NEW ZEALAND RAILWAYS

ENGINEDRIVERS CORRESPONDENCE COURSE

Ab CLASS STEAM LOCOMOTIVES

LESSON No. 2

SUPERHEATED STEAM

It is proposed in this lesson, to deal with the use of superheaters and superheated steam.

Steam is said to be superheated when its temperature has been raised above that of the water from which it is formed. The term "saturated" is applied to steam when in contact with the water in the boiler, under which conditions its temperature cannot be raised without a corresponding increase of pressure. If additional heat be applied to the steam after it has left contact with the water its temperature may be raised and a constant pressure maintained by allowing for the increase of volume. This larger volume is provided for by placing the superheater between the regulator and engine cylinders, in which case further heating of the steam occurs without an increase in pressure.

The larger production of steam is equivalent to an increase in the size of the boiler. Experimental and practical trials have demonstrated that the volume of saturated steam delivered by the boiler may be increased by 33 per cent, with 200 degrees F. of superheat.

The great reduction of losses from condensation is the most important saving effected by the use of superheated steam. It has been calculated that from 20 to 30 per cent of the steam entering the cylinder in a simple expansion engine may be condensed by the contact with the low exhaust temperature of the cylinder walls. The prevention of this large amount of condensation would therefore again be equal to an increase in the boiler capacity according to the amount of saving effected. By superheating, the temperature of the steam above that of saturation point is available for counteracting the cooling influence of expansion, and condensation does not commence until the superheat has been extracted.

Superheating practice shows the advisability of making the initial steam temperature high enough to ensure that there is still some superheat when it is released from the cylinder.

Owing to the elimination of initial condensation and the increase volume of steam from the water evaporated, it will be understood that superheating provides a substantial saving in coal and water consumption.

LESSON NO. 2

The vapour characteristic of the steam is changed to one of a more gaseous nature, thus improving the expansive action of the steam in the cylinder. It has been found that a given weight of superheated steam will transmit a larger amount of energy than a similar weight of steam at a saturation temperature. The frictional resistance of the steam as it traverses the pipe or port passages is also much reduced when in this gaseous state, with a corresponding decrease in condensation, since the flow is more rapid. Its heat conductivity as compared with saturated steam is also considerably reduced, hence a further reduction in the amount of heat lost by transmission to the cylinder metal.

Briefly, the advantages derived from superheating are:

(1) The temperature is raised above that of the water from which it is obtained as well as increasing the volume of the steam.

(2) Reduction in losses due to cylinder condensation.

(3) More efficient expansive behaviour of the steam in the cylinders.

(4) Reduction of losses and risks due to priming because any moisture that is carried from the boiler is evaporated.

(5) Reduction in the size of the boiler for a given load, or a 20 to 30 per cent reduction in the pressure carried. This results in a decrease in upkeep costs as well as lengthening the life of the boiler.

(6) A saving is effected in fuel and water consumption.

TYPES OF SUPERHEATERS ON N.Z.R. LOCOMOTIVES

Some of our locomotives have been fitted with various makes and types of superheating equipment, such as the "Robinson", "Schmidt" and the "N.Z.R." type, but probably one of the best known and most widely used systems applied to locomotive work is that manufactured by the Superheater Co. Ltd, under the trade mark "Melesco", abbreviated to "M.L.S.".

This takes the form of a header carried in the smokebox, above the level of the top row of tubes, and joined by means of a flange on the front tubeplate to the main steam pipe from the boiler. Flanges on the front of the header connect up to the main pipes leading to the steam chests. The header is divided into a series of small compartments. Half of these receive the steam as it enters the header from the main steam pipe from the boiler, and give access to the superheater elements which lead from the underside of the header into the superheater flue tubes in the boiler. The superheater elements are usually formed in such a way that the saturated steam to be superheated is fed first towards the firebox end of the flue. It is returned by a bend to within a short distance of the front end of the flue and then returns to a second bend at the firebox end. It then passes along the fourth portion of the element piping to rejoin the underside of the header and enters the remaining half of the compartments, which communicate by way of the main steam pipes in the smokebox to the valves and cylinders. During its passage from the first, or saturated steam compartments, through the elements to the second, or superheated steam compartments, the steam has been entirely freed of moisture, whilst the temperature has been raised or, in other words, it has become superheated.

The superheater element consists of a continuous pipe formed of four lengths of solid, cold-drawn, weldless steel tubing connected by three return bends. The inlet and outlet ends of each element are bent upward, to allow of them being clamped to the bottom face of the header in such a manner that the inlet end communicates with a saturated steam compartment and the outlet end with a superheated steam compartment.

The ends of the elements nearest the firebox, known as the return bends, are the parts which require the most careful attention in manufacture. They must withstand high temperatures, and they are also exposed to erosion from the matter carried over by the high temperature gases in their passage through the flue tubes. Deposits are formed and the return bends are liable to be burned.

To protect the return bends of the elements, the thickness of the metal is increased at the bend so that it is in fact stronger than the straight tube.

In order to hold the lengths of each element together tightly, to prevent leaky joints due to vibration, and to keep the element in its proper position in the flue tube, simple bands and supports are secured to the elements - usually two for each, near the extremities of the flues.

The path of the steam from boiler to atmosphere may now be summarised. Steam is formed in the boiler, collects in the dome and passes through the regulator valve to the internal pipe and saturated steam compartments of the header. It then passes through the superheater elements and back to the superheated steam compartments of the header and through the steam pipes to the valve chests. It then passes to the cylinders as live steam and back through the valve chests as exhaust steam to the blast pipe and up through the funnel to atmosphere.

