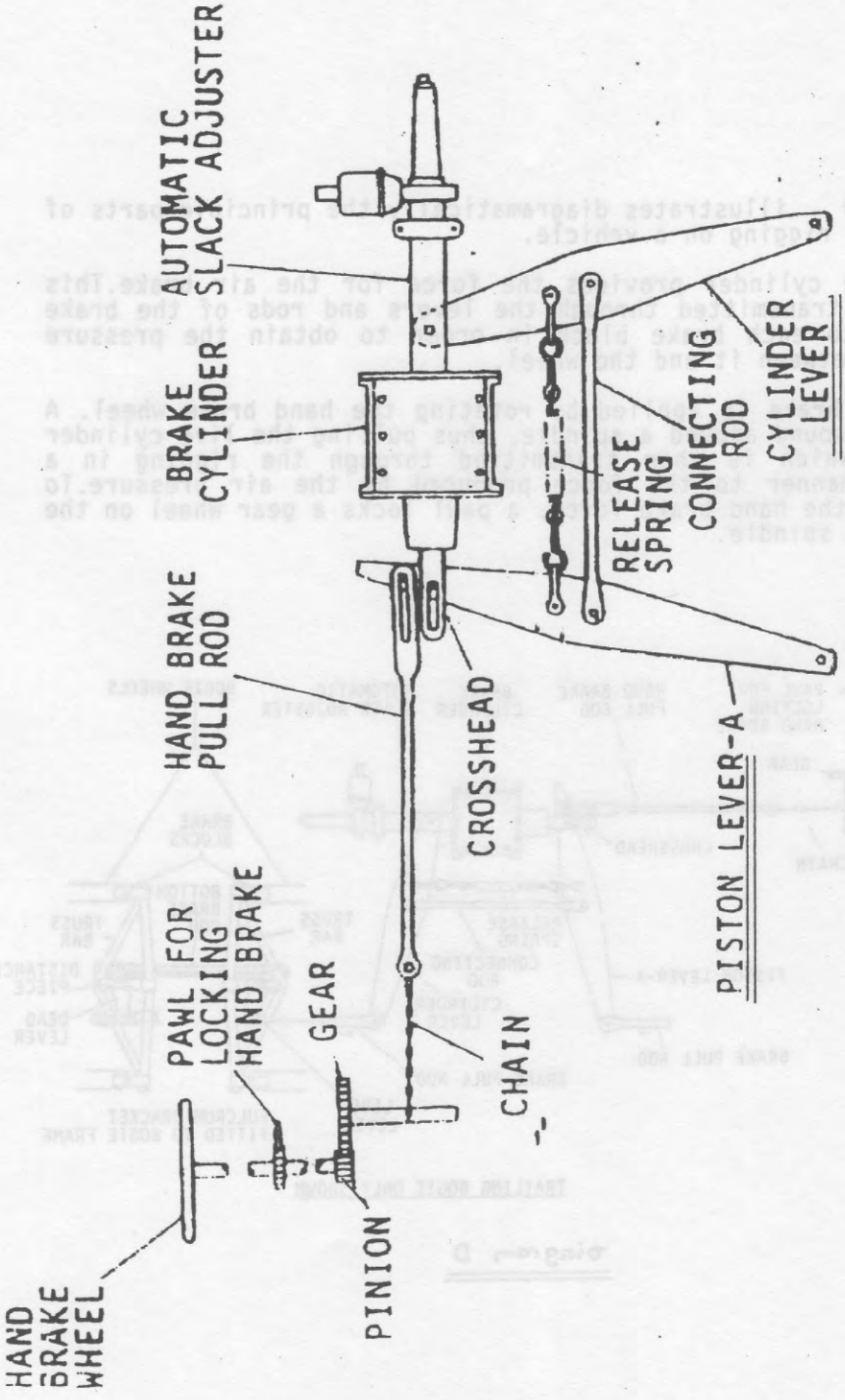
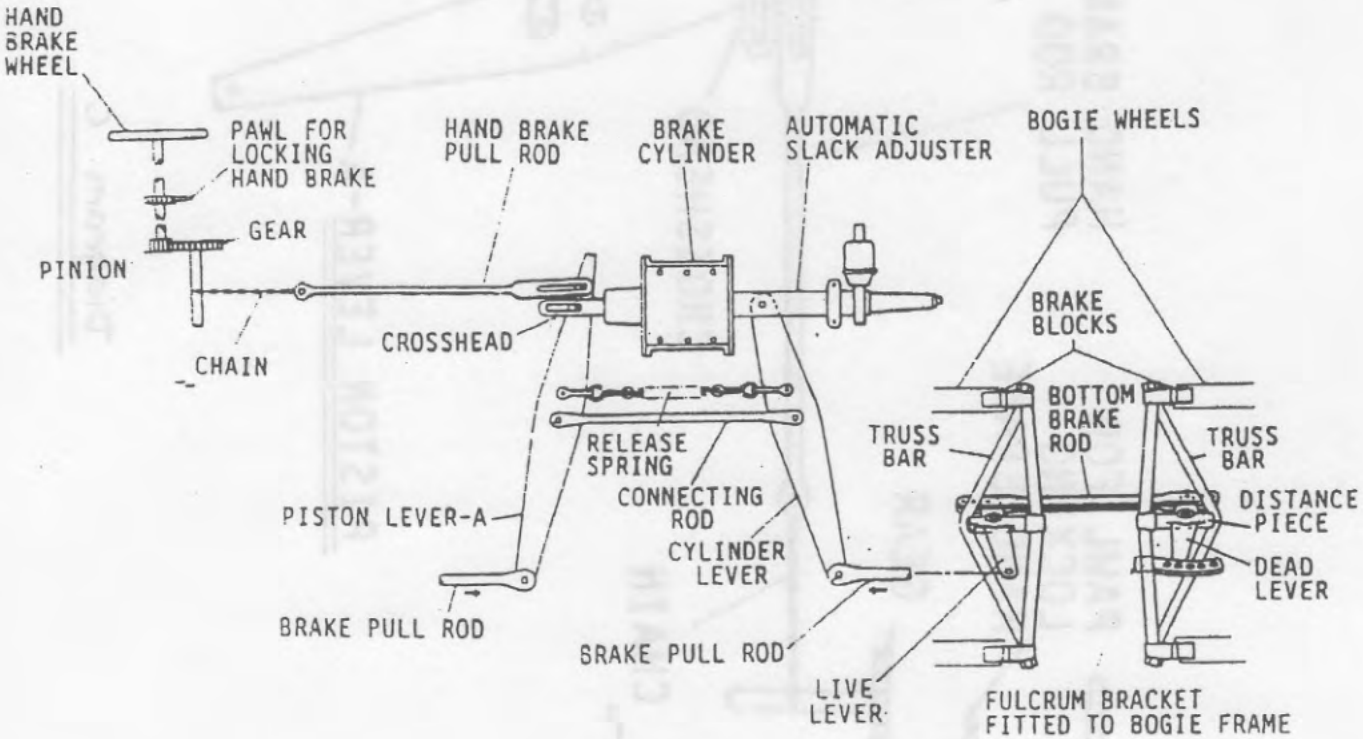

AUTOMATIC SLACK ADJUSTER
BRAKE CYLINDER
HAND BRAKE PULL ROD
CROSSHEAD
PISTON LEVER-A
RELEASE SPRING
CONNECTING ROD
CYLINDER LEVER
PAWL FOR LOCKING HAND BRAKE
GEAR
CHAIN
PINION
HAND BRAKE WHEEL

Diagram C

Diagram D illustrates diagramatically the principle parts of the brake rigging on a vehicle.

The brake cylinder provides the force for the air brake.This force is transmitted through the levers and rods of the brake rigging to each brake block in order to obtain the pressure desired between it and the wheel.

