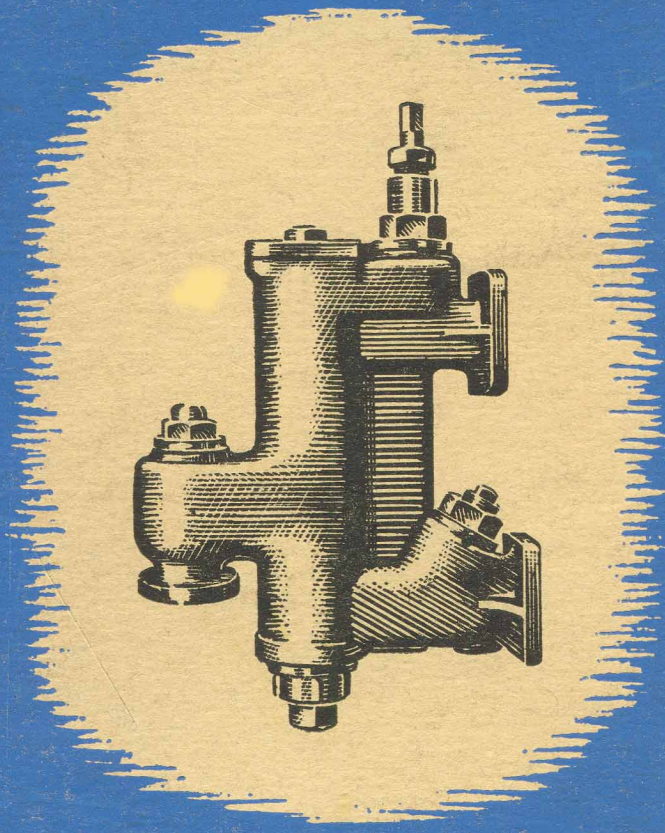
MONITOR TYPE LOCOMOTIVE

LIVE STEAM INJECTOR



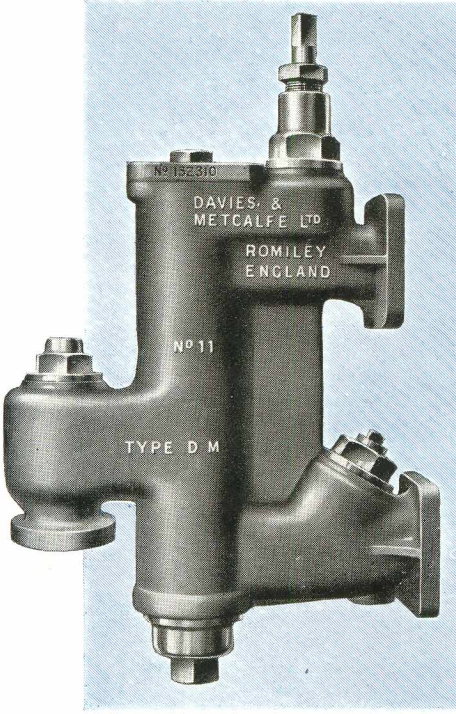
DAVIES & METCALFE LTD
INJECTOR WORKS ROMILEY

METCALFE'S

MONITOR LOCOMOTIVE

LIVE STEAM

INJECTORS *(TYPE "M")*



Simplicity of Operation

Reliability in Service

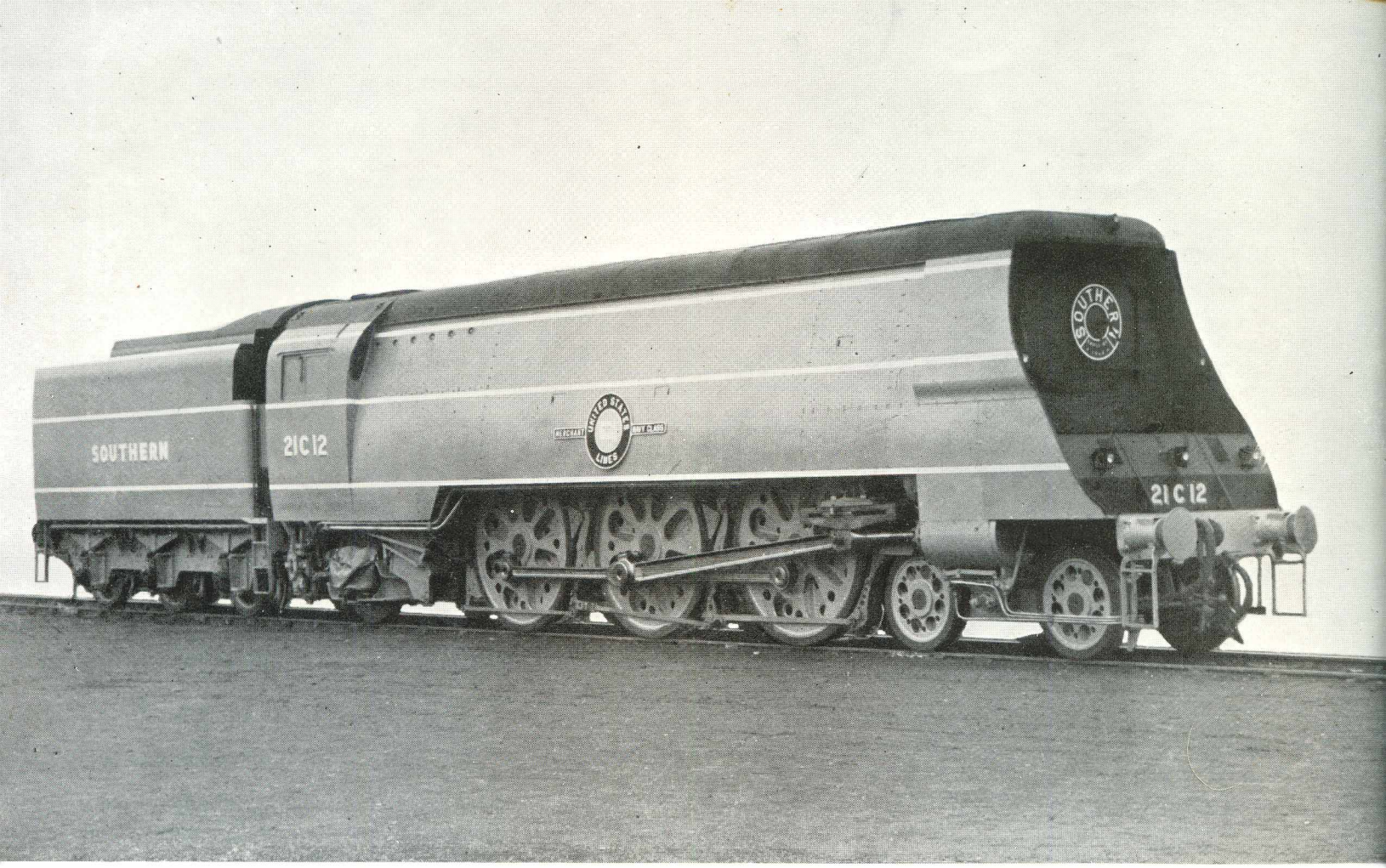
Low Maintenance Costs

METCALFE'S PATENT

DAVIES & METCALFE LTD

INJECTOR WORKS, ROMILEY

Near MANCHESTER ENGLAND *Tel. WOOdley* 2219



Merchant Navy, West Country and Battle of Britain Class Locomotives of the Southern Railway

are fitted with two No. 11 Monitor Injectors, both on the Fireman's side,

and Metcalfe Vacuum Brake Ejectors.

4 – 6 – 2 Engine. Working Pressure 280 lb. per sq. in.

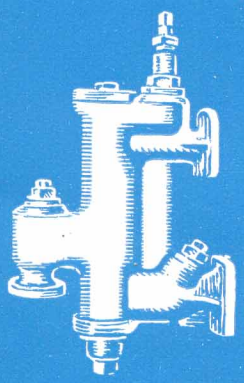
By kind permission of O. V. Bulleid, Esq., C.M.E., Southern Railway.

THE DAVIES & METCALFE MONITOR INJECTOR

Modern locomotive operating conditions demand a design of Injector giving the utmost reliability combined with simplicity of design and consequent freedom from heavy maintenance. The Davies & Metcalfe "Monitor" type Live Steam Injector fulfils these conditions.

This type of Injector has been adopted as a standard for many years, giving the most excellent results and showing a marked improvement over all other types of Injectors in reliability and maintenance costs. It is eminently suitable for use in conjunction with the high boiler pressures found in modern locomotive practice.

In the following pages, a few of the applications of this Injector are illustrated and described, but the system of Cones is such that the Injector can be designed to replace any existing type of Injector, or if necessary the Monitor type Cones can be supplied to fit into existing Injector Bodies.



The system of Cones is shown on Fig. 1 (page 4) and consists of a twin jet Steam Cone, together with a gap type Combining Cone, embodying a patent Delivery Cone Renewable End, thus eliminating all moving parts in the Cone system.