The amount of superheat obtainable is directly dependent upon the temperature of the flue gases, so that any defect or leakage whereby an excessive amount of air is permitted to enter the smokebox or firebox will be detrimental to the efficiency of the engine. It is therefore essential that the Fireman, after cleaning out the smokebox, should see that the door is securely tightened. For similar reasons, the firehole door should not be opened unless absolutely necessary, otherwise the rush of cold air through the tubes will result in a sudden and considerable reduction in the amount of superheat obtained. This also applies to the firegate, since a fire that is too thin will allow of the admission of too much air, more especially if the bars are bare in places. It is a well known fact that bare places are formed when coal is fired in large lumps since the smaller pieces surrounding the lumps are rapidly burned away. This admits an excessive amount of cold air. So it is necessary to break the coal into pieces not larger than the size of a man's fist and maintain a concave shaped fire, particularly at the back corners of the firebox and against the firebox plates.

This even form of fire, however, cannot be maintained if the coal is fired in large quantities, hence the necessity for firing light and often. This is all the more necessary by reason of the amount of heat absorbed when a heavy charge of coal is newly fired, as it causes a heavy discharge of smoke, which together with the total amount of heat required for the evaporation of the moisture in the coal, will result in a considerable fall of the firebox temperature. In addition it further reduces the efficiency of the locomotive by reason of the soot or unconsumed particles of carbon fouling the superheater tubes.

The superheat will be detrimentally effected, if the water is carried too high in the boiler, thus causing wasteful priming and partial flooding of the superheater. When this occurs a sudden drop of temperature will be the result. This necessitates the immediate closing of the regulator, and the opening of the cylinder cocks. The regulator should then be opened gradually to prevent any further lifting of the water.

Although the Enginedriver must of necessity be guided by the gradients and the load on his engine, it will usually be found that the most economical results will be obtained with the regulator fully opened and the reversing lever notched up to about 25 per cent cut-off. If, however, pounding in the rods, boxes, or journals should occur with this percentage of cut-off, a longer period of cut-off may be used with the regulator eased down.

With heavy loads, or up a stiff bank, the best results would undoubtedly be obtained with the regulator fully

LESSON NO. 2

open and the reversing lever notched up to the point that is consistent with running the train to time. When it is necessary to stop at signals or stations, the reversing lever should be put slowly over to full forward gear immediately after closing the regulator. This gives the piston valves a maximum amount of travel which ensures that the highly heated metals of the valves and faces will not seize up while at the same time, preventing ashes from being sucked down the blast pipe from the smokebox.

THE DRIFTING VALVE

Primarily, the purpose of the drifting valve is to supply saturated steam to the valves and cylinders to maintain the temperature created by the intense heat from superheated steam. This prevents the carbonisation of the lubricant and also assists in its distribution when drifting, as well as providing for a gradual cooling down process of the cylinder metals during long drifting periods. When steaming, the drifting valve should be opened "off its face" to prevent the accumulation of condensation in the drifting valve steam pipes. However, when the regulator is shut off and the engine is drifting, in order to maintain the temperature by excluding the admission of air in a cold state, the drifter should be opened sufficiently to do so. It may be necessary to open the drifter up to a full turn to do this depending on the speed being run and the size of the locomotive.

OPERATION OF THE SUPERHEATED LOCOMOTIVE : GENERAL INFORMATION

It is now an accepted fact that the efficiency of superheated steam increases with its temperature; hence the importance of a full appreciation of the different conditions which may lead to a loss of temperature with consequent inefficient results.

In order, therefore, to minimise these heat losses, the driver should see that the locomotive cylinders are thoroughly warmed through before leaving the shed. The reversing lever should be placed in full forward or full backward gear, with the cylinder drain cocks opened, and a small amount of steam being admitted through the regulator.

This procedure ensures that the temperature of the cylinder metal will be raised to approximately that of the steam with which it is brought into contact. This greatly reduces initial condensation losses and allows the full economical effect of the superheater to be brought into immediate use.

LESSON NO. 2

The cylinder relief cocks should remain open after starting until all sign of moisture has disappeared.

In addition to raising the temperature of the cylinder metal, "blowing through" in this manner when first starting up will ensure the removal of dirty deposits in the steam-chests or the carbonised remains of lubricant that may be adhering to the wearing surfaces of the piston valve faces and cylinder walls.

Since the lubricating quality of the steam decreases with the amount of superheat attained, it will be obvious that proper attention to the arrangements provided for lubrication prior to the commencement of a journey is of vital importance.

The general operation of the superheated locomotive is the same as that of the saturated steam locomotive, but the following information should assist the Enginedriver to work the superheated locomotive to the best advantage:

Cylinder relief cocks should be left open to drain the cylinders while standing and be kept open until dry steam appears when starting. The reverse lever should also be in full gear to ensure adequate oil distribution throughout the length of the valve and cylinder chambers.

When water is carried over into the superheater, closing the regulator does not stop the supply of steam until all the water in the superheater has been evaporated. Care is necessary, therefore, in handling the locomotive when shunting etc., to avoid damage to the locomotive and rolling stock by a too violent impact.

Water can be carried through the elements just as readily as steam, but water cannot be superheated. Much, possibly all, of the water carried over will be evaporated in its passage through the elements. If, however, the superheater is used to evaporate water it becomes an auxiliary part of the boiler, so it cannot at the same time perform its intended function, that of superheating steam.

To obtain the best results from the superheated locomotive, the water should be carried at the minimum height demanded by the ruling conditions. Half a glass is better than three parts and less than half a glass is still better if conditions will permit.

Firing should be regular and light enough to ensure the maximum temperature and as nearly perfect combustion as possible in the firebox. Heavy firing reduces the firebox temperature and consequently the temperature of the superheated steam, thus more coal is used wastefully, the Fireman has to work harder, and the locomotive is rendered less efficient.