The hand brake is applied by rotating the hand brake wheel. A chain is wound around a spindle, thus pulling the live cylinder lever A;which is then transmitted through the rigging in a similar manner to the force produced by the air pressure.To maintain the hand brake force, a pawl locks a gear wheel on the handbrake spindle.



TRAILING BOGIE ONLY SHOWN

Diagram D

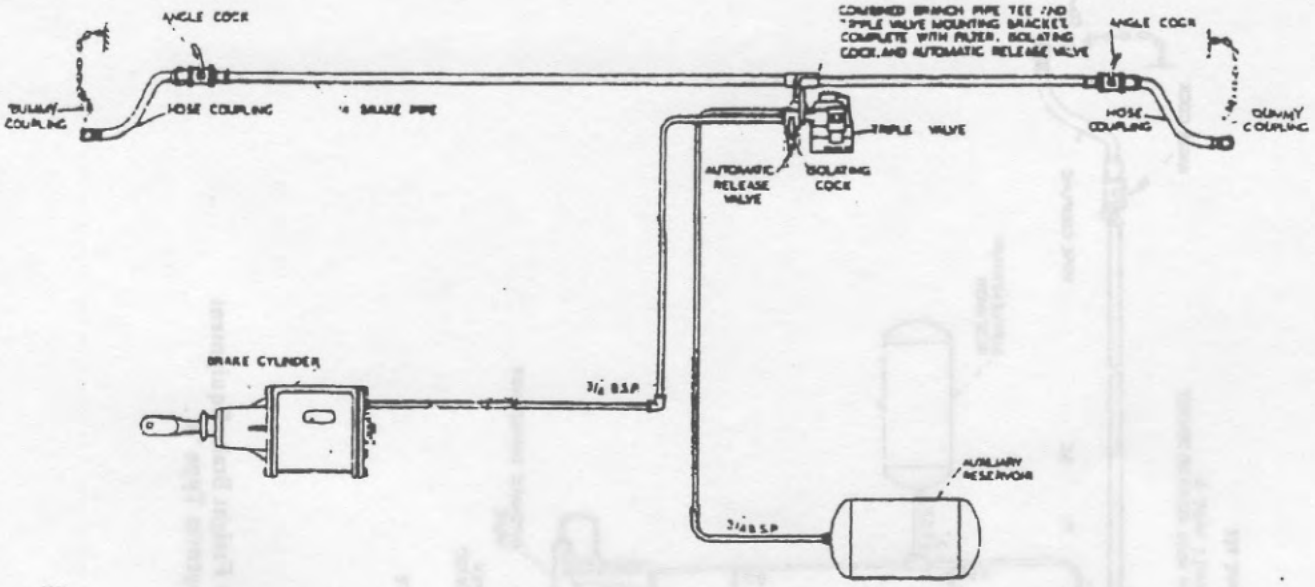


Diagram E

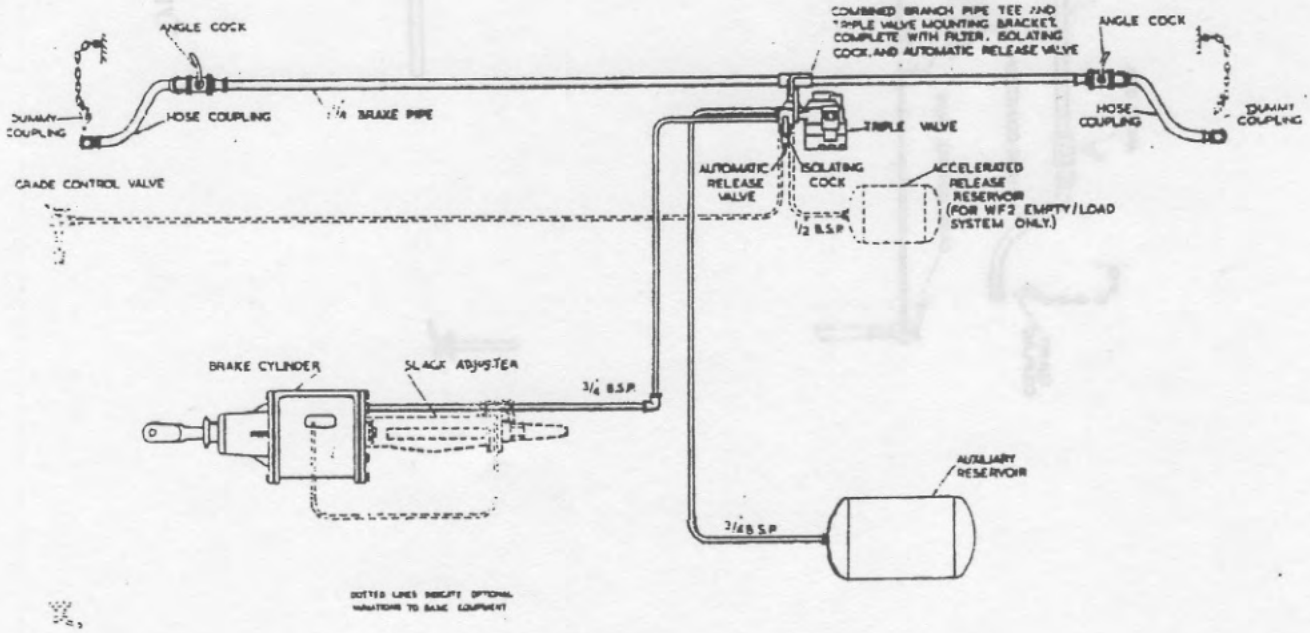
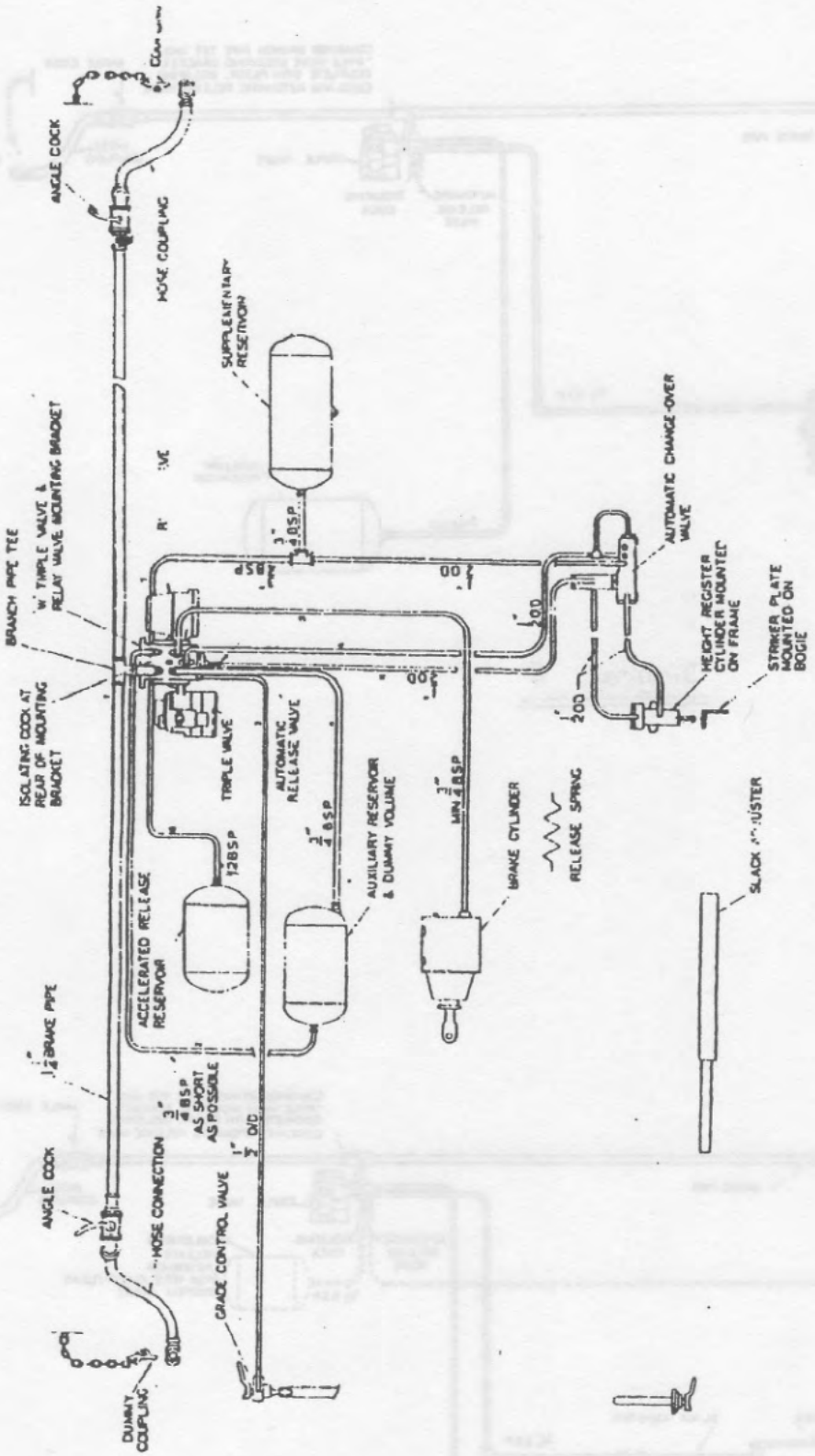
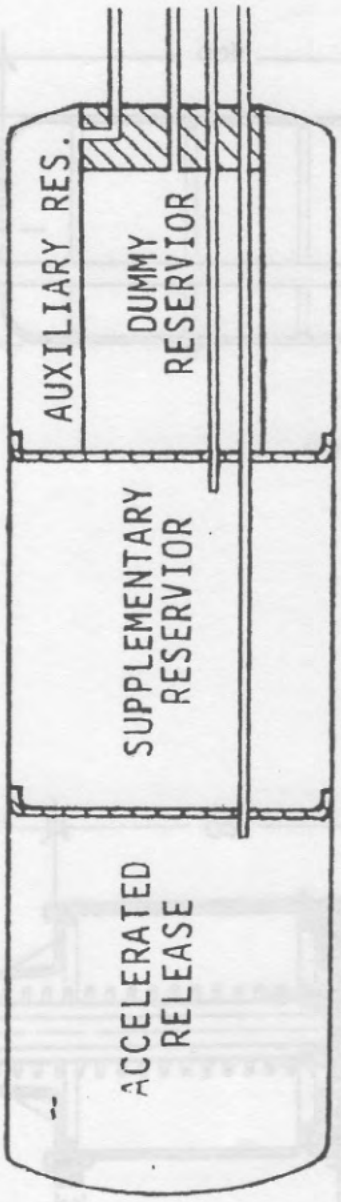