TYPE "M" CONE SYSTEM

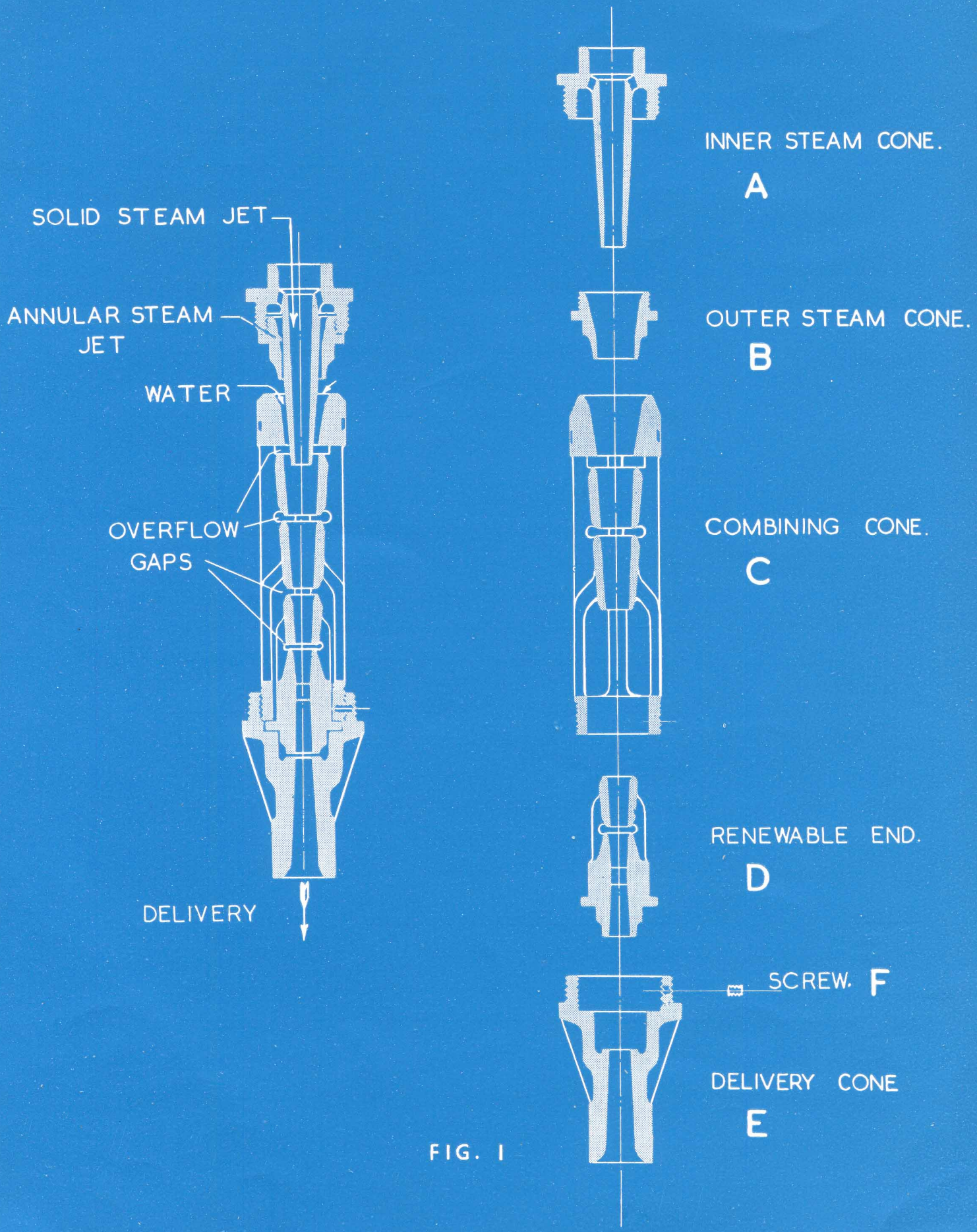


FIG. 1

TYPE "*M*" CONE SYSTEM

STEAM CONE This unit is made up of two pieces :—
The Inner Steam Cone (A)
The Outer Steam Cone (B)
which are screwed together to form one unit.

INNER STEAM CONE (A) is screwed into the Injector body and its bore admits the secondary or forcing jet of steam.

OUTER STEAM CONE (B) is a sleeve shaped cone which screws on to the Inner Cone forming an annular passage between the two cones. The steam admitted through this annular passage is known as the primary or annular steam jet.

COMBINING CONE (C) is of the usual converging shape with slots or gaps in its length. These slots are in the wall of the Cone and give access from the Cone itself into the Injector Overflow Chamber. When starting up, the mixture of steam and water entering the Combining Cone escapes freely through these slots into the Overflow Chamber, and so into the Overflow Pipe, until the jet is established and the Injector commences to work, when the fast moving jet of steam and water jumps these gaps without waste. It will thus be seen that with the Monitor system of Cones there are **no moving parts** to the Combining Cone. Starting is therefore **positive** and **certain.**

DELIVERY CONE RENEWABLE END (D) is a patented feature which greatly reduces maintenance costs. It consists of a small unit which forms the small ends of both the Combining and Delivery Cones together with the Overflow Gap between these Cones.

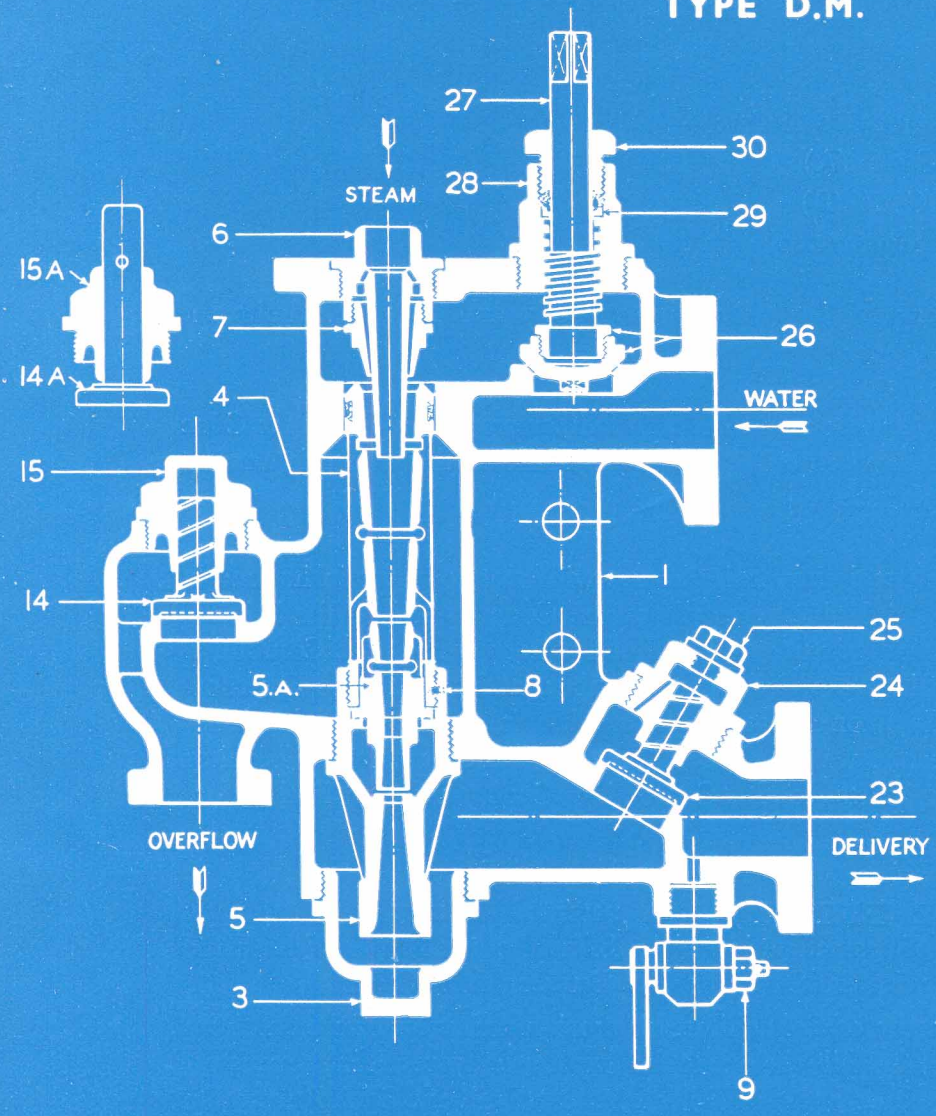
It is a well-known fact that the usual cause of Cone failures is erosion and wear of the end bore of the Combining and Delivery Cones, and any failures, due to this wear, usually result in the renewal of the Delivery Cone, or Combining Cone or both. With the patent Delivery Cone Renewable End, the replacement of this small part restores both the Combining and Delivery Cones to their original condition at this point for a very small cost.

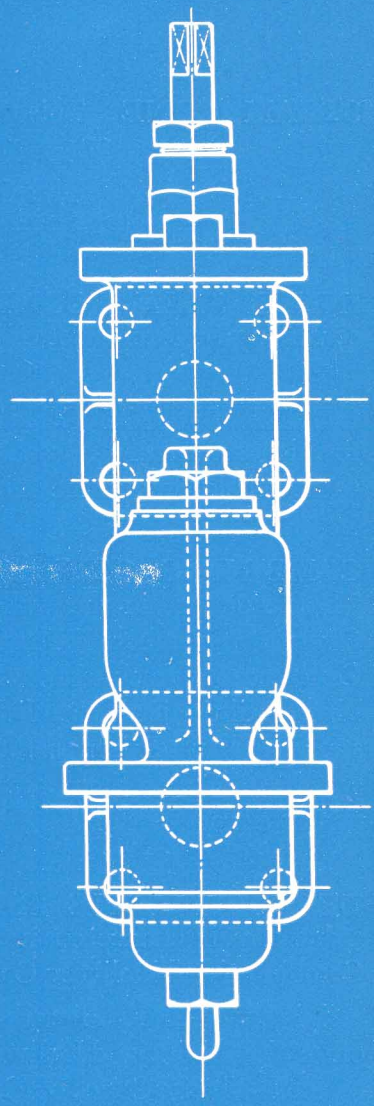
DELIVERY CONE (E) is the usual divergent shaped Cone, on to the receiving end of which the Combining Cone is screwed, thus forming one unit. It also has the advantage of being one unit, so that the Combining and Delivery Cones can be removed from the Injector Body as a complete unit by simply unscrewing the Delivery Cone from the Injector Body. A small grub screw (F) holds the Combining Cone and Delivery Cone together, preventing the Combining Cone becoming detached from the Delivery Cone when removing the Delivery Cone.

Between the Combining and Delivery Cone is fitted the Delivery Cone Renewable End.

NON-LIFTING INJECTOR
STANDARD PATTERN

TYPE D.M.





REF:	PART.	REF:	PART.
1	INJECTOR BODY.	15	OVERFLOW CAP NUT.
3	DELIVERY CAP NUT.	23	BACK PRESSURE VALVE.
4	COMBINING CONE.	24	BACK PRESS: VALVE CAP NUT.
5	DELIVERY CONE.	25	GRINDING NUT.
5.A	RENEWABLE END.	26	WATER VALVE AND NUT.
6	INNER STEAM CONE.	27	WATER VALVE SPINDLE.
7	OUTER STEAM CONE.	28	BOX NUT.
8	SCREW.	29	NECK RING.
9	DRAIN COCK.	30	PACKING GLAND.
14	OVERFLOW VALVE.		

