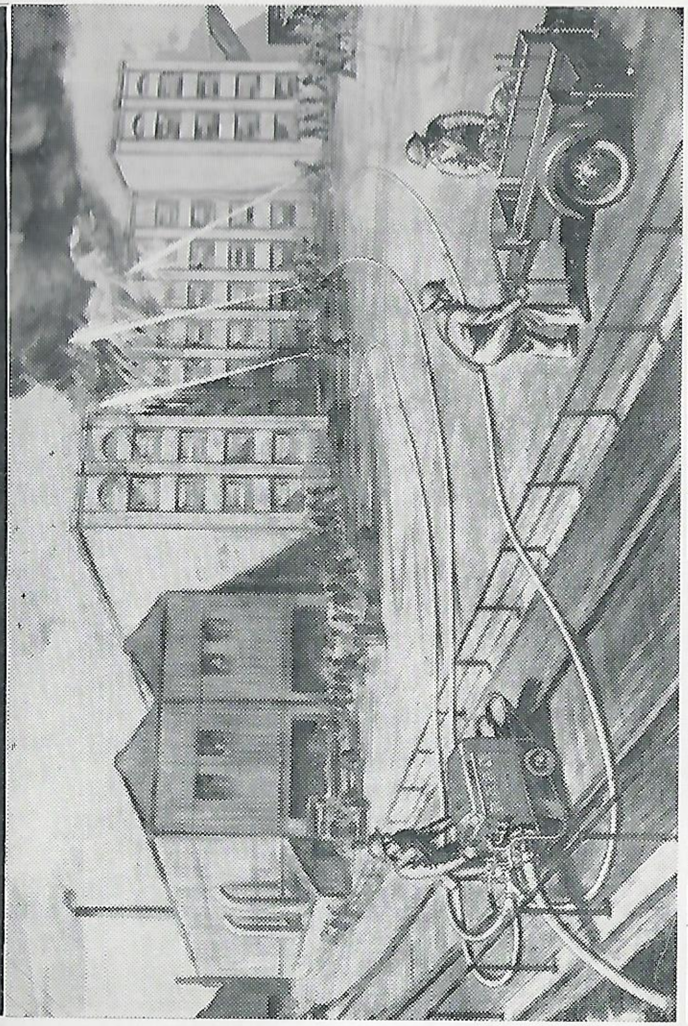
THE JET

Bristol's AFS Magazine

3d.