Diagram F



Type 'W' Direct Release Empty/Load Pressure Change Freight Brake Equipment with Retractable Load Sensing Automatic Changeover Type 'R'.

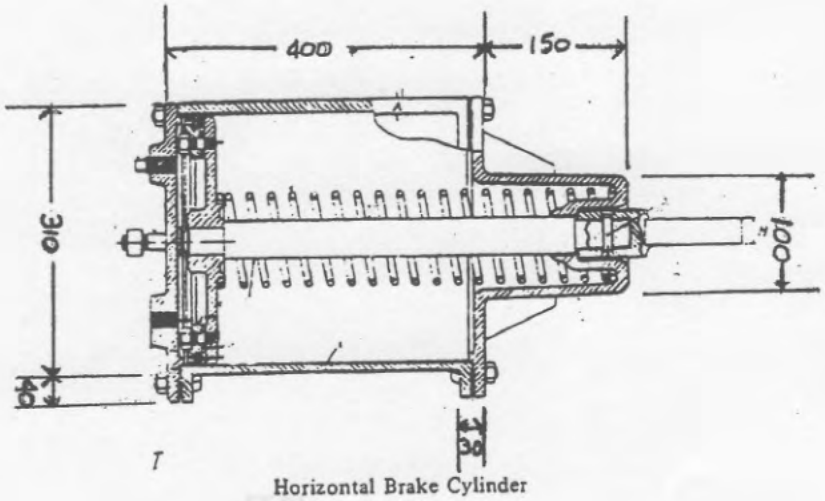
Diagram G



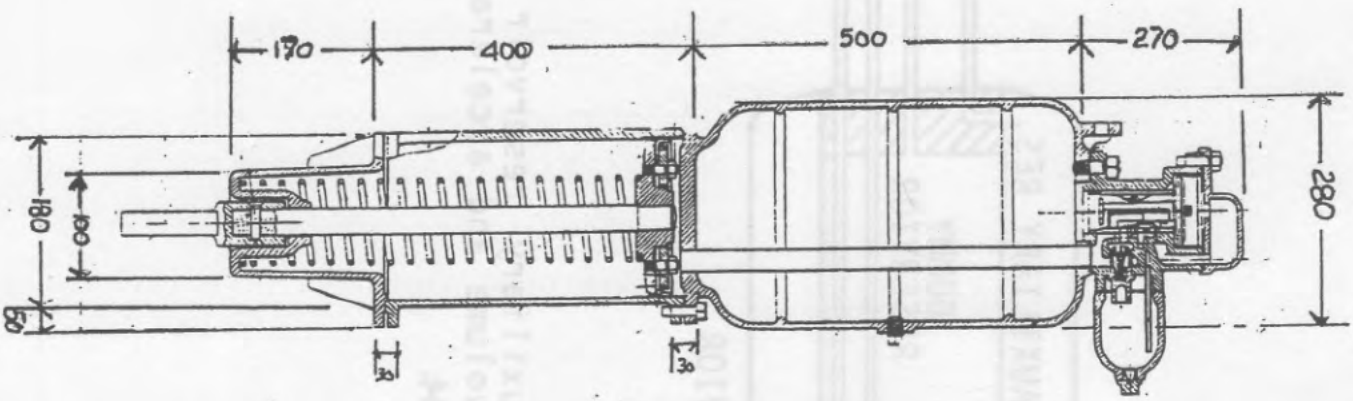
FOUR COMPARTMENT RESERVIOR
(where fitted)

Diagram H.

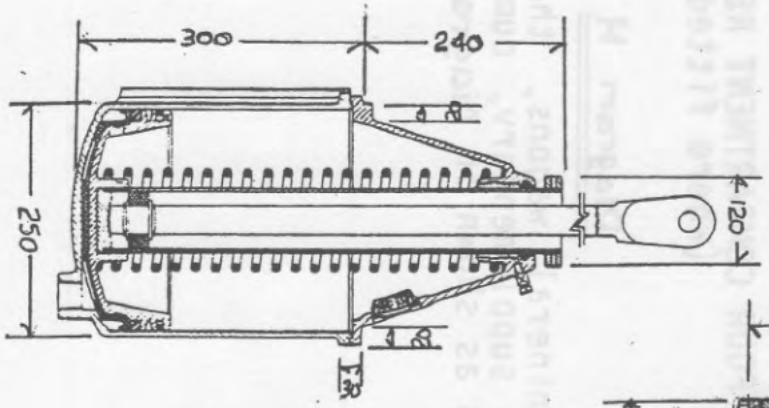
On most modern mineral wagons, the auxiliary reservoir is combined with the supplementary, dummy volume and accelerated release reservoirs as shown in Diagram H.