ECONOMY of the superheated steam comes from superheating the steam highly and is proportional to the degree of superheat obtained. More coal is saved with 250 degrees of superheat than with 200 degrees or less. Less coal and water is used for the tonnage handled, and Enginedrivers and Firemen have a much easier time in completing the run.

Locomotives which do not steam freely, and do not show a normal saving of 18 per cent fuel economy over saturated locomotives in the same service and with the same load, should be examined for dirty flues and the elements booked for testing. It should be remembered that the heat which is added to the steam in order to superheat it , is absorbed through the superheater elements from the hot gases as they pass through the large flues. Consequently, if one of the superheater flues is blocked with ashes, that particular group of elements is cut off from receiving hot gases and thus materially reduces the capacity of the superheater. One flue tube completely blocked in a 25 element heater is estimated to reduce the superheating surface by 4 percent. The effect, therefore, of several flues becoming blocked would quickly show in a falling off in the performance of the locomotive.

LUBRICATION OF VALVES AND CYLINDERS ON SUPERHEATED LOCOMOTIVES

Since the lubricating qualities of the steam decreases with the degree of superheat attained, it will be obvious that proper attention to lubrication is of vital importance. Saturated steam, being at a lower temperature, and of a more vaporous nature, is a superior agent for distributing the lubricant in the valve chests and cylinders than is superheated steam. The higher temperature of superheated steam making it drier and more gaseous reduces this quality and makes it a relatively poor distributing agent. Hence the necessity of introducing a high grade mineral oil with a high flash point to ensure efficient lubrication of superheated locomotives. While the locomotive is working steadily on long runs, the temperature of the cylinder walls and valve face metals may be well in excess of 600 degrees fahrenheit, which is above the flash point of the oil. It is evident that scoring of the valve bushes and cylinders will occur if regular and sufficient oil is not supplied.

When the regulator is closed and the locomotive is drifting, the admission of cold air into the valve chests and cylinders while they are highly heated will cause the oil to carbonise and burn thus clogging valve rings and ports. Hence the necessity of introducing the use of the drifting valve steam as already explained.

Seeing that piston ring friction is always present when running, the lubrication of the valves and pistons must be continuous either with steam pressure in the cylinder or with steam shut off.

LESSON NO. 2

Approximately the same amount of oil must be fed to the steam chests as to the cylinders, and the quantity fed should be similar to that required by a saturated locomotive.

The proper use of the drifting valve together with the correct quantity of lubricant will provide efficient lubrication and maintain the valves and pistons in good condition. Frequent observation of valve spindles, piston rods, snifters and cylinder cocks will give an indication of the condition inside the valve chests and cylinders. If these parts are dry and free from oil obviously the supply is inadequate. On the other hand, if a film of oil is visible on these parts and the oil is dripping from the cylinder cocks, then too much is being supplied. The ideal condition is to have a light film of oil on these parts; oil dampness at the snifters and cylinder cocks is the best indication of good conditions, and if the young Engine-driver makes a habit of observing the foregoing, experience will soon enable him to confidently and correctly regulate the oil supply.

DETROIT HYDROSTATIC LUBRICATOR

The lubricator used on the N.Z.R. for lubricating the cylinders and valve chests is the "Detroit" Sight Feed Lubricator, which works on the principle that water will displace oil from a chamber in which they are present together. In the "Detroit" lubricator there are two connections one for steam and a separate one for oil. The force which operates this form of lubricator is the weight of a column of water, condensed from the steam led in from the boiler, which displaces a lighter column of oil. The pressure of the steam exerts little effect since it is almost balanced, for there is nearly the same pressure on the top of the column of water as there is at the oil outlet. The pressure inside the oil reservoir is equal to the boiler pressure plus the weight of a column of water in the condenser whilst the sightfeed chambers and oil pipes are under boiler pressure only. The water from the condenser, therefore, under the pressure due to a constant head, enters the oil reservoir and displaces the oil drop by forcing it through the sight-feed passages, which in the "Detroit" lubricator are contained inside the lubricator casing.

These sight-feed passages are capable on inspection from outside by means of "bull's eye" inspection glasses, which are designed to obviate the possibility of breakage and consequent danger to the driver and at the same time to reflect the maximum amount of light into the sight-feed passages. For efficient working the inlets to the steam chest and the cylinder are fitted with a "choke".

LESSON NO. 2

The areas of the steam supply and equalising tubes of the lubricator require this "choke" to be of a certain diameter to maintain a balance. The lubricator then feeds against a constant boiler pressure in the oil pipes and not against a pressure that fluctuates with the pressure in the steam chest. This choke consists of a small steel plug having small holes through it. The choke performs the function of atomising the oil thus allowing it to be supplied to the steam chests in the form of a spray. The inlet to the main steam pipe just above the steam chest also has a further atomiser in the steam pipe itself. The end of the oil pipe inside the steam pipe is made in the form of a spoon, which has a number of narrow longitudinal slots in it, and the oil is blown through these by the current of steam. By atomising the oil a smaller quantity may be used than when the oil is delivered through an open-ended tube.

LESSON NO. 2

Principle Of Operation DETROIT HYDROSTATIC LUBRICATOR

The principle is illustrated in fig 1.

Steam at full boiler pressure enters the lubricator at A and condenses. The water resulting from this condensation fills the condenser to point C. The condenser is connected to the reservoir by means of water passage B. When the water valve G is open, water enters the reservoir and fills all spaces not occupied by the oil, and because of its lower specific gravity the oil floats on the water. The weight of the column of water measured between points C and E is exerted upon the oil in the reservoir and forces it, in the manner indicated by the arrows, down the oil passage J, through the regulating valve F, and drop by drop into the sight feed chamber. The latter is kept filled with water through the condensation of steam entering from the equalising passage D. The drops of oil float on top of the water at I, and are carried by the circulation of steam from equalising passage D into the oil-delivery pipe and thence to the point of lubrication.