FIG. 2

HOW THE INJECTOR WORKS

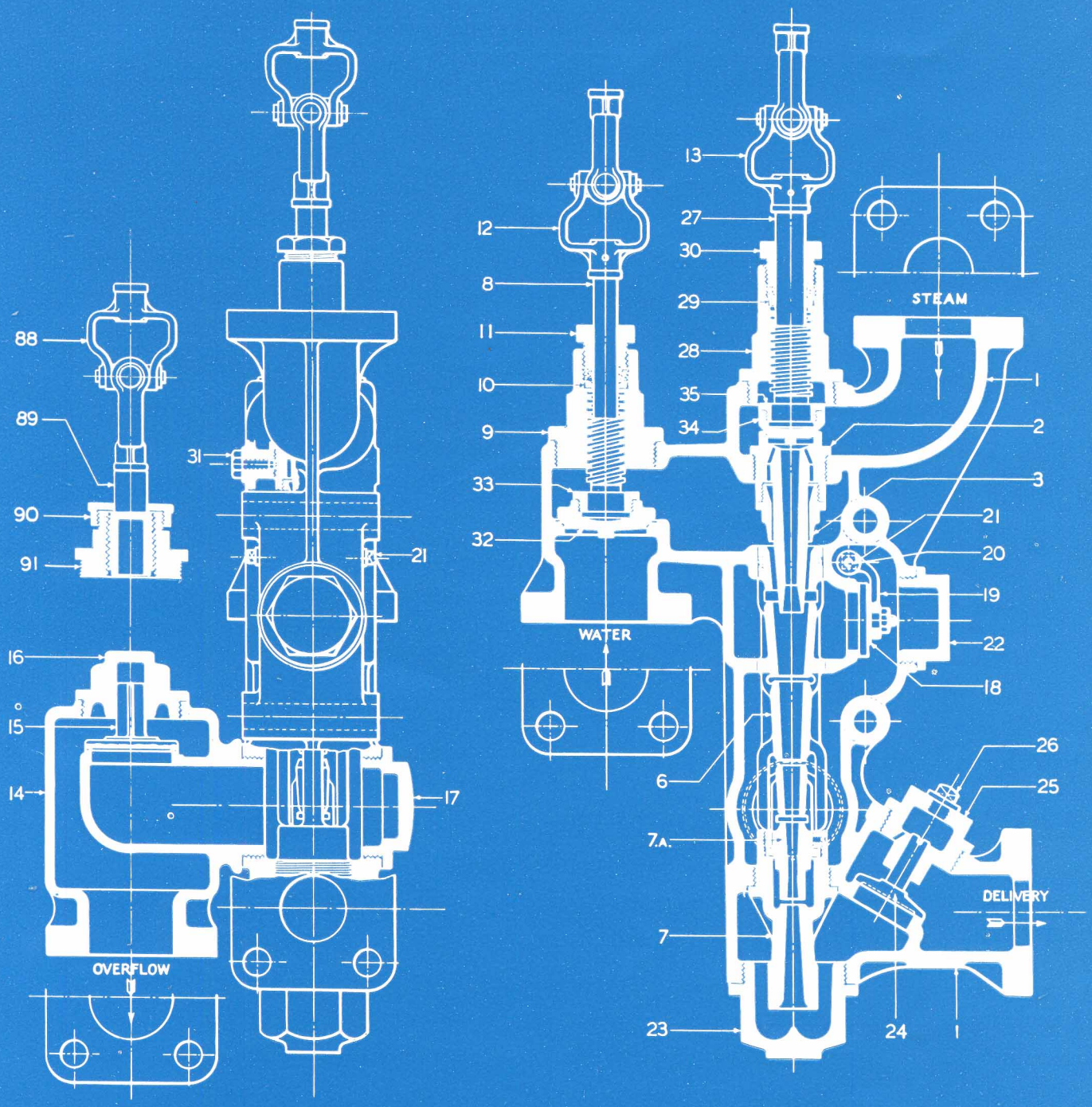
When the Water Cock is opened, the water flows into the Combining Cone, and then passes through the gaps in this Cone into the Overflow. When Steam is turned on it enters the Steam Cone and flows out in two jets, first the Primary Annular Jet, and then the Secondary Forcing Jet. The Primary Steam, on leaving the Steam Cone, comes into contact with the water and forces it down the Combining Cone past the end of the Inner Steam Cone, at which point the Secondary Jet of steam is introduced giving a further impulse to the combined jet. The Combined Jet flows on through the Combining Cone where condensation is completed, and enters the Delivery Cone as a jet of hot water moving with very high velocity.

In the Delivery Cone, which is a diverging Cone, the velocity of the jet is gradually reduced as the bore increases, thus changing the velocity energy into pressure energy, so that the hot water leaves the Delivery Cone at a pressure high enough to enter the boiler.

Should any interruption of the jet take place causing the Injector to break off, then the steam and water escape freely through the gaps in the Combining Cone into the Overflow, until the jet is re-formed by the condensation of the steam, and the Injector picks up and restarts.

An important feature is the self-regulating effect of supplying the steam in two jets. As the boiler steam pressure varies, so also does the quantity of steam forming the Primary and Secondary Jets. Now the quantity of water entering the Combining Cone is decided by the amount of steam passing through the Primary Jet, and so will vary with the boiler steam pressure, thus ensuring that the Secondary Steam Jet is never overloaded. The water is forced along by the Primary Steam past the end of the Inner Steam Cone, where it receives the secondary supply of steam which gives it sufficient energy to feed the boiler. The **Injector will start to work with a Full Open Water Cock at any steam pressure from 40 lb. upwards** and will continue working without wasting at the Overflow irrespective of any change in boiler pressure. It is only necessary to handle the Water Cock when a change of capacity is required. By the use of the Water Cock the minimum capacity can be regulated to 40 per cent.—45 per cent of the maximum.

NON-LIFTING INJECTOR



REF:	PART	REF:	PART	REF:	PART	REF:	PART
1	INJECTOR BODY.	12	UNIVERSAL JOINT – WATER.	22	CAP NUT.	32	WATER VALVE.
2	STEAM CONE - INNER.	13	UNIVERSAL JOINT – STEAM.	23	DELIVERY CAP NUT.	33	LOCKING NUT.
3	STEAM CONE - OUTER.	14	OVERFLOW BODY.	24	BACK PRESSURE VALVE.	34	STEAM VALVE.
6	COMBINING CONE.	15	OVERFLOW VALVE.	25	B.P. VALVE CAP NUT.	35	LOCKING NUT.
7.A	RENEWABLE END.	16	OVERFLOW CAP NUT.	26	GRINDING PLUG.	88	UNIVERSAL JOINT.
7	DELIVERY CONE.	17	CAP NUT SIDE.	27	STEAM VALVE SPINDLE.	89	WARMING SCREW.
8	WATER VALVE SPINDLE.	18	OVERFLOW VALVE - HINGED.	28	BOX NUT.	90	STOP COLLAR.
9	BOX NUT.	19	HANGER.	29	NECK RING.	91	OVERFLOW CAP NUT.
10	NECK RING.	20	HINGE PIN.	30	GLAND.		
11	GLAND.	21	HINGE PIN NUT.	31	SETSCREW.		

FIG. 3

THE OVERFLOW VALVE

The Overflow Valve, Fig. 2 (page 6), consists of an ordinary drop valve resting on a seating formed on the Injector Casing, and cutting off communication between the Overflow Chamber and the atmosphere. When the Injector is working a Vacuum is formed in the Overflow Chamber, so that the Overflow Valve is held on its seating, preventing any air from being drawn into the Injector. Should the Injector break off, steam and water from the Cones pass into the Overflow Chamber, and force the Overflow Valve from its seating, so allowing a free flow into the Overflow Pipe and thence to the atmosphere, until the jet is re-formed, when the Overflow Valve falls on to its seating again.

This sealing of the Overflow Chamber, preventing the entrance of air, is important, as the admission of air upsets the working of *all* Injectors. Air so drawn into the boiler is also a principal factor in causing corrosion and pitting of the boiler tubes and plates.

Consequently, an **Overflow Valve should always be fitted** to an Injector.

A further type of Overflow Valve, illustrated on Fig. 2 (14A) can be fitted, having the Valve Stem projecting through the Guide Nut so that the Valve can be held in the open position. Cold water can then be introduced into the boiler through the Injector Overflow Pipe, for the purpose of cooling down the boiler for " washing out," etc.

A " screwed down " type Overflow Valve, Fig. 3 (page 8), is fitted when desired. By locking this valve on to its seating, steam can be forced back into the tender to warm up the water in very cold climates. This is also useful in the event of the tender sieve becoming fouled, as by blowing steam into the tender, any obstructions will be removed. The fitting of these Screw Down Valves is optional and can be replaced by the standard nut and valve.

The standard type " M " Cones will handle tender feed water at all temperatures up to 110° F. Where temperatures exceed this figure Injectors can be supplied, fitted with the standard type " M " Cones, in conjunction with a special Automatic Pressure Loaded Overflow Valve.

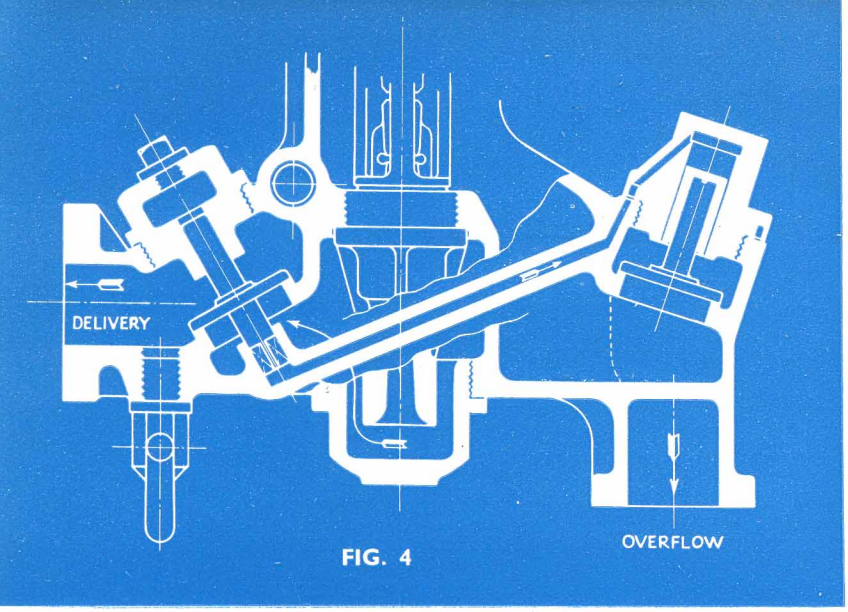


FIG. 4

Diagram of
AUTOMATIC
OVERFLOW VALVE

Fig. 4 illustrates this type of Valve which will be seen to be extremely simple in design. In operation the Automatic Overflow Valve is quite trouble-free and entirely automatic and safe.