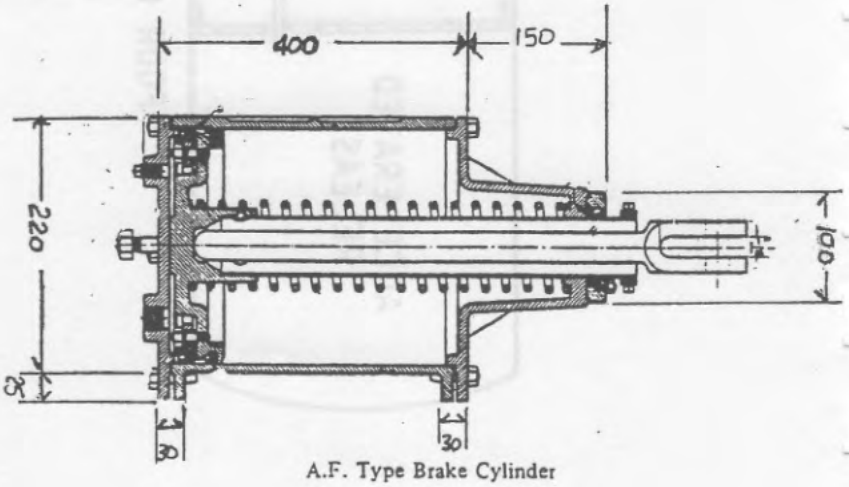
Horizontal Brake Cylinder



Combined Brake Apparatus



Lightweight Brake Cylinder



A.F. Type Brake Cylinder

Diagram I