FEBRUARY



THE JET

Bristol's A.F.S. Magazine

VOL. I. No. 2. **FEB. 1940**

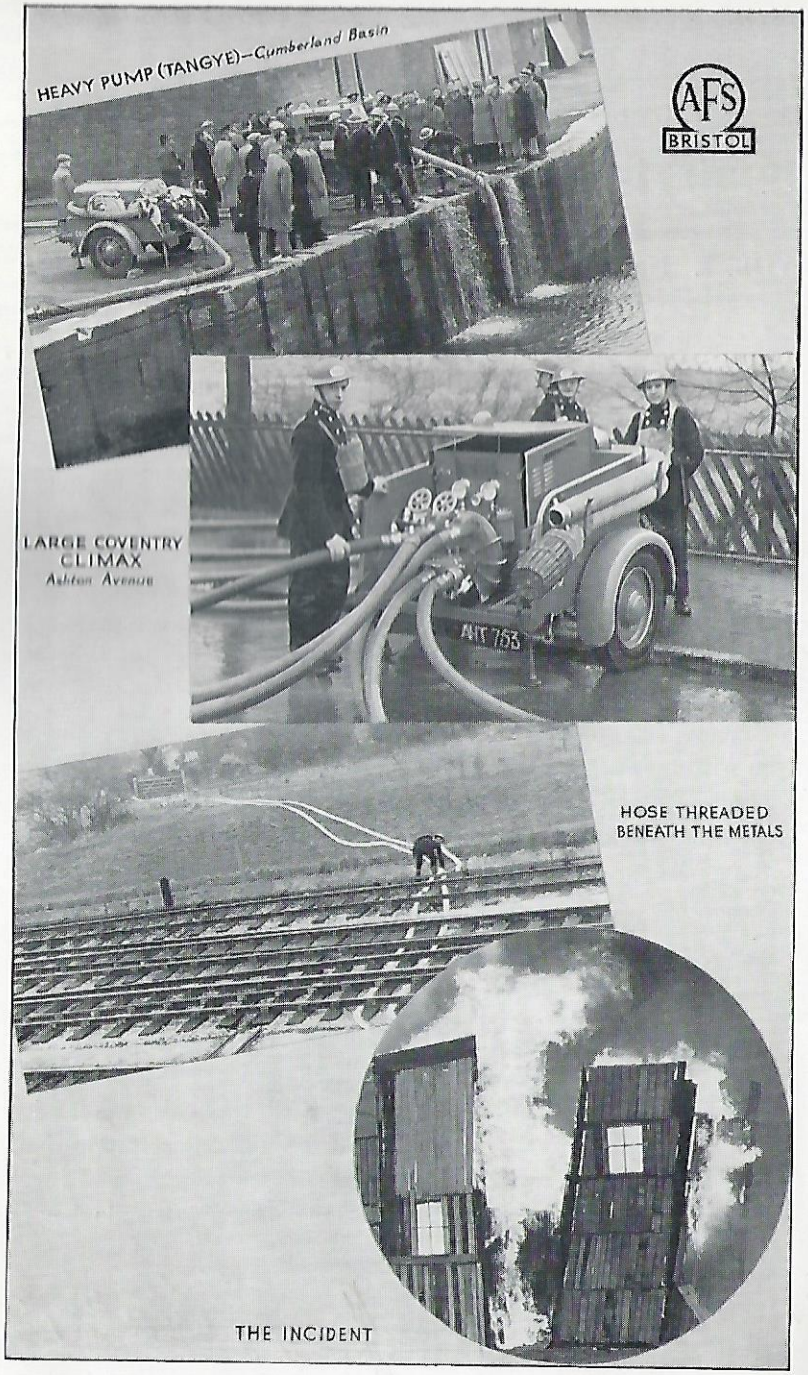
I SHOULD first like to thank those who have written wishing success to *The Jet*. In addition to letters which have been received from Fire Brigades all over the country, it is extremely gratifying to know that members of Bristol Auxiliary Fire Service appreciate the magazine and are showing keen interest in its production. Many helpful suggestions and a variety of articles have been submitted, together with requests for articles on a number of subjects relating to fire-fighting. I regret that, owing to the limited space available, it is impossible to include all material received in this issue. The magazine is intended to embrace all branches of A.F.S. activity month by month, and any suggestions put forward will be welcome. I hope you will enjoy reading the second number of *The Jet*, and find it an improvement on the first. The entries for the Competition were somewhat disappointing, and I have decided to vary the conditions. An announcement regarding this will be found on page 35.

To ensure the continued success of the publication, I appeal to all who are interested to become regular subscribers and place an order now.

January 1940 has seen the birth of a kindred publication, *The Siren*, magazine of Bristol's Air Raid Wardens. The Editor is Chief Inspector Andrews, and I should like to take this opportunity to congratulate him and his colleagues on an excellent production. Many of its features are of particular interest to the A.F.S., and I feel sure that Auxiliaries will give this magazine the support it undoubtedly deserves.

J. G. Kirkup

EDITOR.



PRACTICE EXERCISE - BEDMINSTER DIVISION

December 17th, 1939

PRACTICE EXERCISES

BEDMINSTER DIVISION, DECEMBER 17th, 1939

BEDMINSTER Division of Bristol Auxiliary Fire Service combined with other A.R.P. Services in a large-scale exercise at Ashton Gate on December 17th. For the purpose of the exercise it was assumed that the North Somerset Electric Light Company's building, brick kiln, etc., represented an Explosives Factory. A three-storey structure (" Uncle Tom's Cabin ") was erected by the A.F.S. on a stretch of low-lying country at the rear of the factory to represent the Manager's office and dwelling house.