An important factor to be noted is that the boiler pressure has no effect on the operation of the lubricator, because by virtue of the equalising passage D there is the same steam pressure at both ends of the lubricator - that is, at A and I. The only pressure exerted on the oil to provide the féed is that obtained from the column of water as measured from C to E.

Refer now to fig 2, which shows another sectional view of a common three-feed lubricator.

A constant water level is maintained at C, the rate of condensation being more than sufficient to replace the water that enters the reservoir through the passage B to displace the oil fed by the lubricator. Excess condensation overflows at point C and is carried away through the equalising passage D. The water flowing through the passage B is controlled by the water valve G and is carried to the lowest part of the reservoir, thus floating the oil. The oil is then forced through passage J and the control valve Q by the hydrostatic pressure previously explained. After passing the oil-control valve, the oil is carried to the bottom of the passage J, where the rate of feed is controlled by the adjustment of the feed valve F. After leaving the nozzle, the drops of oil float up through the water in the sight feed chamber. When the oil reaches point I it is picked up by the steam coming down through the equalising passage D, which carries it out of the lubricator into the oil pipe and thence to the steam-chest plugs located at the cylinders, steam chest, or steam pipes, dependent on the type of lubricator fitted. It should be noted that four feed lubricators are installed on Ab class locomotives, and staff should note the parts fed by each feed valve. As a rule the point to which each feed valve is connected is stamped on the brass plate surrounding the valve connection to the lubricator, i.e. "LH cylinder" "RH cylinder etc."

The full boiler pressure is maintained through the equalising passage D and in the oil pipes to the steam chest plugs, which are provided with a choke having a hole of small diameter. There is thus a constant circulation of steam through the oil pipes towards the valves and cylinders that carries the oil along, ensuring constant lubrication. It is important that this arrangement should be clearly understood, for it is by this means that the same quantity of oil as is being fed through the sight feed nozzle reaches the point of lubrication.

Bullseye glasses serve to show the formation and feeding of the oil drops. The vent stem T is provided to blow out and clean the passage J, while the drain valve U enables the entire body of the lubricator to be blown out and all dirt and sediment removed.

The air space or expansion chamber will be noted at V.

Description of Parts

(a) Oil Control Valve. This valve (Q in fig 2) is located in the oil passage between the reservoir and the sight feed regulating valves, and provides the means of instantly starting, stopping or throttling the rate of feed. It does away with the necessity of shutting off the feed-regulating valves at a terminal or while refilling on the road and consequently with the readjustment of these valves after refilling. Once the regulating valves have been set, the control of the feeds by means of the control valve ensures the correct amount of lubrication at all times.

This valve has a lever handle and index plate and is so designed that from the "closed" position a half turn to the "all open" position will open all feeds. Staff should ensure that the "closed" and "all open" positions are clearly marked on the index plate.

When standing at a station or siding, the control valve should be placed in "closed" position.

(b) Expansion Chamber. This chamber is shown at point V in figs 2 and 3. Oil heated to the temperature of steam at 1380 Kpa will expand about one-fifth in volume. While, in ordinary circumstances, the oil in the reservoir is never heated to this degree, nevertheless, when the lubricator is not in operation considerable expansion will take place, and unless provision is made for this the reservoir will be subjected to excessive pressure.

(c) The Filler Plug (R) it will be noted, is screwed into a removable seat and not into the body of the lubricator itself, so that all thread wear takes place on a small part that is readily replaceable.

(c) Water check Valve. The brass ball check at the bottom of the water passage - fig 2 - is an emergency feature designed to prevent syphoning or equalisation of pressure through the water passage if the operator has failed to shut off the water valve before cutting off the boiler pressure from the condenser. It should be regarded as a safeguard only, and is not intended to relieve the operator from the responsibility of always closing the water valve before shutting the steam valve.

Filling

To fill or refill the lubricator, move the oil control valve Q to closed position, close the water valve G and the steam valve H. Open the drain valve U, and loosen the filling plug R. When the lubricator is emptied of water, a little oil will come away through the drain valve, and the lubricator is then ready for filling. Close the drain valve, remove the filling plug, and fill with clean oil. Replace the plug and tighten.

If the lubricator is under pressure, proceed as before but remove the filling plug slowly to allow the pressure above the oil to escape and the air to enter. Fill the reservoir. If there is not sufficient oil for this purpose, use water to make up the required quantity. This method will expel the air and enable the feeds to start without exhausting the water from the condenser or materially lowering its level.

In cold weather it may be found necessary to heat the oil so that it will pour freely.

Be careful, when a change is made in the brands of oil used, to clean the lubricator thoroughly and drain it of all oil before using the new brand, otherwise substances held in suspension may be deposited when the oils are mixed and the deposit may cause blockages in the delivery pipes and chokes.

The steam valve on the boiler and the steam valve on top of the condenser must be left wide open all the time the locomotive is in service.

Starting

Always start the lubricator about 15 minutes before leaving the depot. Be sure that the steam valve on the boiler is wide open then open as wide as possible the steam valve at the top of the condenser and keep it wide open all the time that the lubricator is in operation. Allow sufficient time for the condenser and sight feed chambers to fill with water, then open the water valve. Three turns will give full port opening. Move the oil control valve to "all open" position. In adjusting the feeds after the oil-control valve has been opened regulate the cylinder and valve feeds with the respective feed valves located at the bottom of the lubricator. After these valves have been adjusted, they must not be used further for the ordinary operation of the lubricator. The oil control valve is employed to shut off all of them. The individual feeds should be adjusted for the maximum amount of oil required during the hardest part of the run. This is a fixed adjustment and need not be changed.