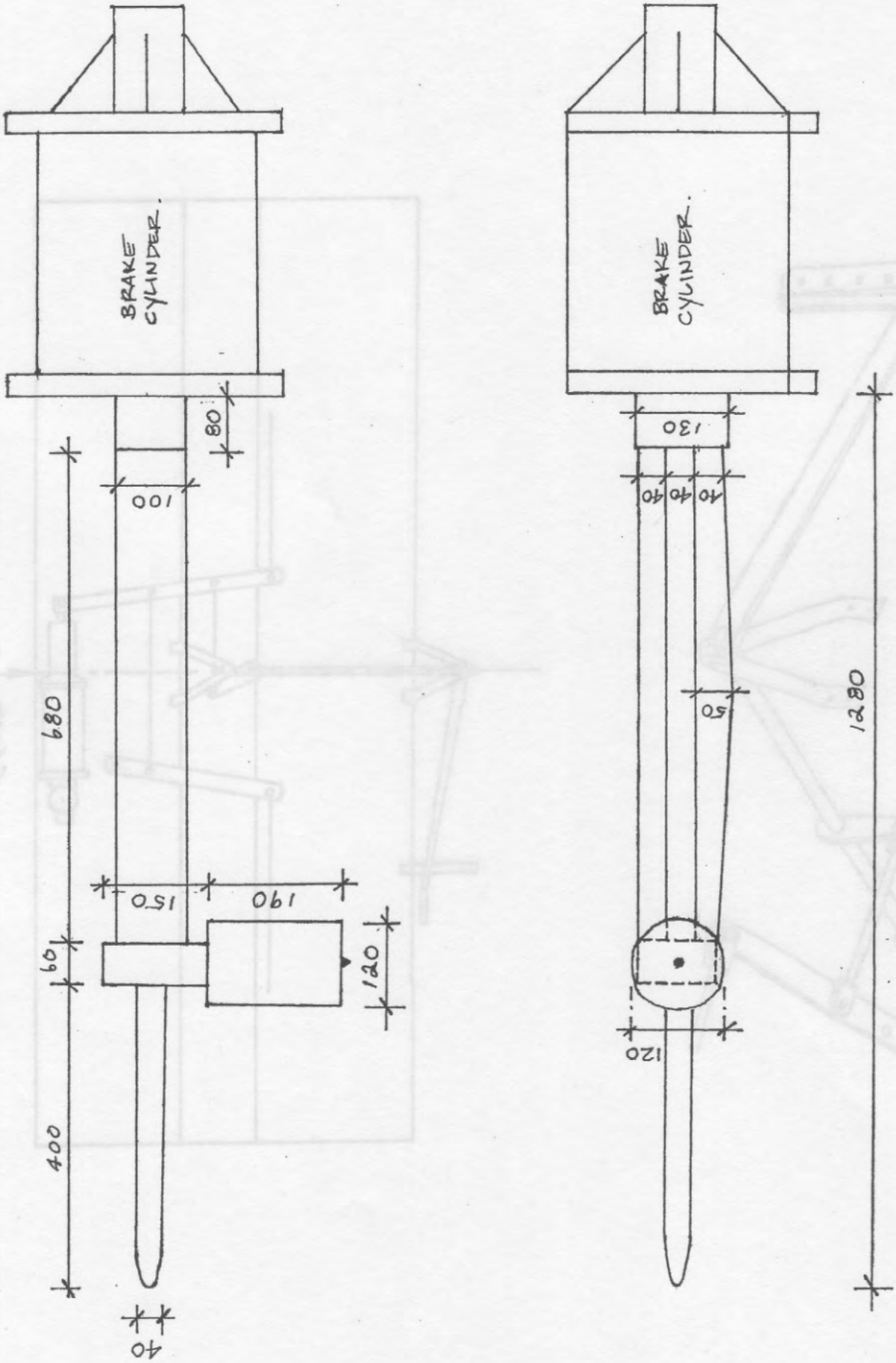
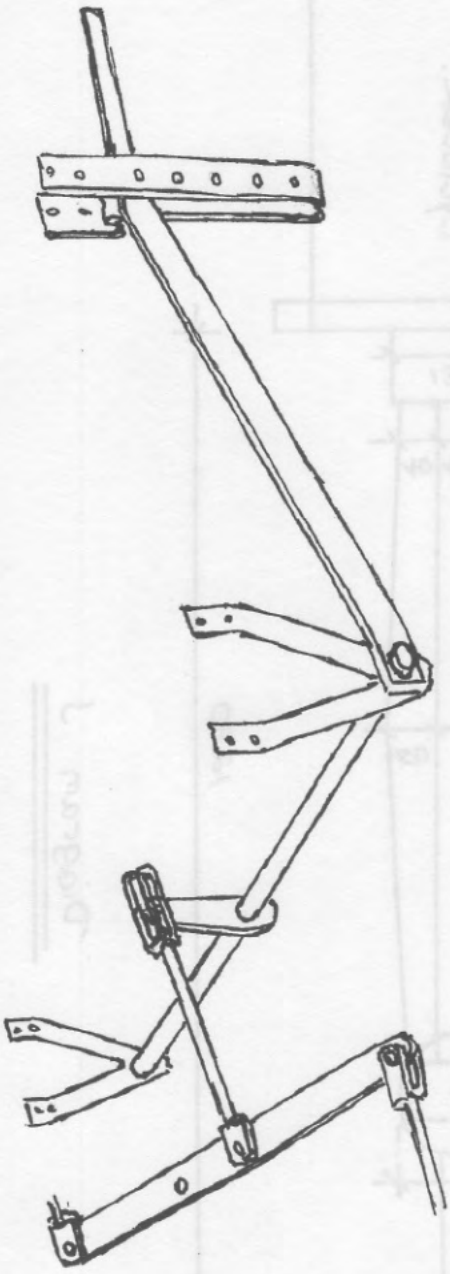
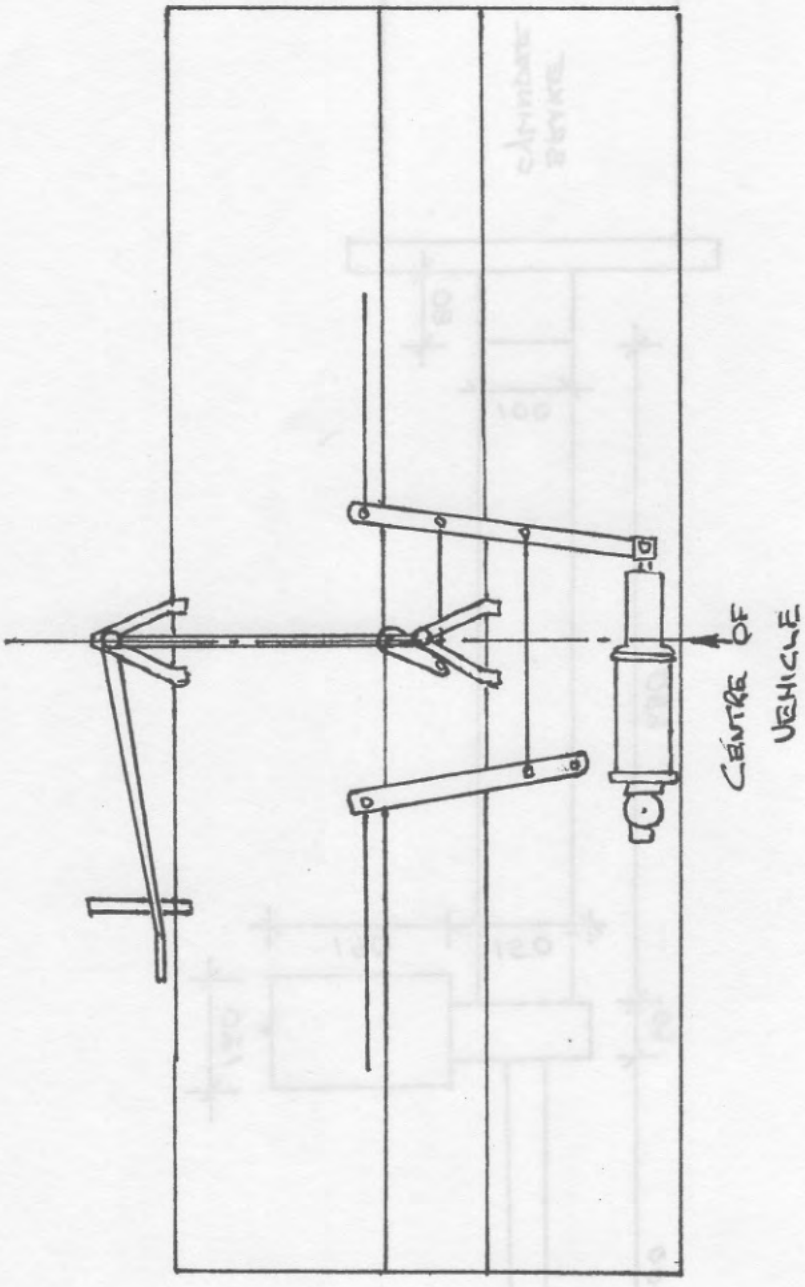
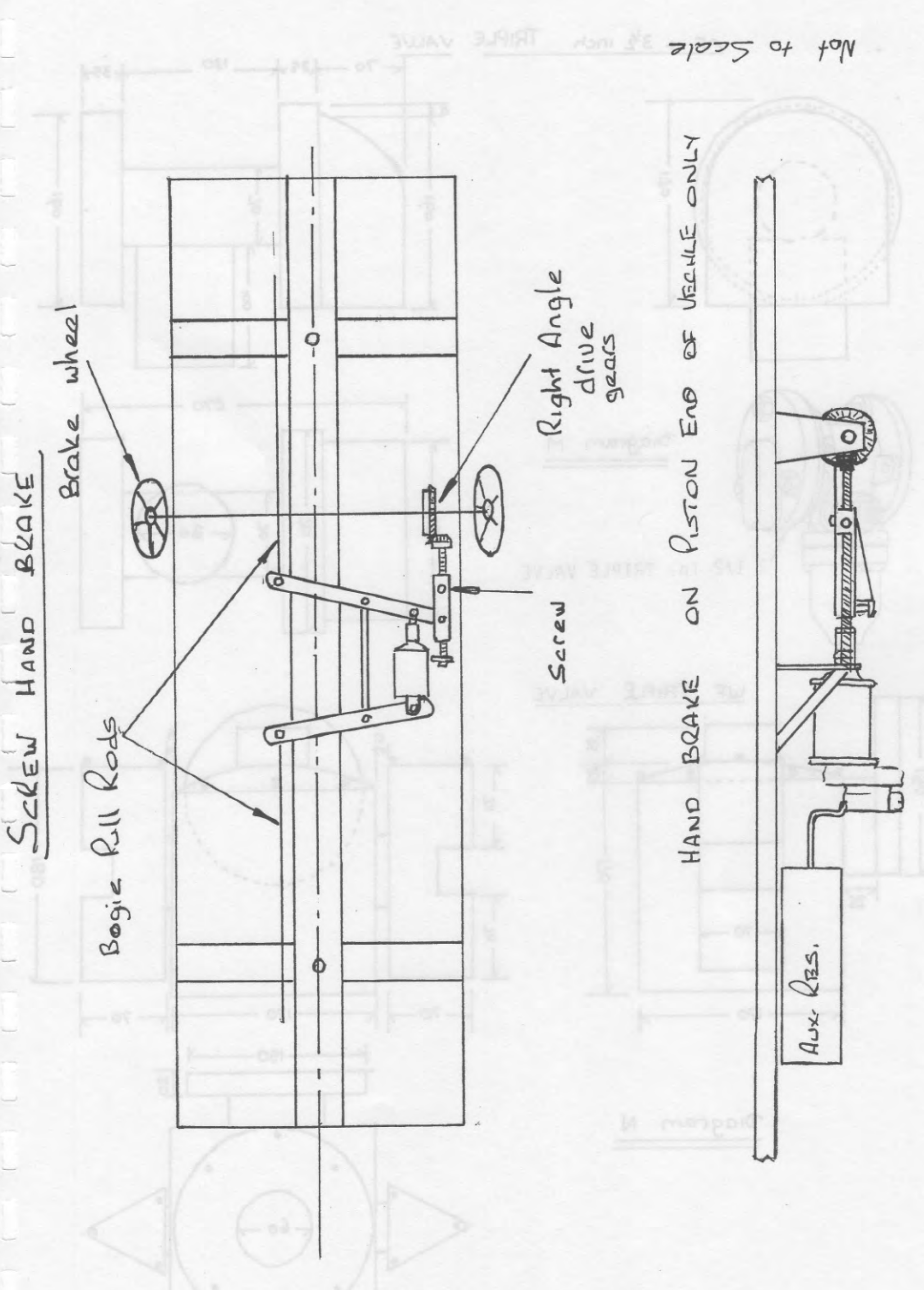