Operations commenced at 10 a.m., when it was reported that H.E. bombs had been dropped on the Explosives Factory during an air raid, one of which had fallen on the Cordite Storage Hut, detonating the cordite and wrecking buildings. Another bomb had fallen near the Manager's office, which was unsafe and in risk of fire.

First on the scene were two pump units from Ashton Gate Auxiliary Fire Station, who carried out rescue work from the Manager's house, using jumping sheet, life line and ladder. The structure was then fired by (practice) incendiary bombs,the blazing inferno which quickly resulted vividly illustrating the fierce inflammatory properties of this type of bomb. This incident provided the main purpose of the exercise, namely, relay pumping from Cumberland Basin.

Pump units were ordered to their various stations by Divisional Officer Duggan, who was in charge of all fire operations. At Cumberland Basin a heavy pump (Tangye) was stationed, and water relayed by four lines of hose *via* the bridge to the first large pump (Coventry Climax) in Ashton Avenue. Thence three lines of hose were run out to the end of the Avenue, where a collecting breeching was used to take two lines down an embankment and across the railway (for this purpose the lengths of hose were threaded beneath the metals). The second large pump was situated in the Whitening Yard some 200 yards from the scene of the incident. Water was delivered from this unit to two light pumps (Coventry Climax), the final stage of the relay. From one of these light pumps two lengths of hose were run out to a dividing breeching, giving two deliveries (one length each). A single delivery of three lengths was taken from the other. Some difficulty was experienced on account of the difficult nature of the terrain, but it was not long before three effective jets were brought to play on the blazing building and the fire quickly extinguished. During this relay the Tangye at the dock registered an output pressure of 120-125 lb. per square inch with a 14 ft. lift. The first large pump registered 150 lb. (approx. 25 lb. reserve), and the second 80-85 lb. with a reserve of from 5-10 lb. Each of the light pumps averaged 75-80 lb., and $\frac{3}{4}$ inch nozzles were used at the branches. The total distance of the relay was approximately one mile, and altogether 200 lengths of hose were used.

Two other incidents were also staged. In the first it was assumed that oil tanks in the vicinity had been fired by sparks. A light pump unit from Hemplow House Station arrived on the scene eight minutes after receiving the call and immediately got to work using a foam branchpipe and water from a brook. Within two minutes the oil fire was put out—an exceedingly smart performance.

The second incident was a burning rubber dump, and this fire was quickly got under control by another light pump unit that also obtained water from the brook.

This exercise provided a severe test under realistic conditions for all branches of A.R.P. concerned. Considerable practical experience was gained and, in spite of bitterly cold weather, everyone taking part thoroughly enjoyed the experience.

AVONMOUTH SUB-DIVISION, JANUARY 7th, 1940

The ruined Munitions Factory on Chittening Estate, Avonmouth, was the scene of an important A.R.P. Exercise on January 7th, 1940. The assumption was that air raids had been made on the factory, H.E., gas and incendiary bombs being dropped. Avonmouth Sub-Division of Bristol Auxiliary Fire Service, under the supervision of Divisional Officer Aldridge, combined with other Services in this exercise, which was carried out under extremely realistic conditions. Part of the factory—a relic of the Great War—had been gutted by fire in April, 1938, and charred debris and twisted girders were everywhere in evidence.

In the first raid it was assumed that an H.E. bomb had caused severe damage to part of the factory on the north side of Smoke Lane. One building was demolished and casualties were trapped under the wreckage. First on the scene was a Heavy Rescue Party, which released those who were buried beneath the debris. First Aid Parties and Ambulance units also arrived and attended to the injured, and a First Aid Post was established near the scene of the incident. An unexploded H.E. bomb was also discovered and a protective wall of sandbags built around it by the Demolition Squad.