LESSON NO. 2

Shutting Off the Lubricator

To shut down the lubricator for short stops, close the oil control valve only.

For terminal stops or when closing the lubricator when putting the locomotive away, close the oil-control valve first, then the water valve and lastly the steam valve on the lubricator. It should be noted that the steam valve on the boiler should be left open at all times unless it is defective.

When putting away a locomotive the water valve and oil-control valve should be turned off about 15 minutes before turning off the steam valve as this practice allows the steam to carry off the oil in the feed pipes and prevents the oil carried back by the superheated steam from being deposited on the sight feed glasses and nozzle tips.

Variations in the Rate of Feed

(a) Erratic action in the rate of feed may be due to the lack of condensation through shortage of steam, either as a result of throttling the steam valves or the steam supply being decreased in meeting the requirements of other auxiliaries. This can be overcome only by ensuring that the boiler and lubricator steam valves are fully open while the lubricator is in operation.

(b) Impurities carried into the condenser from the boiler will gradually accumulate at the base of the water valve, and by decreasing the size of the water passage will decrease the amount of water admitted to the oil reservoir, thus displacing a smaller quantity of oil and reducing the rate of feed. To rectify this, close the oil-control valve and water valve. Open the drain valve, and allow about ½ pint of water to drain off. The condenser pressure will force the sediment down to the bottom of the lubricator, where it should be allowed to remain until the lubricator has been emptied of oil, when it can then be blown out in the usual manner. If the sediment is permitted to remain in the water passage for too long it may solidify there, in which case difficulty will be experienced in removing it; the usual practice in such cases is to book the lubricator for cleaning, and the obstruction will either be bored out or removed with a wire.

(c) Any deposit or sediment collecting in the oil passages or around the feed valves or nozzles will throttle the flow of oil and decrease the rate of feed. If the feeds do not respond properly close all feed stems then the water valve and lastly the steam valve. Open the steam valve slightly, and then one feed valve. Air and water will probably appear, followed by a solid stream of oil, thus removing any obstruction that may be in the feed nozzle. Close the feed valve and repeat the operation for the remaining feeds, then restart the lubricator as previously described. This operation does away with the necessity of draining the lubricator to clean the obstructed feeds.

(d) When a locomotive is being prepared during cold weather it occassionally happens that the oil immediately beneath each feed nozzle has become congealed to such a degree that it will not feed. To overcome this, close all feeds and open all the vents to the sight feed chambers located on the face of the lubricator. This will allow steam to heat up the feed nozzles and the congealed oil beneath each one. Close all vents, and, as soon as the space within the sight-feed chambers is filled with condensate, start all feeds.

Obstructed Feed Nozzles

Open and close quickly the vent of the sight feed chamber of the obstructed feed nozzle. If the oil will not flow, open the vent wide so that all the oil will be exhausted; the escaping steam lessens the steam pressure within the particular sight feed chamber which is equivalent to adding additional force to the hydrostatic pressure and is usually sufficient to force out the obstruction.

If this fails, close the regulating stems to the feeds which are working and also the water valve (which confines boiler pressure within the oil reservoir) then gradually throttle the steam valve to a point where the boiler pressure, confined within the oil reservoir, becomes sufficient to force the obstruction from the nozzle tip.

If the above methods are unsuccessful close the oil control valve and remove the centrepiece of the affected feed; insert a wire in the feed nozzle in order to raise the ball check, and this will allow steam pressure to force the obstruction downward and outside to atmosphere. Replace the centrepiece, open the oil-control valve, and reset the affected feed.

Cleaning

In order to obtain good performances, it is necessary to clean out all dirt and foreign matter from the lubricator at regular intervals. When a lubricator has emptied it is in good condition for cleaning out with hot water and hydrostatic pressure the oil passages, control valve ports, sight-feed chamber and feed nozzles.

Leave the lubricator set in the same manner as it was when the oil ceased feeding and open all vent stems. This will decrease the pressure within the sight-feed chambers and at the same time allow the hot water to flow from the feed nozzle tips to the atmosphere. Close all the regulating stems the moment water ceases to flow from the feed nozzles, as this is an indication that the water in the condenser is exhausted. Then blow out the oil reservoir through the oil-drain valve, close all valves, refill, and put the lubricator into operation. The lubricators on superheated locomotives should be blown out at least once each week.

LESSON NO. 2

If air or water has accumulated in the oil passage beneath the feed nozzles, it can be expelled by momentarily racing the end feeds to start the circulation.

If a feed refuses to respond promptly, tap the bottom of the feed handle lightly.

In cleaning, it is sometimes accepted that blowing out the oil reservoir through the drain valves and the sight feed chambers through the vents is all that is required.

It should be remembered however, that this practice does not clean out the oil feed chamber unless carried out with water or by removing all the feed centrepieces and blowing out with steam.

A small piece of soap inserted in the reservoir about once each week will assist in keeping the walls, passages, and glasses reasonably clean if, after the oil has been fed out, the feed is allowed to continue so that the soapy water will be forced through into the sight feed chambers. After using soap, blow out the lubricator with steam.

ENGINEDRIVERS CORRESPONDENCE COURSE

Ab CLASS STEAM LOCOMOTIVES

LESSON NO.2 LIST OF QUESTIONS

1. What is your understanding of the advantages to be gained by using superheated steam?

2. Describe the superheater header and explain how the steam is superheated.

3. Trace the passage of the steam from the boiler to the atmosphere on the Ab class locomotive with the regulator located in the steam dome.