BRAKE CYLINDER.
80
100
680
150
190
60
120
400
40
BRAKE CYLINDER.
130
40
40
40
150
1280
120

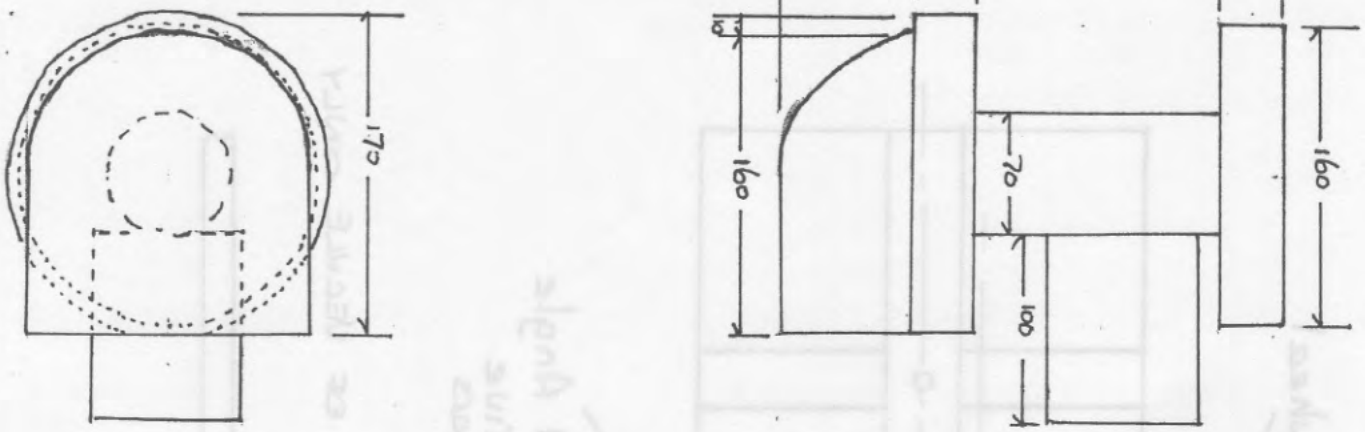
Diagram J




CENTRE OF
VEHICLE


Screw Hand Brake
Brake wheel
Bogie Pull Rods
Right Angle drive gears
Screw
Hand Brake on Piston End of Vehicle only
Aux Res.
Not to Scale

AF + 3½ inch TRIPLE VALVE



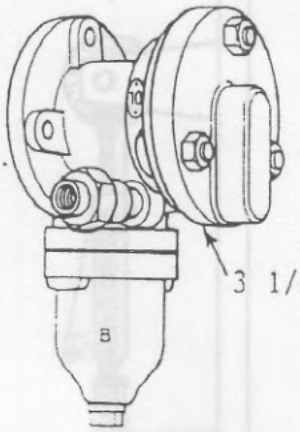
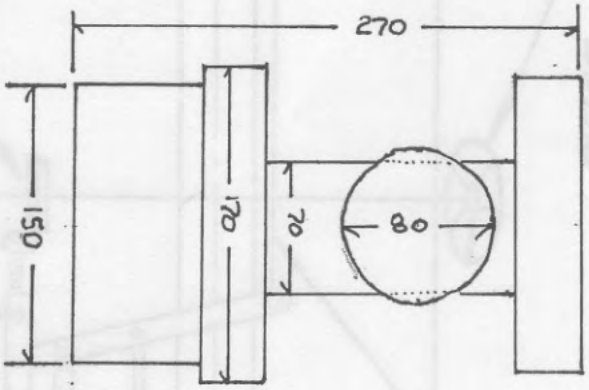
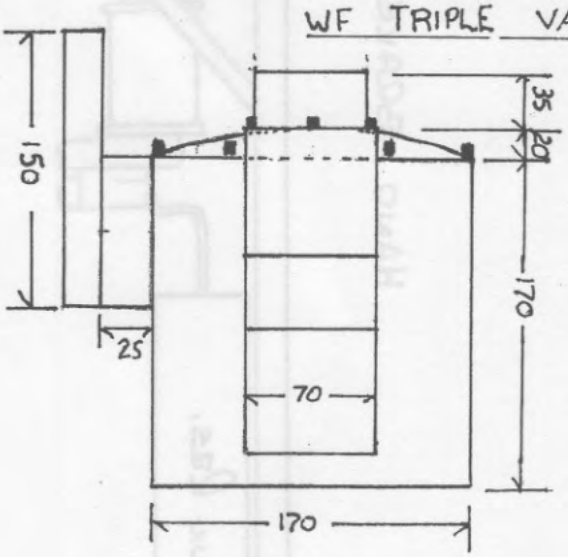
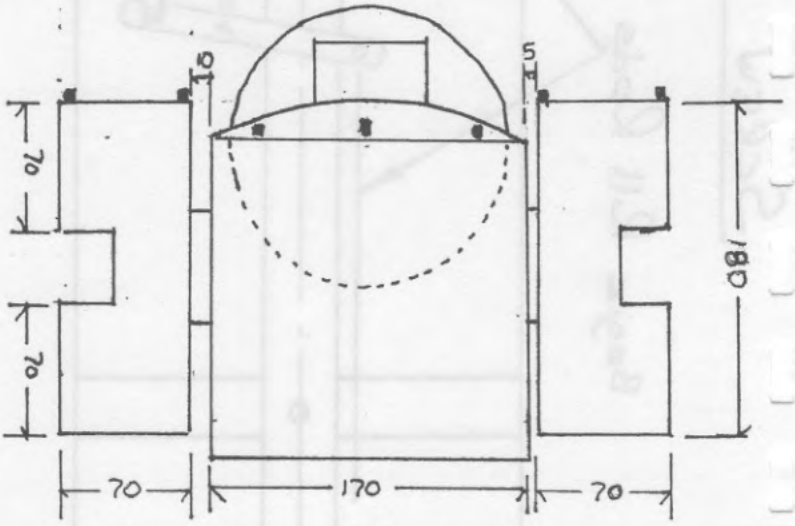


Diagram M



WF TRIPLE VALVE





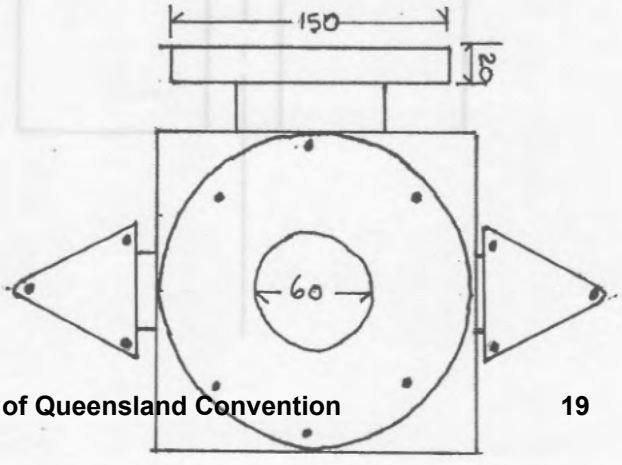
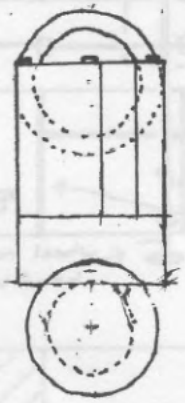
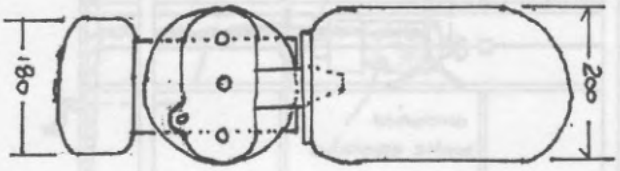
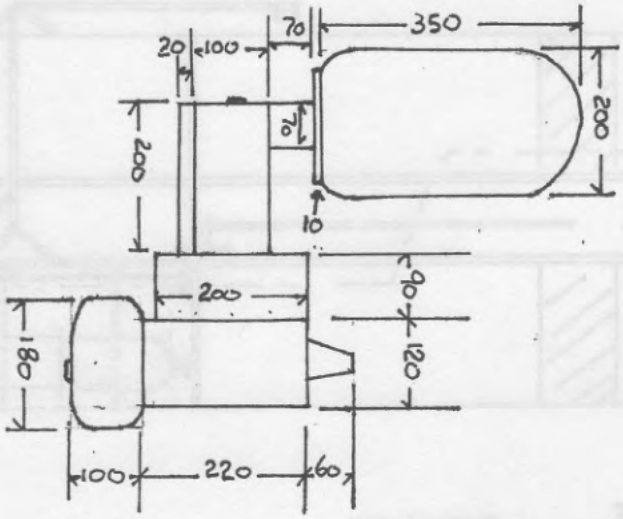