Another raid occurred shortly after the first. Incendiary bombs were dropped on the site of the previous raid, setting fire to the building, also a mustard gas bomb, which fell some 150 yards to the west.

Within six minutes of receiving the call, a trailer pump unit arrived at the end of an overgrown track leading to the burning building. From this point the pump was manhandled a distance of over 200 yards and got to work as a first aid measure from a rhine at Greensplott Farm. Two lines of hose (three lengths each) were run out from the pump to a collecting breeching ; three lengths and branch. An effective fire jet was directed into the fire (indicated by a smoke bomb) eight minutes from the time of arrival—a smart performance, considering the difficult nature of the ground and the fact that the crew were working in respirators. The pump registered a pressure of 70 lb. (estimated reserve 30 lb.) with a 4 feet lift and $\frac{5}{8}$ in. nozzle.

Meanwhile 4 light trailer pump units had arrived from Avonmouth and, after crossing the hose from the first unit by means of ramps, two of these proceeded to the northern extremity of the factory. Difficult conditions were again encountered, and the pumps had to be manhandled some distance over a rough undulating surface before reaching Stuppill Rhine, the source of water supply for the relay. From each pump two lines of hose were run out a distance of approximately 400 yards (48 lengths in four lines of 12) to the collecting heads of the other two trailer pumps, which had been drawn up 150 yards from the fire. Single deliveries, each comprising 12 lengths of hose, were then taken from these pumps, and two effective jets ($\frac{5}{8}$ in. nozzles) were directed into the building 17 minutes from the time when the four units arrived on the scene. With a lift of 6 ft., both pumps at Stuppill Rhine gave an average output pressure of 100 lb. per sq. inch, each of the booster pumps registering 150 lb., with a reserve of approximately 20. The total distance of the relay was about 550 yards.

Although not on quite so large a scale as the Bedminster operations, this exercise was especially interesting as it demonstrated the practicability of relaying water considerable distances by light pump units only. Also, the mobility of this type of pump under difficult conditions was effectively illustrated, the crews taking part gaining practical experience of this somewhat tricky procedure.

PUMPS AND PRIMING

(This article is published by kind permission of the Home Office)

THE work done by a fire pump can be divided into two distinct parts : (*a*) the suction, and (*b*) the delivery.

Suction Lift

When a pump has to work from static water at a level below the suction inlet, the depth from which it can draw water is limited by atmospheric conditions, as a vacuum has to be created in the pump and suction hose. To understand why water is lifted in such a manner it is first necessary to appreciate the real meaning of the term " vacuum," which for our purpose is a space from which air has been exhausted by means of a priming device, such as an air pump, or exhauster.

In order to create a vacuum it is essential for the pump and suction hose to be air-tight. If this is not the case water cannot be lifted to the pump. The most usual places where the air is inadvertently permitted to enter either the pump or unsubmerged suction hose are :—

(*a*) A defective pump, or badly packed glands.
(*b*) Cooling water system cock or drain cock left open.
(*c*) Suction couplings not tight, or faulty or missing washers.
(*d*) Suction strainer not being sufficiently submerged under the surface of the water.

It is known that the weight of the air produces a pressure around us, which is approximately 14.7 lb. per square inch (varying according to barometric pressure). When this pressure is reduced in a vessel, such as a pump interior or a pipe, by exhausting some of the air, it is said to be " under a partial vacuum." It is also known that if there is an opening in the vessel in direct connection with the atmosphere, air is pushed through the opening into the vessel by atmospheric pressure.

Let us assume that the air pump or exhauster is set to work with the end of the suction hose placed under the surface of static or open water. Under such conditions the air cannot rush straight into the suction hose or pump, but has to push the water in front of it into the suction hose. If the air pressure in the pump and suction hose is reduced sufficiently or, as we say, " the vacuum is high enough," the water will be pushed right up the suction hose into the pump itself.