Injectors that are fitted with this type of Valve will handle tender feed water efficiently and safely at ALL temperatures up to 130° F. without any extra attention or manipulation by the operator. The Injector is started, stopped and regulated in precisely the same manner as the standard type of Monitor Injector. For high boiler pressure, and warm feed water, we advocate the use of the type of Injector shown on Fig. 3. It will be seen that the top Overflow Gap, in the Combining Cone is enclosed in the separate chamber, sealed from the main Overflow Chamber by the Auxiliary Overflow Valve.

DELIVERY CHECK VALVE. This consists of a simple Drop Valve and Guide Nut resting on a seating formed on the delivery side of the Injector Casing. This is a very useful fitting, and acts as a safeguard in the event of the main boiler Check Valve sticking, in addition to saving, the waste of the water, contained in the delivery pipe between the Injector and the Check Valve on the boiler. A Drain Plug can be fitted to drain this water out in cold climates.

THE FEATURES OF THE MONITOR TYPE INJECTORS

AUTOMATIC STARTING AND RANGING. The outstanding features of this type of Injector are the Automatic Starting, and the range over which the Injector will operate. The standard patterns are designed to operate at any steam pressure from 40—250 lb. per sq. inch, and within this pressure range it is only necessary to open fully the Water Valve and the Steam Valve, when the Injector will start up automatically and feed the boiler without wasting, thus eliminating any necessity to handle the Water Valve or Steam Valve due to variations in boiler pressure. (For pressures higher than 250 lb. special cones can be fitted for pressures up to 350 lb.). This feature "ranging" also results in a substantial saving of water, due to the decreased loss of water at the Overflow.

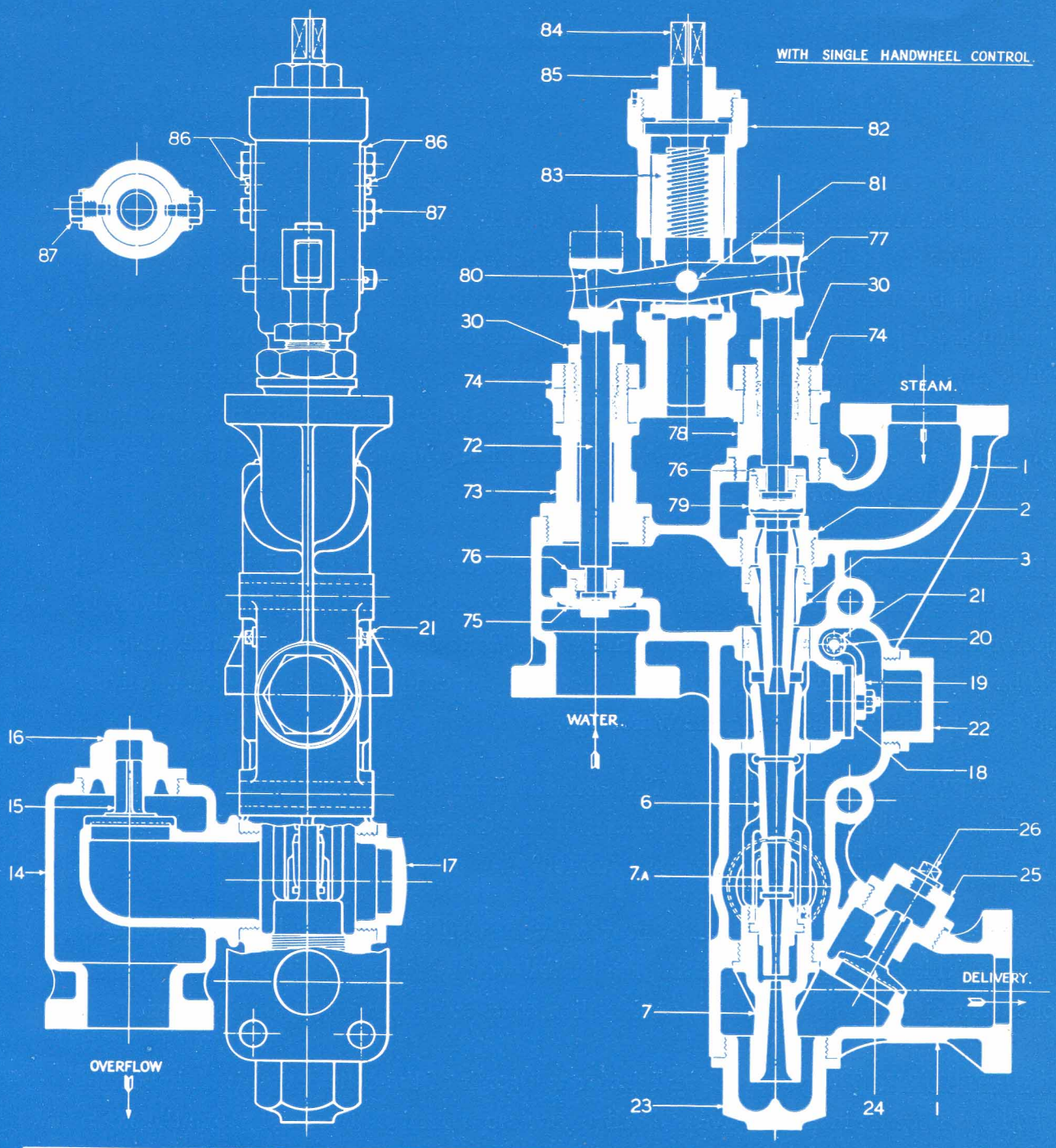
REGULATION OF CAPACITY. Where a regulation of the delivery of the Injector is required in order to suit working conditions, a reduction up to 45 per cent. of the maximum delivery of the Injector can be obtained by the use of the Water Cock or Valve. For instance, a No. 10 Injector, having a maximum delivery of 2,300 galls. per hour can be regulated to give a delivery of 1,265 galls. per hour by adjusting the Water Valve.

FEED WATER TEMPERATURE. The standard Injectors will handle feed water up to 110° F. Those models that are fitted with a screw on the Overflow Valve or with the Automatic Type Overflow Valve will accept feed water up to 130° F.

TYPE "M" CONES. There are **no moving cones** sliding parts or loose valves in the cone system of this Injector, thus obviating mechanical wear and the necessity to grind them in. The Cones screw into the body ensuring perfect alignment, and easy removal for examination.

OVER PRESSURE. The power of the Injector as a result of the cone design is an important asset. 50 lb. per square inch is an average delivery pressure obtained over and above the steam supply pressure, and under good conditions 70 and 80 lb. per square inch over pressures are obtained. This feature in particular prolongs the life of the Injector Cones considerably and ensures trouble-free working under difficult conditions.

NON-LIFTING INJECTOR
TYPE O.M.



REF.	PART	REF:	PART	REF:	PART	REF:	PART.
1	INJECTOR BODY.	18	OVERFLOW VALVE - HINGED.	72	WATER VALVE SPINDLE.	82	SPINDLE GUIDE.
2	STEAM CONE. - INNER.	19	HANGER.	73	BOX NUT.	83	OUTER SPINDLE.
3	STEAM CONE. - OUTER.	20	HINGE PIN.	74	LOCK NUT.	84	INNER SPINDLE.
6	COMBINING CONE.	21	HINGE PIN NUT.	75	WATER VALVE.	85	GUIDE NUT.
7.A.	RENEWABLE END.	22	CAP NUT.	76	LOCKING NUT.	86	LOCKING PLATE AND SCREW
7	DELIVERY CONE.	23	DELIVERY CAP NUT.	77	STEAM VALVE SPINDLE.	87	SCREW FOR SPINDLE.
14	OVERFLOW BODY.	24	BACK PRESSURE VALVE.	78	BOX NUT.		
15	OVERFLOW VALVE.	25	B.P. VALVE CAP NUT.	79	STEAM VALVE.		
16	OVERFLOW CAP NUT.	26	GRINDING PLUG.	80	LEVER.		
17	CAP NUT SIDE.	30	GLAND.	81	FULCRUM PIN.		

FIG. 5

SOME APPLICATIONS OF MONITOR TYPE CONES

The Injector shown in Fig. 3 (page 8), is complete with Steam Valve and Water Valve and is thus entirely self-contained. This type of Injector can be made into either a Right or Left Hand Injector by simply reversing the positions of the overflow body, Item 14, and the side cap nut, Item 17, a very useful point.