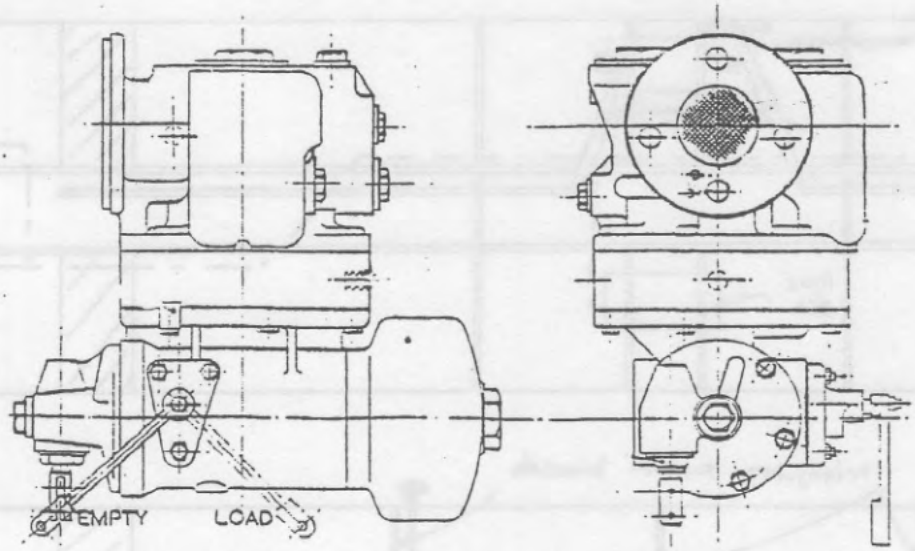
Diagram N

Davies + Metcalf Triple Valve









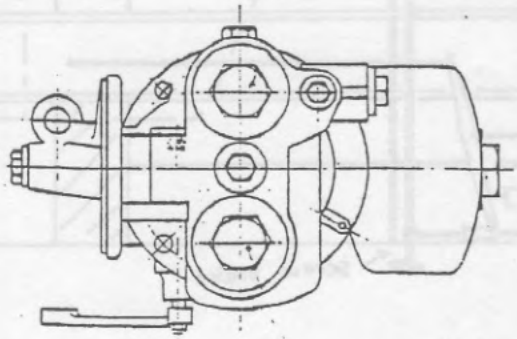
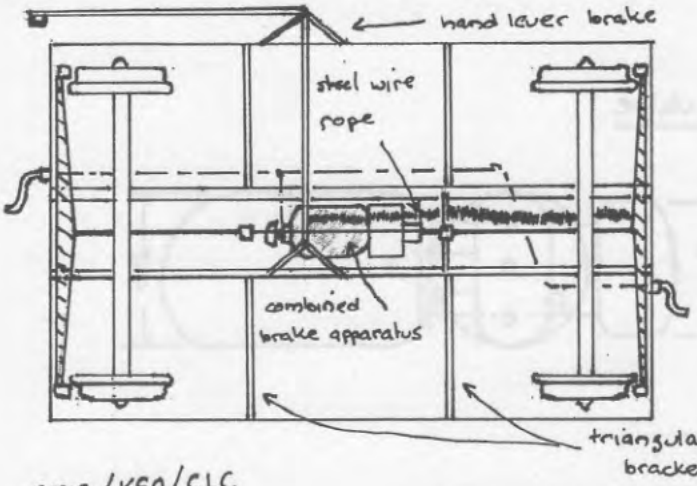