A column of water 1 square inch in area and 34 feet high weighs 14.7 lb.—the same weight as the pressure exerted per square inch by the atmosphere. Therefore the pressure of the atmosphere will counterbalance or support a column of water 34 feet in height in a vertical pipe, providing there is *no pressure on the top of the column of water :* that is to say, there is a " perfect vacuum " at the top. This means that as the pressure of the air is not more than 14.7 lb. per square inch, even with a perfect vacuum (which for various practical reasons cannot be obtained) water cannot be lifted on the suction side of a pump more than 34 feet.

Vacuum gauges are calibrated into 30 divisions, each division representing 1 inch of mercury. As mercury is much heavier than water a column of mercury 30 inches high produces the same pressure at its base as a column of water approximately 34 feet high, and also counterbalances atmospheric pressure. It will, therefore, be appreciated that the readings on a vacuum gauge serve to indicate the height of the suction lift, *but these conditions only apply when the pump is being primed :* when the pump is working the pressure of the air has to overcome the frictional resistance set up by the water passing through the suction hose, and it also has to speed up the water to a relatively high velocity in addition to forcing it up the required vertical height. As frictional resistance increases as the square of the velocity of the water, higher readings will be recorded on the vacuum gauge when large quantities of water are being pumped.

From the foregoing it will be seen that, theoretically, one inch of vacuum as shown on the vacuum gauge should enable the pressure exerted by the atmosphere to force water up a suction hose (*i.e.*, to develop a suction lift of) :

$$\frac{14.7 \times 2.3}{30} = 1.1 \text{ feet}$$

(14.7 being the weight of the atmosphere in pounds per square inch, 2.3 being the height in feet of a column of water one inch square which weighs one pound, and 30 being the height in inches of a column of mercury exerting the same pressure as the atmosphere).

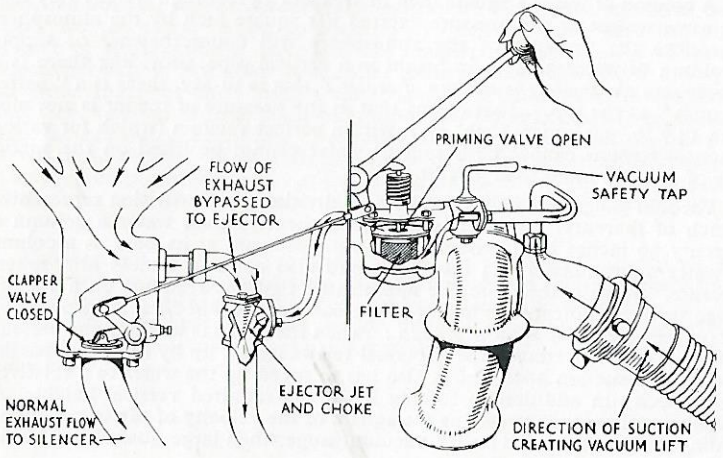
When the pump is working and water is in motion deductions have to be made from this calculation to allow for frictional resistance, but for practical purposes it can be assumed that 25 to 28 feet is a good suction lift and that approximately one inch of vacuum will be recorded for every foot of suction lift. Where there is high velocity of water in the suction hose, higher readings will be recorded.

When working at varying lifts, with varying quantities of water being pumped, it is interesting to note the following points :

(*a*) Vertical height of suction lift.
(*b*) Length of suction hose used (important because the frictional resistance is in direct proportion to length of suction hose used).
(*c*) Quantity of water passed (which can be calculated from nozzle pressures.
(*d*) Vacuum gauge reading.

Abnormally high readings indicate that a pump is being starved for water, which may be due to the suction strainer becoming choked with mud or leaves or to the presence of a foreign body in the suction eye of the pump. When abnormally high readings are observed these points should be checked up.

In this connection it is interesting to note that the smoothness of the internal bore of suction hose very materially affects the quantity of water that can be passed through, particularly at high velocities. Corrugations and roughness not only increase frictional resistance but also induce turbulance. The diameter of the bore of suction hose should be designed to carry the maximum quantity of water a pump can discharge at as low a velocity as possible, therefore the larger the suction hose the better ; but as manhandling has also to be considered, the size of the suction hose has to be kept within limits.