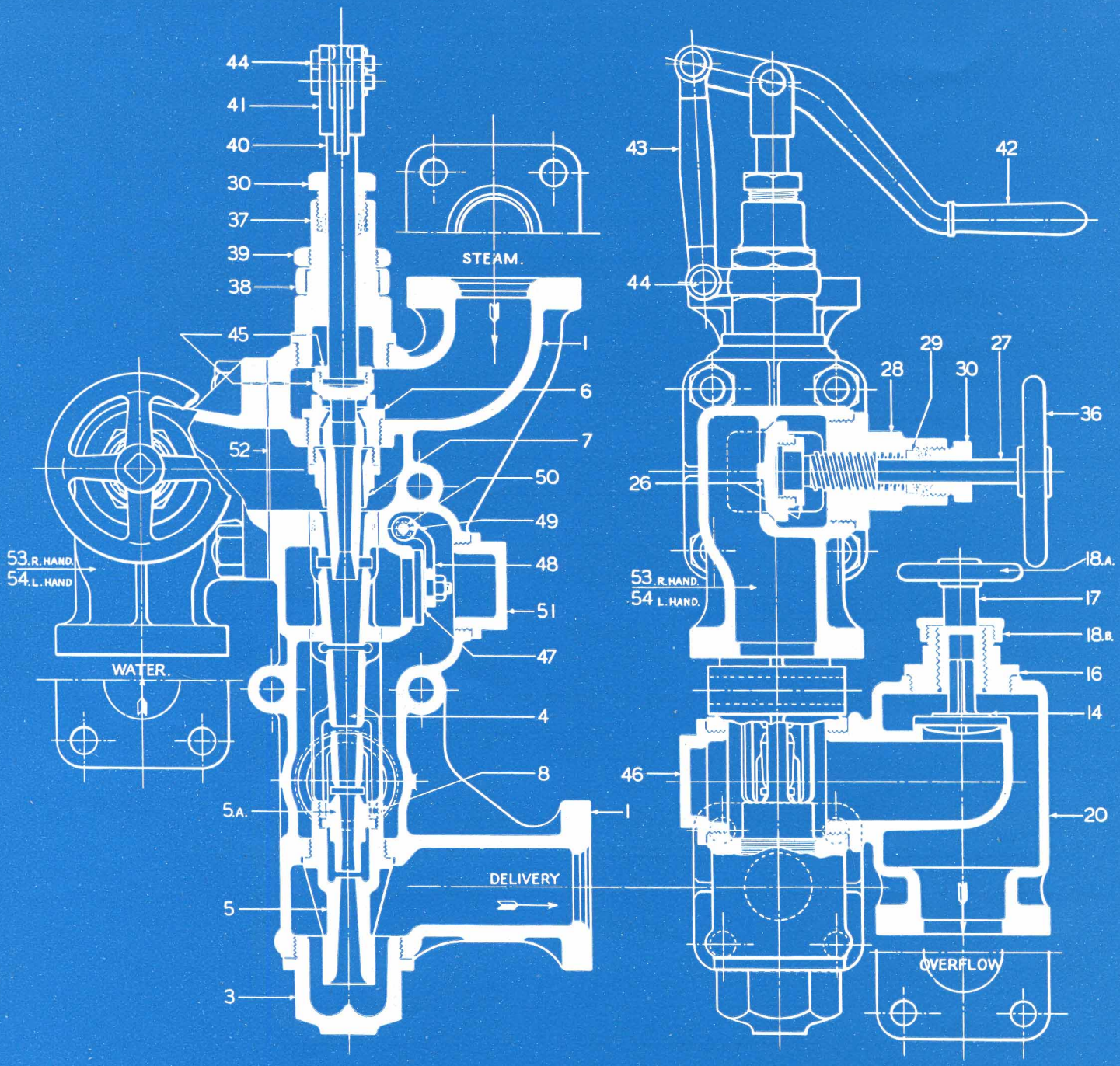
An alternative arrangement of the Steam and Water Valves is shown in our type "OM" Injector (Fig. 5) on the page facing. In this design a single control in the Cab operates both the Steam and Water Valves—there is thus only one control for the Fireman to handle when starting, stopping, or regulating the Injector, and this is found by some users to be very convenient.

The diagram (Fig. 6) on page 14, shows a similar Injector arranged as a Lifting Injector to be fixed in the Cab. Here the Steam Valve is controlled by a lever, the first movement of which opens the steam to the Annular Priming of lifting jet. This jet creates a strong vacuum which quickly causes the Injector to be primed. When water appears at the Overflow, the lever is then moved to the full open position, and the Injector will instantly commence to feed the boiler. Injectors of this design have been very highly commended for their ease of operation and efficient working.

TWO FURTHER DESIGNS of this Injector are depicted in Fig. 7 (page 16). The type "DM" which is a self-contained Injector except for the Steam Valve which must be placed between the Injector and the Boiler in the steam pipe to the Injector, and the type "LM" which is similar to the type "DM" with the exception that the Steam Supply Flange can be provided in alternative positions as shown, and a cap nut is provided for the withdrawal of the Steam Cone. A Steam Valve can be fitted to the Injector in place of this Cap Nut. It will be noted that neither of these Injectors are handed and are thus completely reversible.

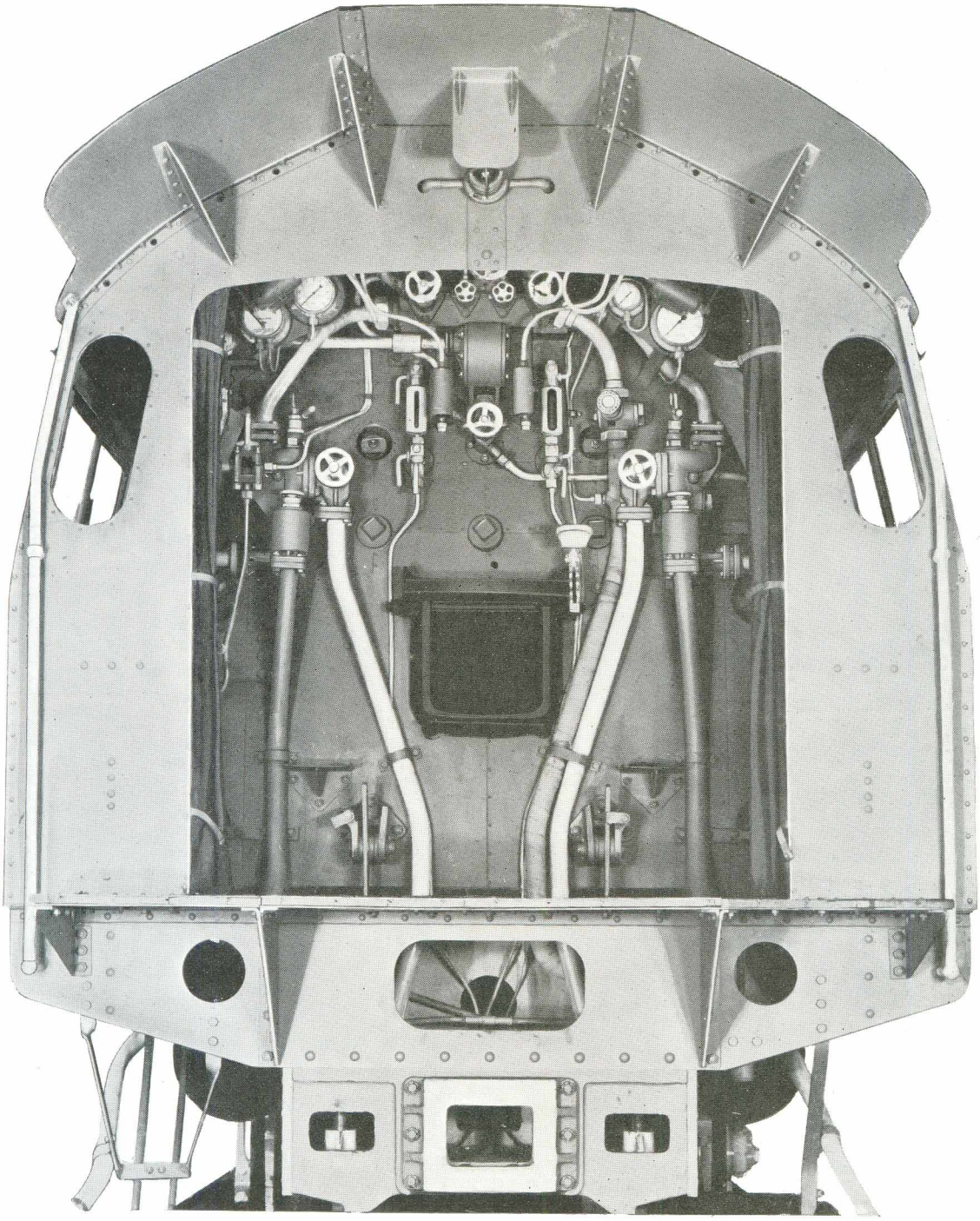
The system of Cones used in the Monitor Injectors, lends itself to incorporation in almost any design, and Monitor Injectors can be supplied to interchange with all the standard patterns of Live Steam Injectors, with the minimum of alteration. In addition, existing Injectors can be converted to Monitor Injectors by changing the Cone system, and this has been carried out with great success in many cases.

LIFTING INJECTOR



REF:	PART.	REF:	PART.	REF:	PART.	REF:	PART.
1	INJECTOR BODY.	17	WARMING SCREW.	37	STEAM VALVE BOX NUT.	46	CAP NUT - SIDE.
3	DELIVERY CAP NUT.	18A	HANDWHEEL - OVERFLOW.	38	FULCRUM BRACKET.	47	OVERFLOW VALVE - HINGED.
4	COMBINING CONE.	18B	STOP COLLAR.	39	LOCK NUT.	48	HANGER.
5	DELIVERY CONE.	20	OVERFLOW BODY.	30	PACKING GLAND.	49	HINGE PIN.
5A.	RENEWABLE END.	26	WATER VALVE AND NUT.	40	STEAM VALVE SPINDLE.	50	HINGE PIN NUT.
6	INNER STEAM CONE.	27	WATER VALVE SPINDLE.	41	SPINDLE CROSS HEAD.	51	CAP NUT.
7	OUTER STEAM CONE.	28	BOX NUT.	42	STEAM VALVE LEVER.	52	ASBESTOS JOINT.
8	SCREW.	29	NECK RING.	43	LINK.	53	WATER VALVE BODY. - R.H.
14	OVERFLOW VALVE.	30	PACKING GLAND.	44	HINGE PIN.	54	WATER VALVE BODY. - L.H.
16	OVERFLOW VALVE CAP NUT.	36	HANDWHEEL - WATER VALVE.	45	STEAM VALVE AND NUT.		