4. Explain the purpose of the drifting valve and how it should be operated.

5. What effect does superheated steam have on valve and cylinder lubrication and how would you know when a locomotive is getting too much, too little or sufficient lubrication?

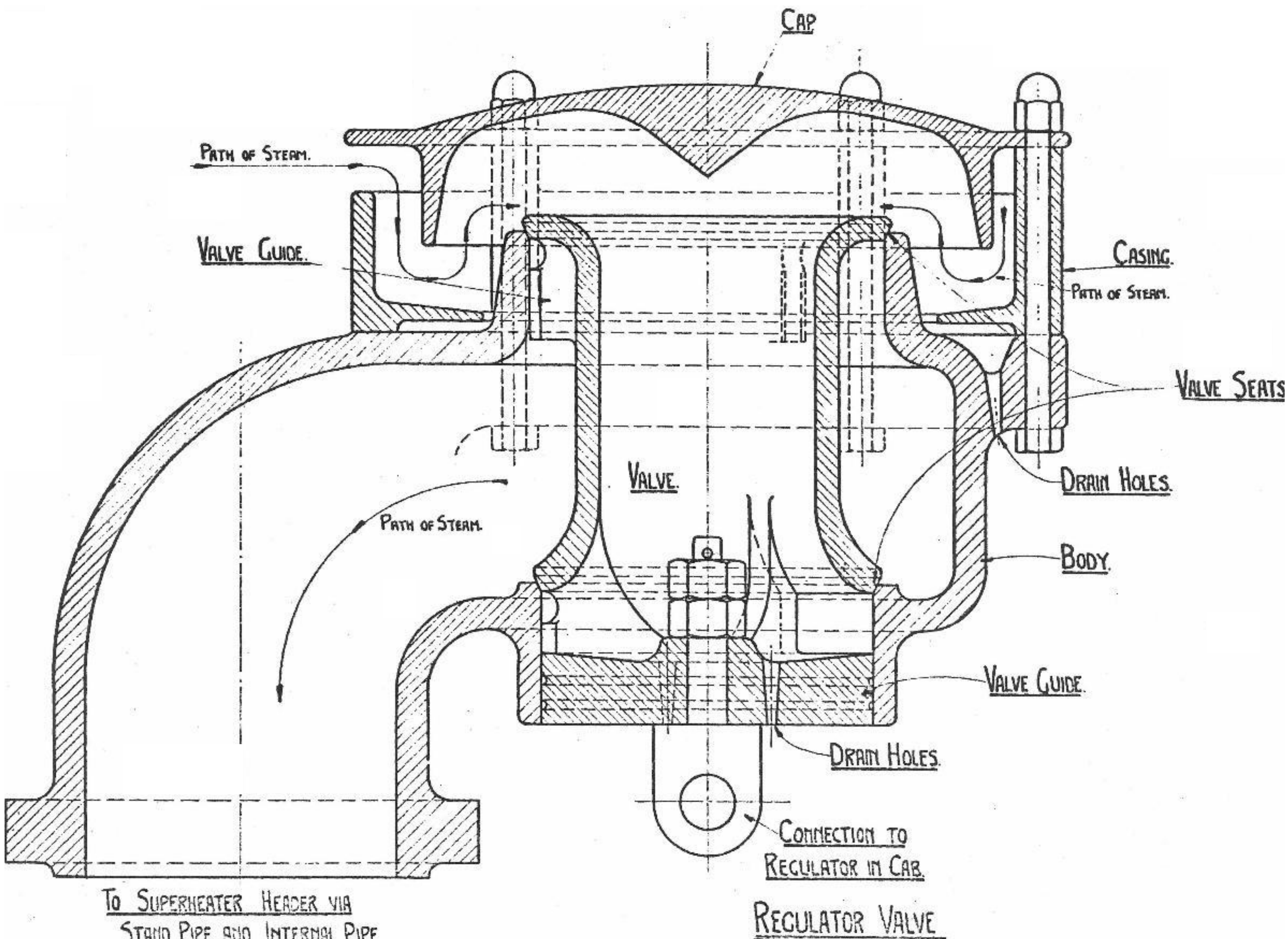
6. Explain how a Detroit lubricator works. In doing so, state the procedure when filling, use of the oil control valve and shutting off the lubricator at the finish of a run. (Pages10 - 15 Lesson No. 2)