EXHAUST PRIMING SYSTEM

The quantity of water entering a pump through a given size suction hose is also materially affected by the height of the suction lift, because the greater the suction lift the more work the atmospheric pressure has to do ; consequently the less is the residual head of water at the inlet to the pump, and further, the frictional loss increases in direct proportion to the length of suction hose used.

When the speed of the impeller of a pump is such as would deliver more water than is being supplied to it through the suction hose, the impeller thrashes the water, causing vaporization, and " cavitation " results. These conditions may arise from an abnormally high suction lift or when the diameter of the suction hose is not sufficient to supply the required quantity of water. Cavitation is indicated by a peculiar noise in the pump and, although the revolutions of the pump impeller may be increased, there is no corresponding increase in the quantity of water discharged. Such conditions are accompanied by high vacuum readings.

Vacuum gauges usually fitted to pumps are of the compound type—that is to say, they register the vacuum created and also any pressure there may be on the suction side. Vacuum is indicated by the hand moving in an anti-clockwise direction ; positive pressure by the hand moving clockwise.

Pumps can also be got to work with a positive pressure on the suction side, such as occurs when the suction inlet is connected direct to a hydrant. Either " soft " (delivery) hose or " hard " (armoured suction) hose can be utilized for this. The former has several disadvantages as there is considerable frictional loss, and, moreover, if the quantity of water the pump is endeavouring to pass exceeds that being supplied from the standpipe, soft hose will collapse, owing to the external pressure of the atmosphere being greater than the internal pressure in the hose. It should, however, be noted that when the quantity of water available is sufficient to feed the pump there is no objection to using soft suction hose. With comparatively low pressure on mains experments have shown that much more water can be passed through " hard " suction hose than is the case with " soft " suction hose.

When working with suction hose directly connected to a pump from a hydrant it is most important to watch the compound gauge carefully. If a vacuum is shown the pump is running away from the water ; the ideal condition is to have 1 or 2 lb. pressure shown on the compound gauge.

Occasions may occur when it is necessary to draw water from a source which necessitates the suction hose being taken over a parapet or the side of a large dam. In such cases the suction hose may be above the level of the suction inlet of the pump, and a quantity of air may be locked in the uppermost part of the bend, causing a restriction on the suction side of the pump and a consequent loss in quantity. There is no certain way of dispersing this air, and in all cases where it is found necessary to pump with the suction hose arranged as described above, acute bends should be avoided.

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COMPETITION

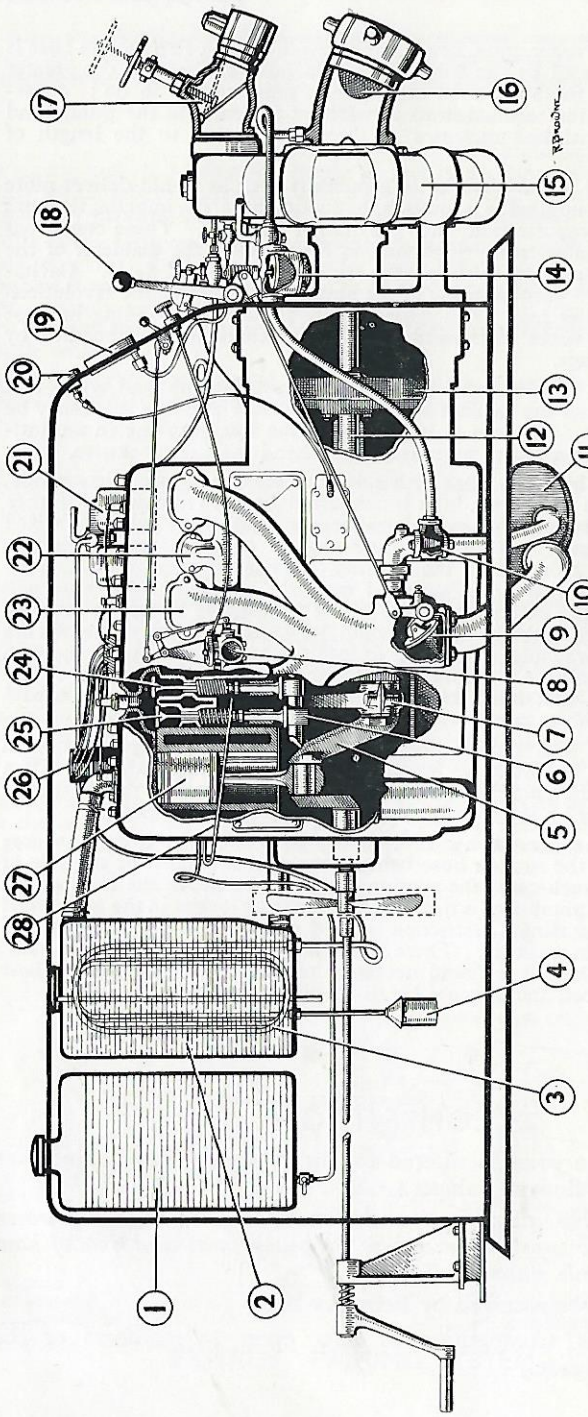
This month a prize is offered for an article (not exceeding 500 words) on the following subject :