FIG. 6

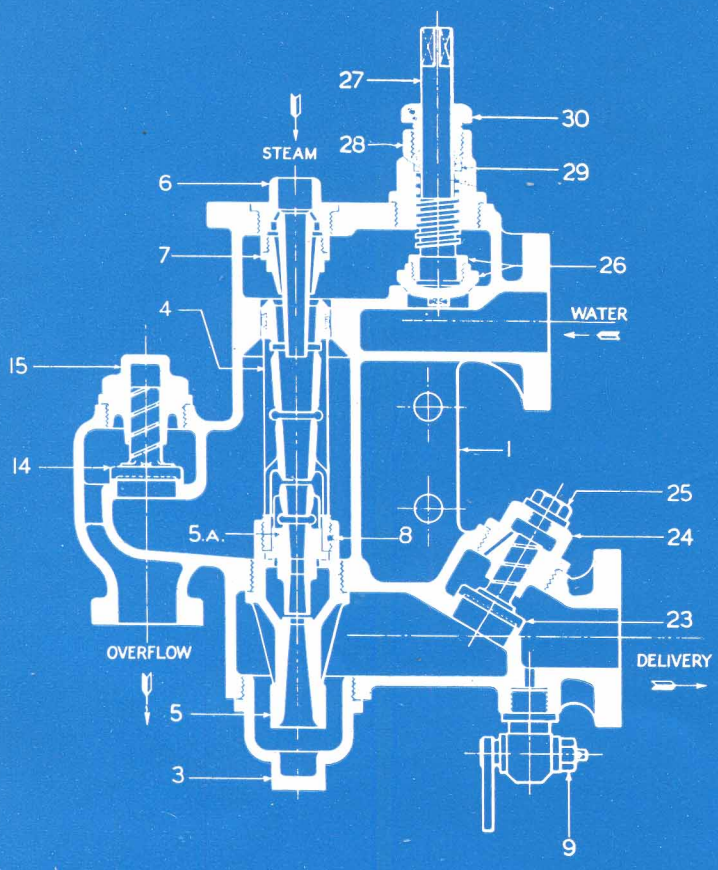


VIEW OF THE CAB OF THE LIBERATION CLASS LOCOMOTIVE built for U.N.R.R.A. by The Vulcan Foundry Ltd., Newton-le-Willows.
2 - 8 - 0 Tender Engine fitted with two No. 11 Davies & Metcalfe Lifting Type Monitor Injectors.

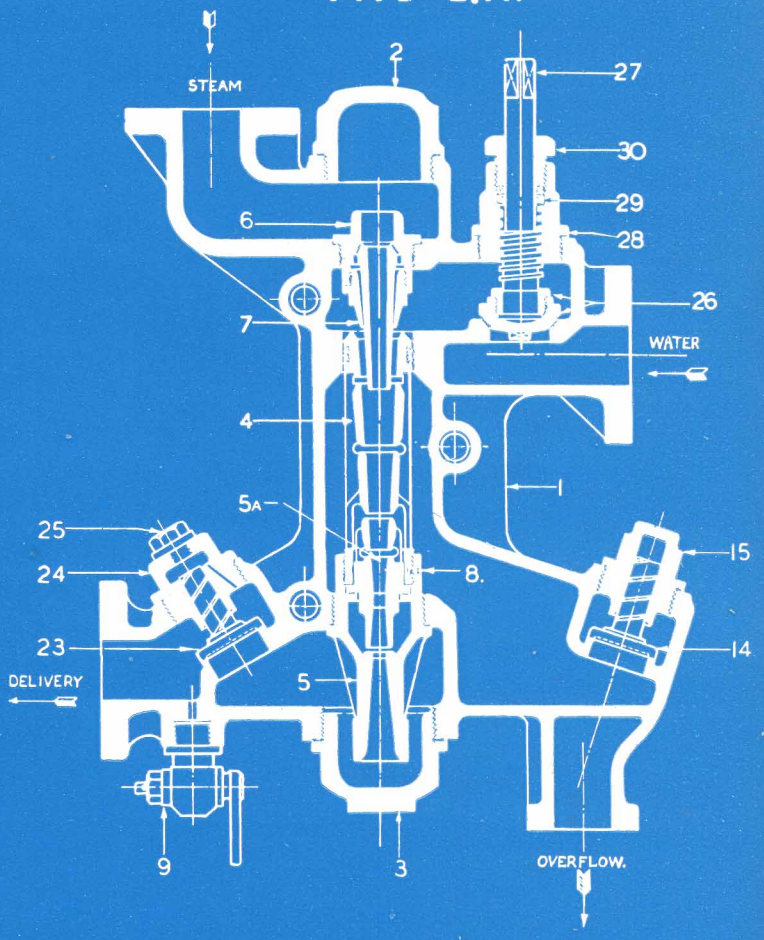
By kind permission of The Vulcan Foundry Ltd.

NON-LIFTING INJECTORS

TYPE D.M.



TYPE L.M.



REF:	PART.	REF:	PART.
1	INJECTOR BODY.	15	OVERFLOW CAP NUT.
3	DELIVERY CAP NUT.	23	BACK PRESSURE VALVE.
4	COMBINING CONE.	24	BACK PRESS: VALVE CAP NUT.
5	DELIVERY CONE.	25	GRINDING NUT.
5.A	RENEWABLE END.	26	WATER VALVE AND NUT.
6	INNER STEAM CONE.	27	WATER VALVE SPINDLE.
7	OUTER STEAM CONE.	28	BOX NUT.
8	SCREW	29	NECK RING.
9	DRAIN COCK.	30	PACKING GLAND.
14	OVERFLOW VALVE.	2	STEAM CAP NUT.

FIG. 7

INSTALLATION

These Injectors (with the exception of the one in Fig. 6, page 14) are of the non-lifting type, i.e., they must be fixed lower than the bottom of the tender tank, so that the water from the tender will flow to the Injector. They are usually fitted below the footplate, and attached by fixing bracket to either the engine frame, or footstep plate. Besides the fixing bracket for the Injector, control rods to the Cab are acquired for the Water Cock or Valve, Steam Valve and Overflow according to the type of Injector. If these control rods cannot be placed vertically above the valves then universal joints may be inserted.

The following pipes are necessary :—

Steam Pipe from Boiler to Injector.
Delivery Pipe from Injector to Boiler.
Feed Water Pipe from Tender to Injector.

The following Valves are necessary :—

Injector Steam Valve in the Cab (if not included in Injector).
Tender Feed Cock (if not included in Injector).
Boiler Check Valve.

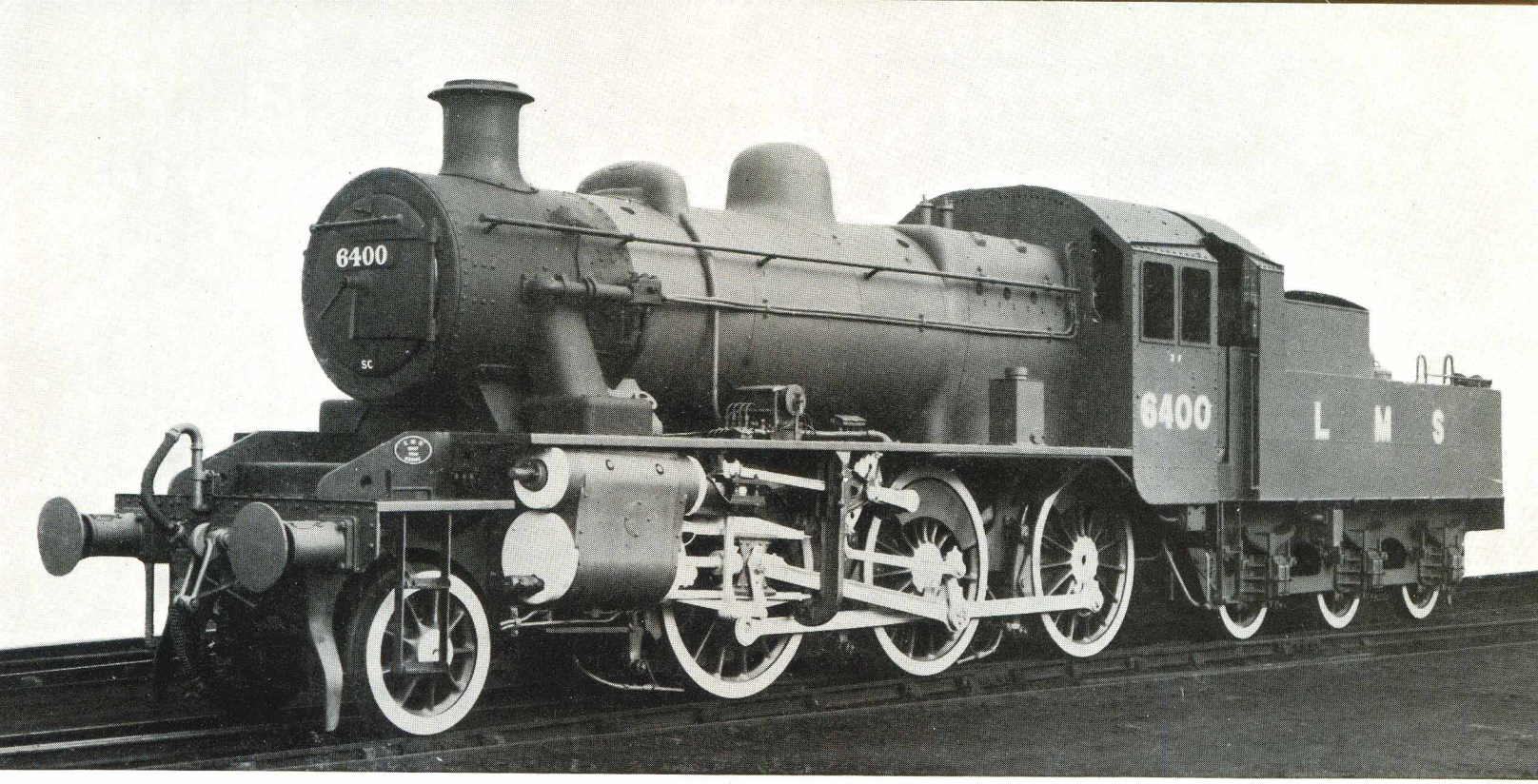
Care *must* be taken that all these pipes and valves are of full bore throughout, and not less internally than shown in the table on page 19. All joints in the pipes must be perfectly tight, so that there can be no leakage of either steam, water or air.

It is most important that the Injector Steam Valve and Boiler Check Valve are of full bore throughout, both in the body and in the diameter and lift of the Valve, etc., and allow an uninterrupted flow of steam or water, and care should be taken that pipe joints do not curtail the area at all. Many cases of Injectors giving faulty working have been traced to incorrectly designed or manufactured Steam Valves or Boiler Check Valves, etc. Note should also be made that where feed water is very hard, the Boiler Check Valve should be designed so that a small accumulation of sediment or scale will not seriously curtail the area through the valve.