7. Where are choke plugs placed and why?

8. How would you clear an obstructed feed nozzle in a Detroit Lubricator?

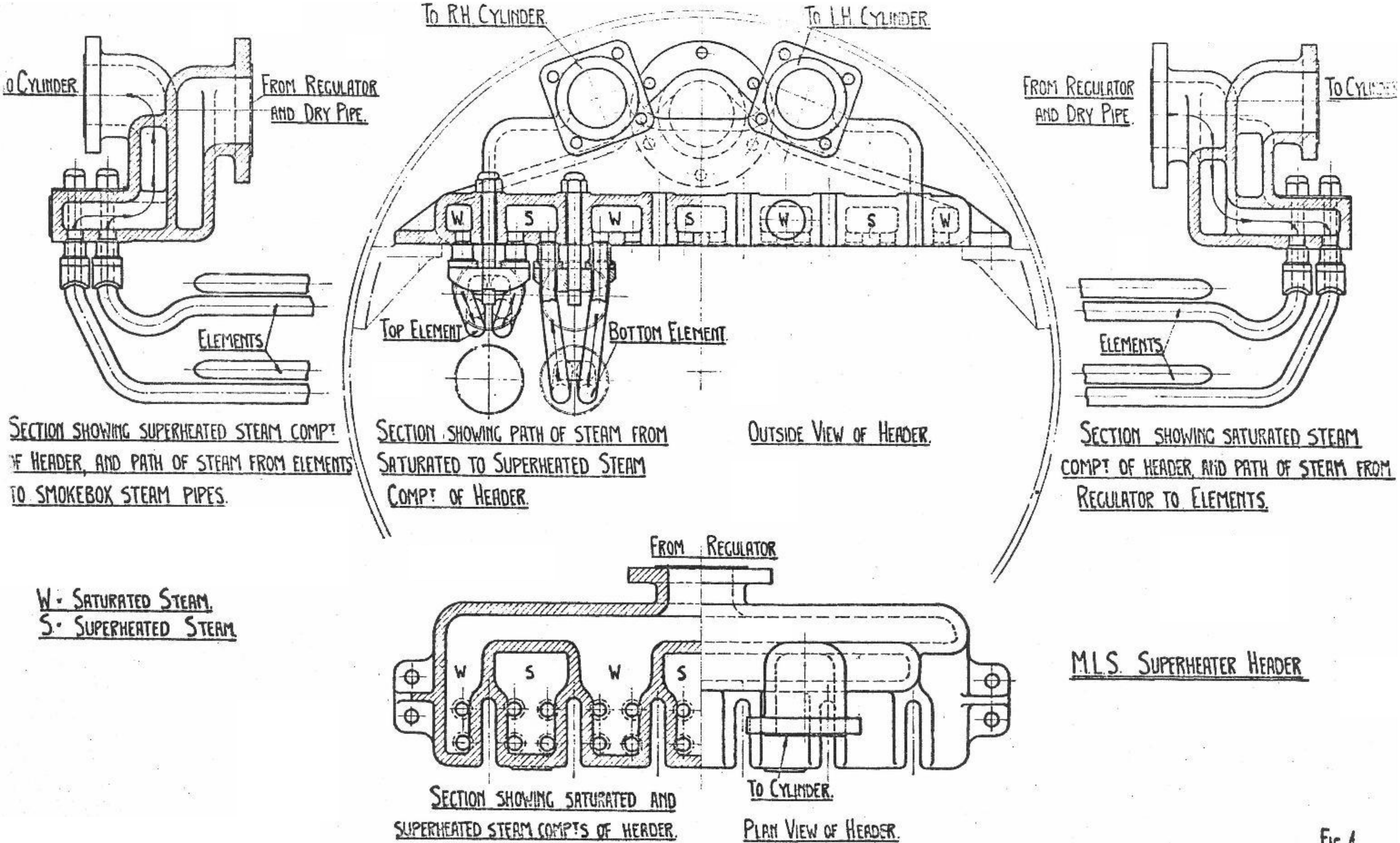
9. Explain the procedure to be adopted before leaving the depot, and subsequently when running a train, to obtain the most efficient results from a superheated locomotive (lesson No. 2).

10. What will cause variations in the rate of feed of a Detroit Hydrostatic Lubricator?



REGULATOR VALVE

FIG. 3.



M.L.S. Superheater Header

Fig. 4.

DETROIT HYDROSTATIC LUBRICATOR

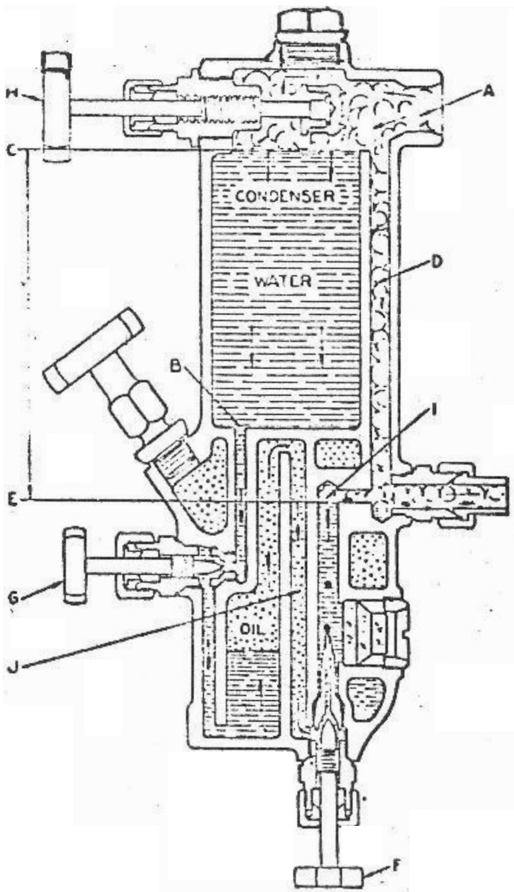


FIG. 1.

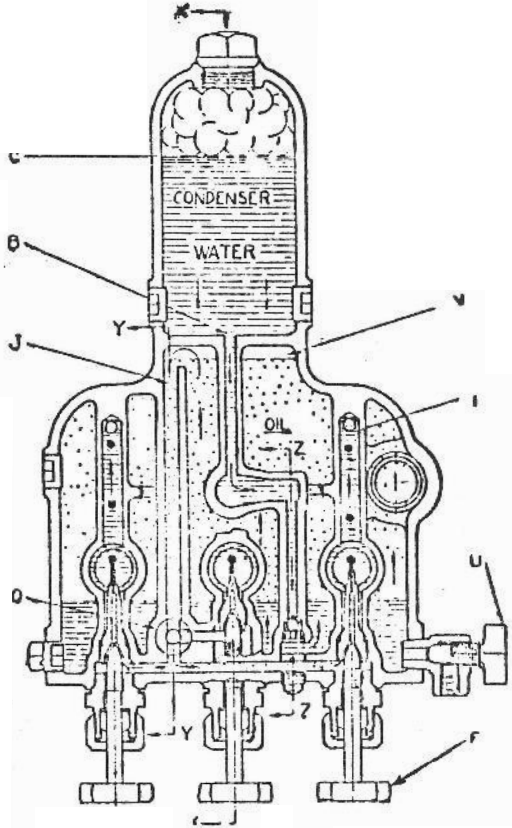


FIG. 2.