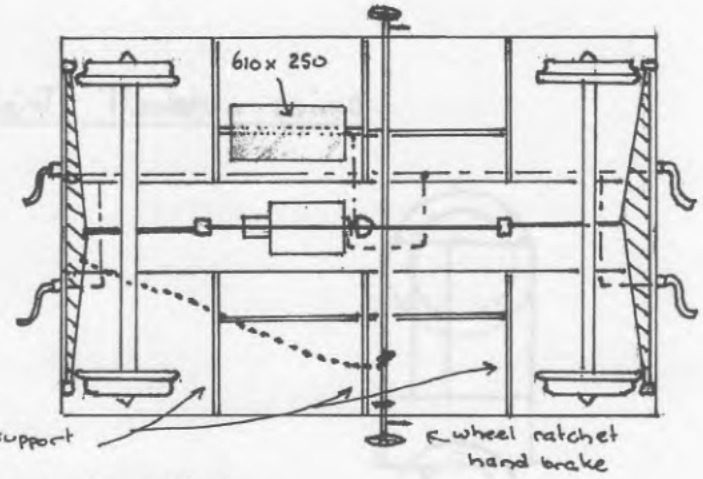
Diagram O

Underneath Detailing of QR Wagons

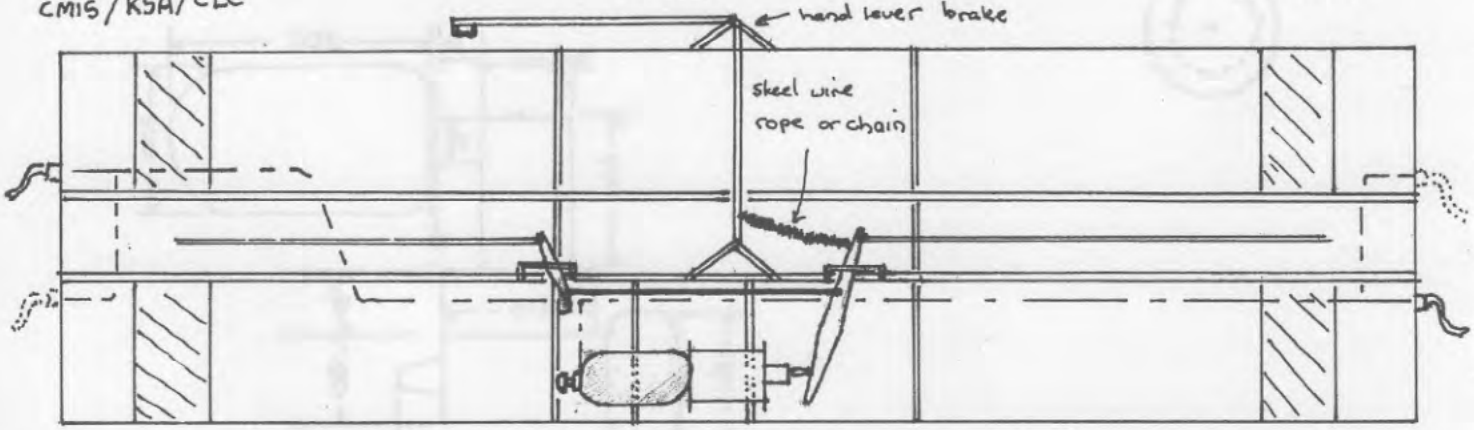
FJS



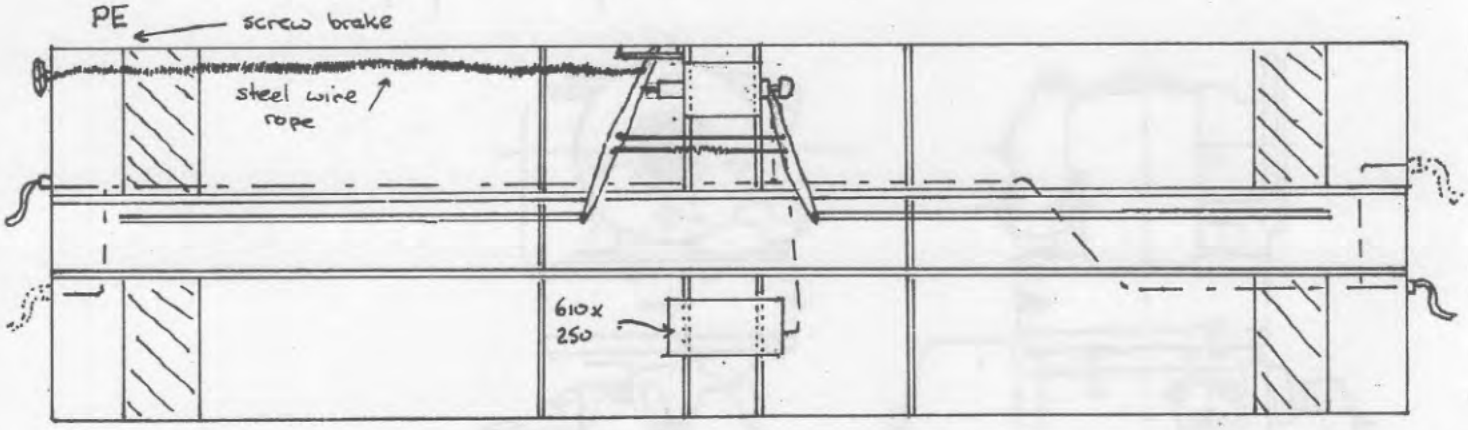
ACY



CMIS/KSA/CLC



PE



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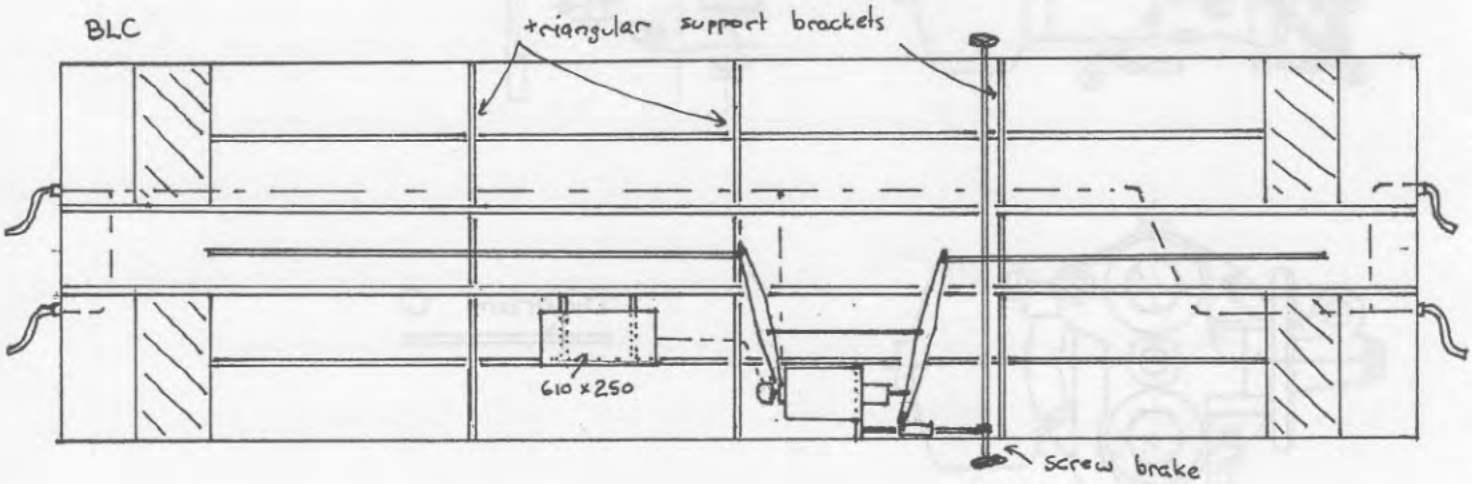
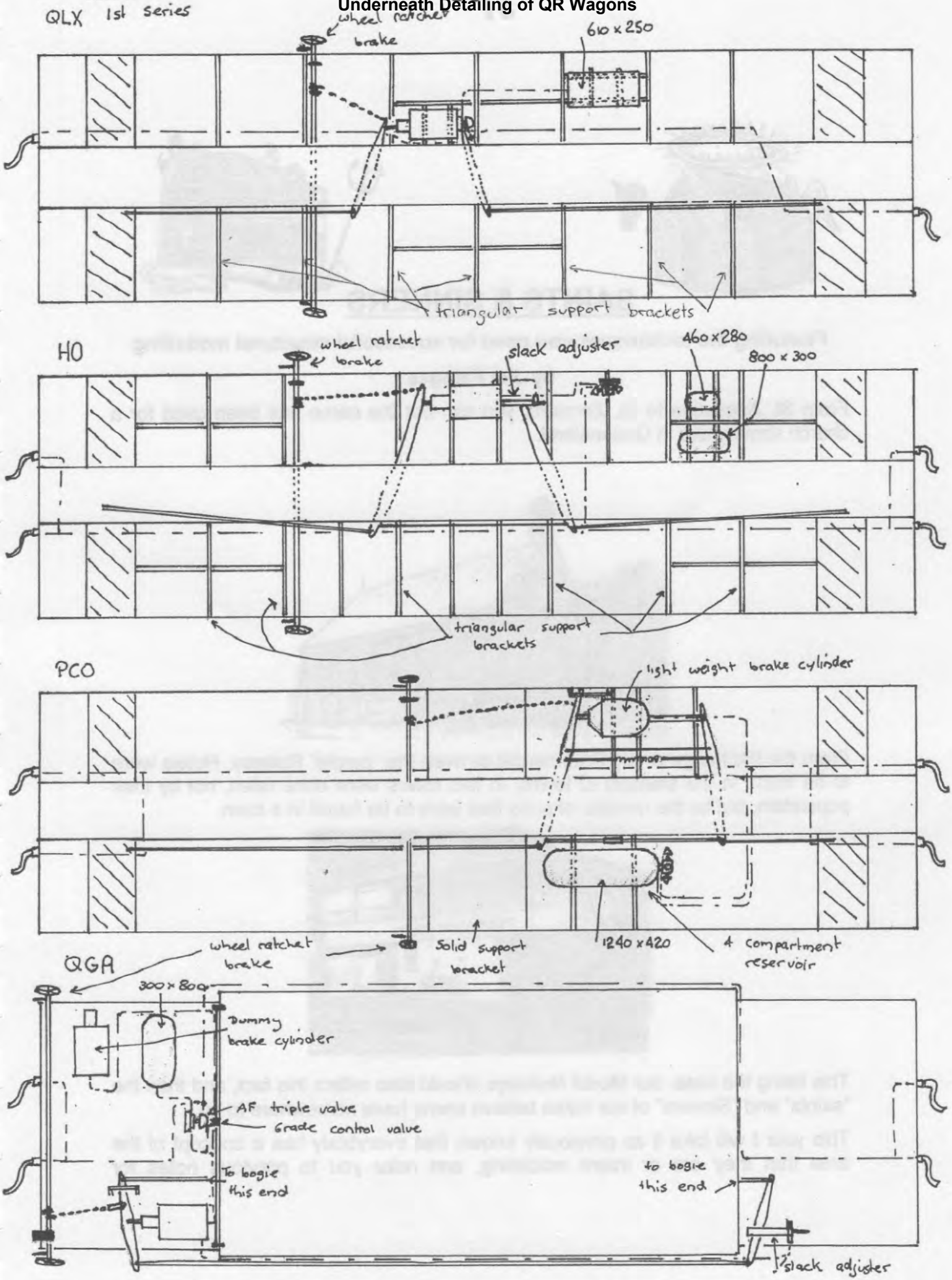


** not to scale **

observed from above



** not to scale **
observed from above