TANK STRAINER. A fine mesh sieve should be fitted into the tender so as to prevent dirt, etc., passing over the feed water. It is imperative that the area of the strainer should be large, so as to admit an ample supply of water, as it is always liable to become partially choked with dirt, leaves, coal, etc. A small tender strainer is a very *frequent* cause of Injector failures. The strainer should be designed to give at least 50 per cent. excess area through the holes above the pipe area.

MAINTENANCE. Tank Hoses and Tender Sieves should be examined, and cleaned frequently. If badly choked there will be erratic action of the Injector.

All valves and cocks must be kept in a tight condition. A leaking water cock or water pipe joint allows air to be entrained in the water supply to the Injector, and is a frequent cause of Injector troubles. The Cones must be removed and examined at regular intervals, and any worn Cones should be renewed. A deposit of scale should not be allowed to accumulate on any part of the Cones : to remove these deposits the Cones should be soaked in a solution composed of 10 parts of water and one part of Hydrochloric Acid, and afterwards rinsed in water. The Cones must not be cleaned with files, reamers, or emery cloth.



2 – 6 – 0 TENDER ENGINE fitted with two Davies & Metcalfe's Monitor Live Steam Injectors.
By kind permission of H. G. Ivatt, Esq., C.M.E., L.M. & S. Rly. Coy.

SPARE PARTS

In manufacture our Injectors are subject to the most thorough test and inspection, which ensures that only the best material is used and that spare parts supplied by us will be perfectly interchangeable with components already supplied. We pay particular attention to the supply of spare parts.

All Injectors supplied by us are carefully tested in steam under the working conditions at our works before being dispatched.

When ordering state :—

Size of Injector.
Part Number.
Name of Part.
Type of Injector.

POSSIBLE CAUSES OF INJECTOR FAILURES

Failures of Injectors occur only if the instructions given are not observed carefully. Such cases may be :—

If the water connections between tender and Injectors are leaking.
If the Tender Strainer is too small or choked with dirt.
If the Cones have not got the correct free areas owing to the use of feed water of poor quality, or to being too long in use without cleaning and examination.
If the feed water is too hot.
If the Delivery Pipe is choked.
If the steam supply to the Injector is curtailed in any way.

TABLE OF PIPE SIZES AND CAPACITIES

For Injector Sizes 4 to 13.

Size of Injector	Capacity Gallons Per Hour	Min. Bore Steam, Water and Delivery	Min. Bore of Overflow
4	300	1″	1¼″
5	500	1¼″	1½″
6	750	1¼″	1½″
7	1100	1¼″	1½″
8	1450	1½″	1½″
9	1850	1½″	1½″
10	2300	1¾″	2″
11	2850	2″	2″
12	3500	2¼″	2½″
13	4200	2½″	2½″

SOUTH AFRICAN RAILWAYS 15F CLASS LOCOMOTIVES

More than two hundred of these 4–8–2 tender Locomotives have been supplied, each fitted with two Davies & Metcalfe Monitor Type " M " Live Steam Injectors.

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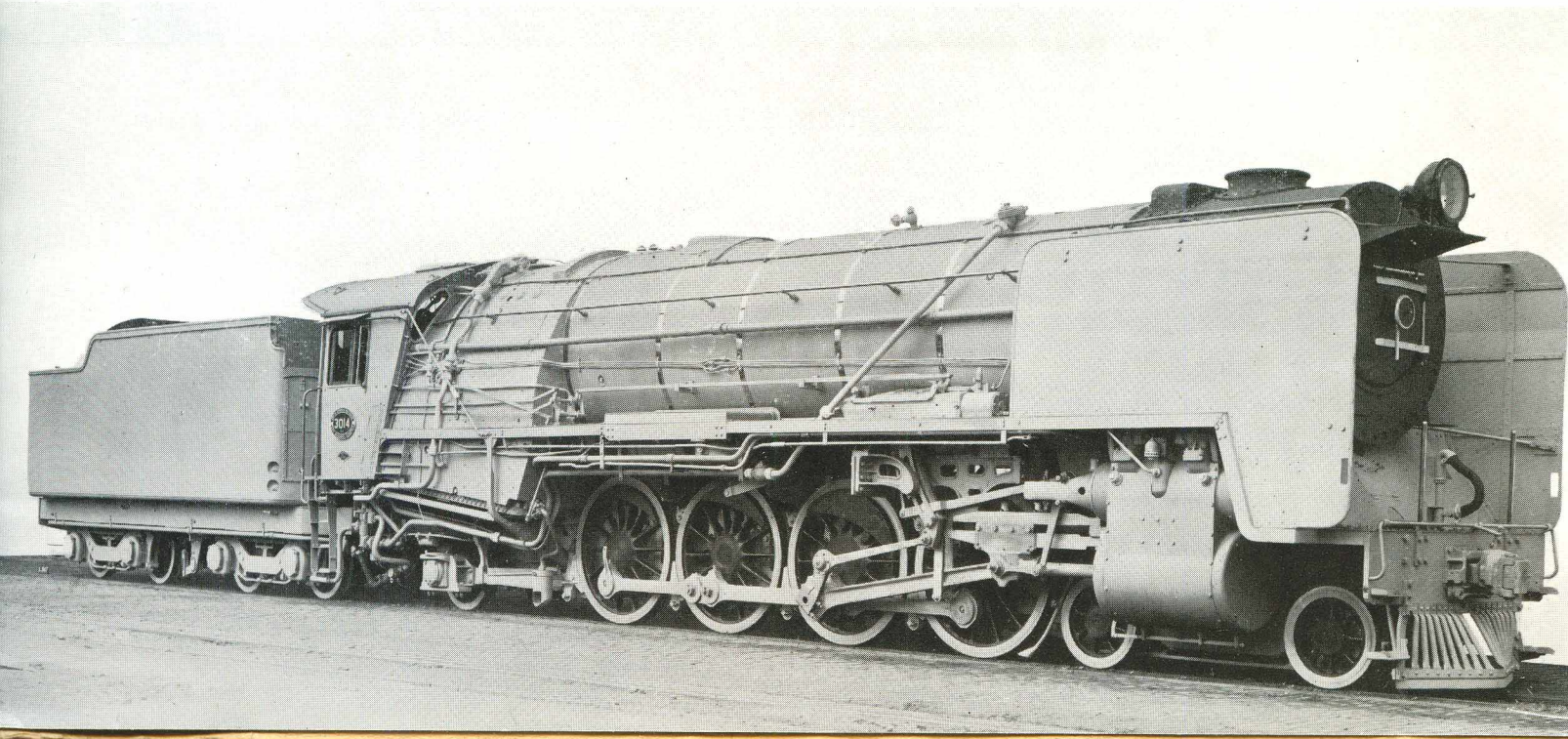
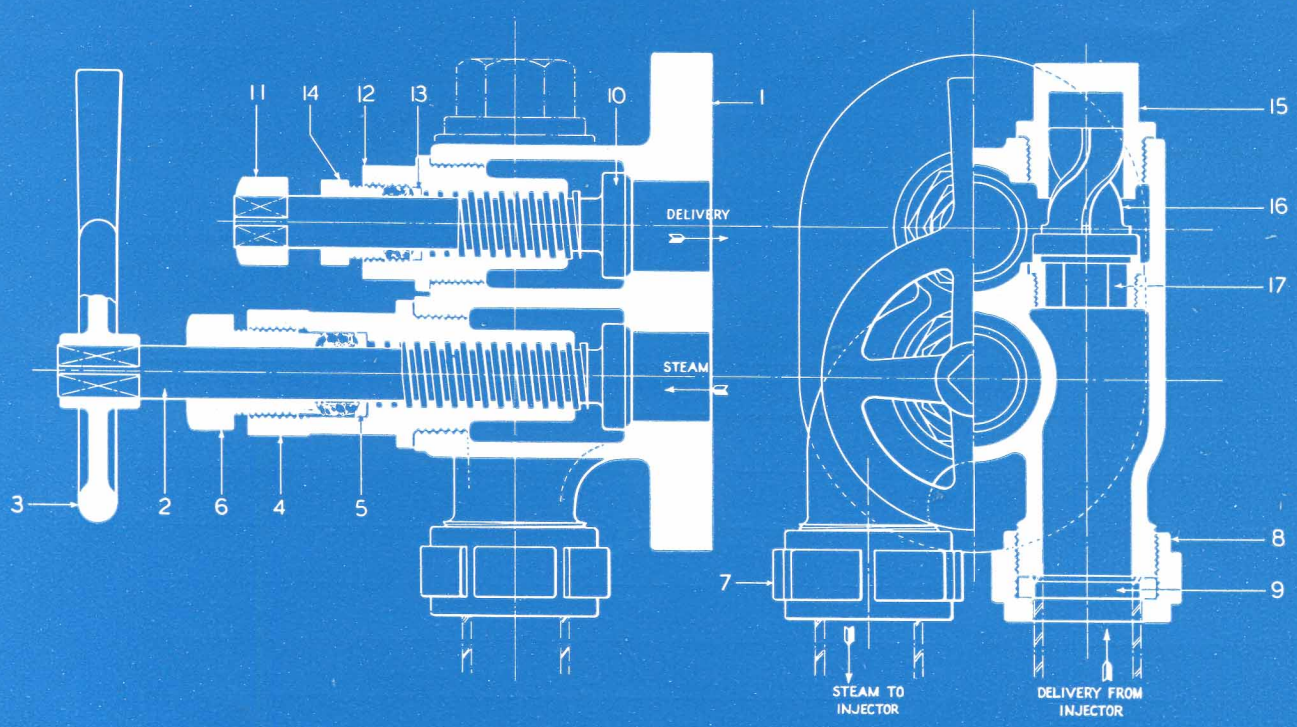


COMBINED STEAM AND DELIVERY VALVE

FOR USE WITH NON-LIFTING INJECTORS



REF:	PART	REF:	PART
1	VALVE BODY	10	DELIVERY STOP VALVE SPINDLE
2	STEAM VALVE SPINDLE	11	DELIVERY STOP VALVE SQUARE
3	STEAM VALVE HANDWHEEL	12	DELIVERY STOP VALVE BOX NUT
4	STEAM VALVE BOX NUT	13	DELIVERY STOP VALVE NECK RING
5	STEAM VALVE NECK RING	14	DELIVERY STOP VALVE GLAND
6	STEAM VALVE GLAND	15	BACK PRESSURE VALVE CAP NUT
7	STEAM BRANCH COUPLING NUT	16	BACK PRESSURE VALVE
8	DELIVERY BRANCH COUPLING NUT	17	BACK PRESSURE VALVE SEATING
9	PIPE COLLAR		