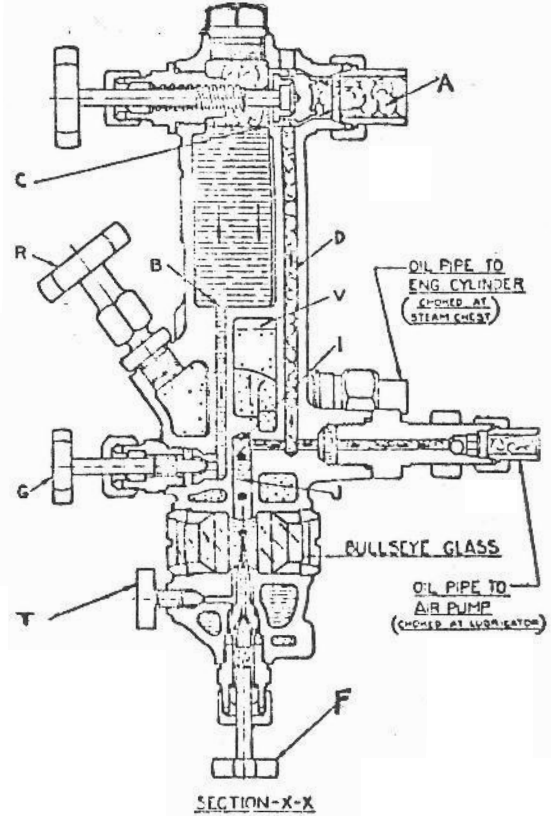
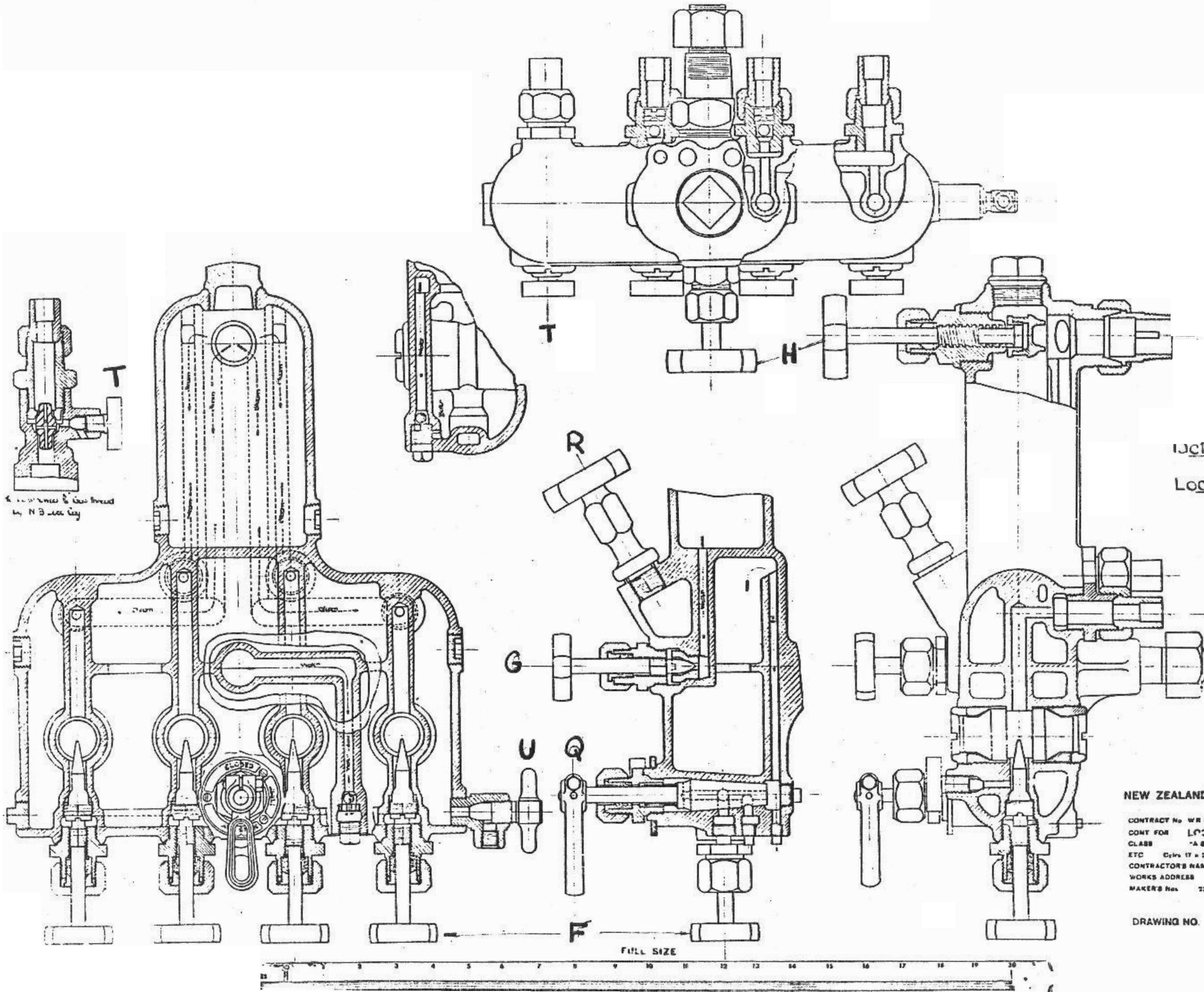


FIG. 3.



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