Discuss the advantages and disadvantages of relaying water from a static supply by means of (*a*) *pump units and lines of hose and* (*b*) *mobile water carriers.*

Entries must be received by February 20th.

(NOTE.—This Competition is also open to members of the Regular Fire Brigade.)

LARGE COVENTRY CLIMAX PUMP showing Essential Parts



1—Petrol Tank.
2—Water Tank.
3—Cooling Coil fed from Pump.
4—Anti-splash Discharge from Water-cooling Coil.
5—Crankshaft.
6—Camshaft.
7—Big end.
8—Air Intake to Carburettor.
9—Clack Valve, lowered to bye-pass exhaust when priming.
10—Venturi Tube.
11—Silencer.
12—Main Bearing.
13—Flywheel.
14—Priming Valve & Strainer.
15—Rotor Casing.
16—Internal Suction Strainer.
17—Delivery Valve.
18—Priming Lever.
19—Delivery Gauge.
20—Oil Gauge.
21—Two-way Filter for Cooling Coil.
22—Induction Manifold.
23—Exhaust Manifold.
24—Exhaust Valve (open).
25—Inlet Valve.
26—Magneto.
27—Piston with 3 Rings.
28—Feed to Carburettor from Petrol Pump.

COVENTRY CLIMAX

LARGE TRAILER PUMP (500 G.P.M.)

By Transport Officer Powell

THIS unit has a 20 h.p. engine, developing a maximum of 75 h.p. at 3,000 revs. per minute. It is made with a cylinder bore of 90 millimetres and a stroke of 130 millimetres, aluminium pistons, and conforms to the general type of car engine, except that a horse power of twenty is now somewhat unusual in a car engine.

As with the Coventry Climax light pump unit, it has a Solex carburettor fitted with a governor or " over speed " device, and a magneto equipped with an impulse starter for easy starting. The firing order is unusual, namely, 1—2—4—3, counting number one as being nearest the starting handle. Petrol tank capacity 12 gallons, and this engine uses about two-and-a-half gallons per hour on full load.

Cooling tank holds 12 gallons of water, and this model is also furnished with a coil of pipe in the cooling tank fed with water from the main pump. This system is known as the indirect type of cooling (see diagram). There is also a pump in the closed water circulating system of the engine ; this is used for circulating the water in the cooling tank around the engine water jackets.

A petrol pump with a hand priming lever is also fitted to this model. To use this, depress the lever to its fullest extent and allow the lever to spring back ; this should be done about half-a-dozen times.