FIG. 8

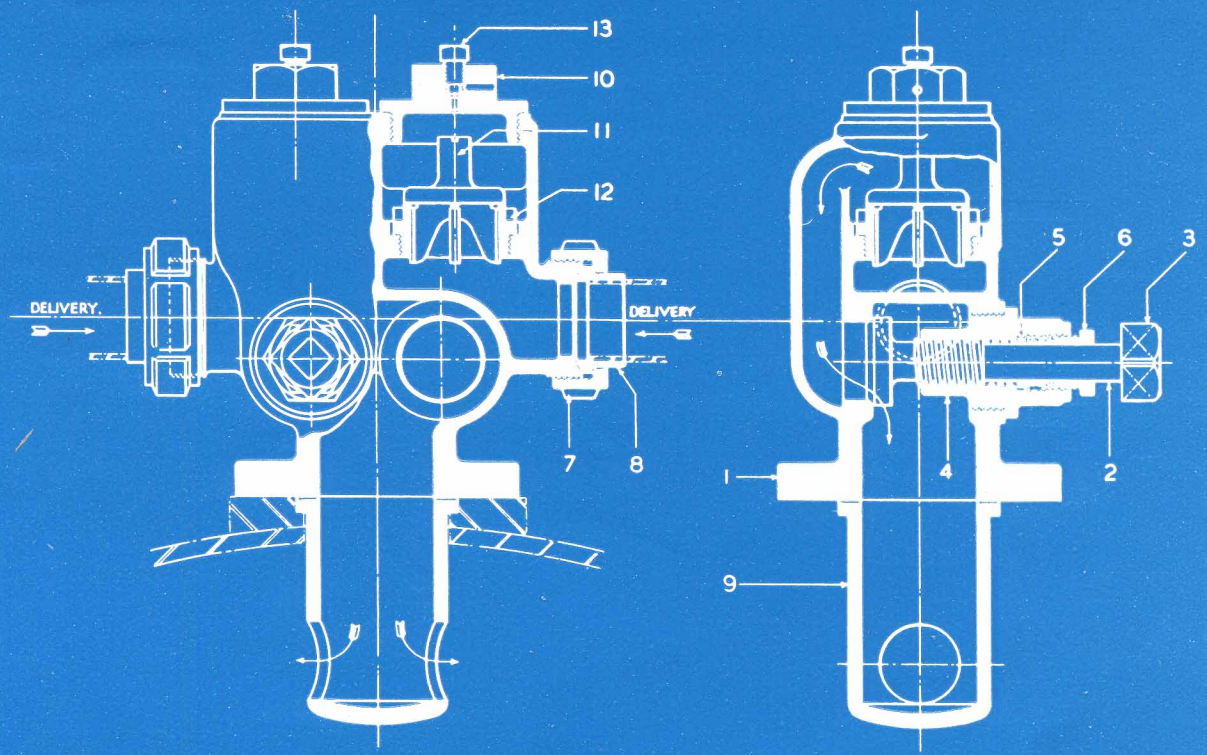
A fitting often adopted for use with Non-Lifting type Injectors is the Combined Steam and Delivery Valve.

The Steam Valve and Delivery Stop Valve are combined with the Back Pressure Valve in one casing and fitted by a flange on to the firebox backplate, with steam and delivery pipes inside the boiler.

By closing the Delivery Stop Valve, the Back Pressure Valve may be examined while the boiler is in steam.

The size of fixing flange can be made to suit requirements.

DUPLEX TOP CHECK AND STOP VALVE



REF:	PART.	REF:	PART.
1	VALVE BODY.	8	PIPE COLLAR.
2	DELIVERY STOP VALVE SPINDLE.	9	DELIVERY BRANCH.
3	DELIVERY STOP VALVE SQUARE.	10	BACK PRESSURE VALVE CAP NUT.
4	DELIVERY STOP VALVE BOX NUT.	11	BACK PRESSURE VALVE.
5	DELIVERY STOP VALVE NECK RING.	12	BACK PRESSURE VALVE SEATING.
6	DELIVERY STOP VALVE GLAND.	13	RELEASE VALVE.
7	COUPLING NUT.		

FIG. 9

Another fitting often adopted for use with Lifting or Non-Lifting type Injectors is the Duplex Top Check and Stop Valve.

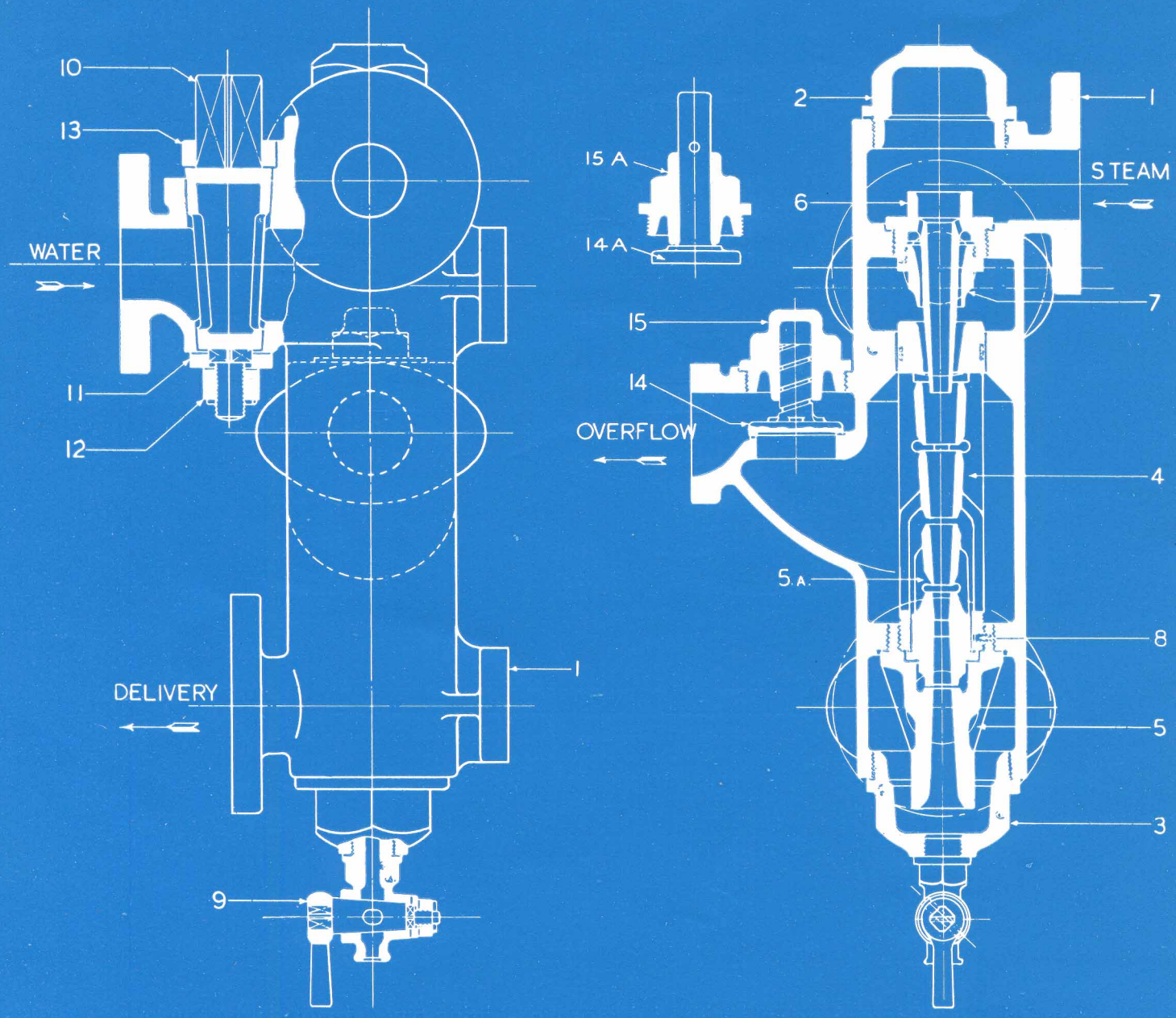
The two independent Stop Valves are combined with two independent Back Pressure Valves in one casing and fitted by a flange on to the top of the boiler.

After passing the Delivery Stop Valve, the delivery is into one branch inside the boiler with two outlets arranged on opposite sides.

By closing the Delivery Stop Valve, the Back Pressure Valve may be examined while the boiler is in steam and the other Injector still working.

The size of fixing flange can be made to suit requirements.

NON-LIFTING INJECTOR
AUSTERITY TYPE



REF:	PART	REF:	PART
1	INJECTOR BODY.	8	SCREW.
2	STEAM CAP NUT.	9	DRAIN COCK.
3	DELIVERY CAP NUT.	10	WATER COCK.
4	COMBINING CONE.	11	WATER COCK WASHER.
5	DELIVERY CONE.	12	WATER COCK NUT.
5.A	RENEWABLE END.	13	STOP WASHER.
6	INNER STEAM CONE.	14	OVERFLOW VALVE.
7	OUTER STEAM CONE.	15	OVERFLOW CAP NUT.

FIG. 10

We specialise in the manufacture of:—

LOCOMOTIVE FITTINGS

EXHAUST STEAM INJECTORS

Utilising Exhaust Steam, saving 10 per cent. fuel and water.

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Davies & Metcalfe Monitor Type and all standard types for locomotives and stationary boilers.

HOT WATER INJECTORS

To work with feed water at any temperature up to 150° F.

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Metcalfe Patent Solid Nozzle type. The simplest and most reliable Ejector made.

WATER HEATERS AND EJECTORS

WATER GAUGE COCKS

All standard locomotive patterns.

TOP FEED CHECK VALVES

COMBINED STEAM AND DELIVERY VALVES

STEAM SANDING EQUIPMENT

AIR SANDING EQUIPMENT

STEAM BRAKE LUBRICATORS (METCALFE'S PATENT)

SPARES FOR ALL TYPES OF INJECTORS

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