In starting the engine—*switch on first*—pull choke—see that throttle is closed. Do not turn the engine over several times with the choke out and the ignition switch off, as this practice tends to flood the cylinders with petrol, thereby washing the oil away from the cylinders and pistons, also giving an over-rich mixture which will not ignite when the switch is turned on ; it also has a tendency to " seize up " the engine owing to the absence of oil around the pistons.

The pump is of the centrifugal type (as is usual on most modern fire engines) and has a rotor or impeller which collects water in the centre and is fitted with curved blades by means of which the water is thrown to the outer edge of the casing by centrifugal force, and then forced through the delivery outlet. The pump shaft in this type has a ball race fitted. The usual type of exhaust priming is employed to produce a vacuum in the pump casing (see diagram opposite). When priming with this pump watch the delivery pressure gauge and, when it shows a pressure of about 50 lb., release the priming lever. Do not watch the vacuum gauge as this will show a reading immediately the priming lever is depressed, giving the impression that water has been obtained when actually such is not the case.

To return to the cooling tank, twelve gallons is sufficient to run the engine for fifteen minutes without water from the main pump passing through the coil. If all the water has been drained from the engine do not run for more than three minutes, and then on no account fill the cooling system with water until you are sure the engine has cooled down, as there is a possibility of cracking the cylinder block.

When draining the main water pump, do not omit the filters, which on some models are fitted on the inter-cooling system. This dual filter has either a tap *under* each filter or else a small plug, and it is most important that the tap, if fitted, should be turned on to allow the water to drain from each filter body, or the small plugs should be taken out for the same purpose.

With a 10-ft. lift through 30 ft. of 4-in. suction hose at 80 lb. pressure, the pump delivers 540 g.p.m. at 80 lb. to the square inch, 510 g.p.m. at 100 lb., 460 g.p.m. at 120 lb., 400 g.p.m. at 140 lb., and 340 at 160 lb.

Fireside Corner

CAN YOU LIGHT A FIRE ?

Success largely depends on using dry sticks, small pieces of coal, and preventing the fuel falling flat before it has a chance to get well alight. If you are using sticks (which must not be too thick), it is a good plan to arrange them pyramid fashion around two or three balls of newspaper. Small pieces of coal are then built up against this pyramid on all sides ; large lumps should only be added when the fire is well alight.

Sheets of newspaper rolled tightly and tied in a knot are a good substitute for sticks.

DO YOU KNOW THIS GAME ?

For any number of players over three. Each draws a square 2 in. by 2 in. divided up into 25 small squares.

First player names a letter of the alphabet, which must be entered in any one of the small squares by each player. Second player calls out another letter (which may or may not be the same as the first), and this must also be put down in one of the small squares.

Game continues in this manner until each of the 25 squares has been filled. Object is to form five-letter words down and across (as in a crossword puzzle), and the player with the most words wins—Hindustani and Chinese not accepted !

Try it—and let us know if you score 10 !

FUEL ECONOMY

Soak newspapers in water, squeeze into large balls and allow to dry. Pack several on a good fire, cover with coal dust and sprinkle with water ; this will keep in a fire for the evening.

Alternatively, make a good fire and almost smother it with coal dust upon which a few cupfuls of water have been poured.

BAKE YOUR BATTERIES

If your battery has run down, try baking it in the oven or standing in front of a fire. This will sometimes give it an extra lease of life and probably prevent your trying conclusions with a lamp-post.

PROBE INTO THESE PROBLEMS WITH YOUR PRICKER BAR

1 Who wrote "God Save the King " ?

2 What language is spoken by the greatest number of people ? (excluding bad language.)

3 Which is the longest canal, the Kiel or the Suez ?

4 Where does the world's largest supply of gold come from ?

5 What is the proportion of land to water on the earth ?

6 Which of the following were leap years, 1800 or 1900 ?

7 What is the maximum temperature ever recorded in Great Britain ?

8 What is the most frequently used letter in the English alphabet ?

9 Which is the brightest star we see ?

10 How are the colours arranged in the R.A.F. wing marking (beginning from the middle) ?

(*Answers on page* 53.)

A.F.S. KNITTING PARTIES.

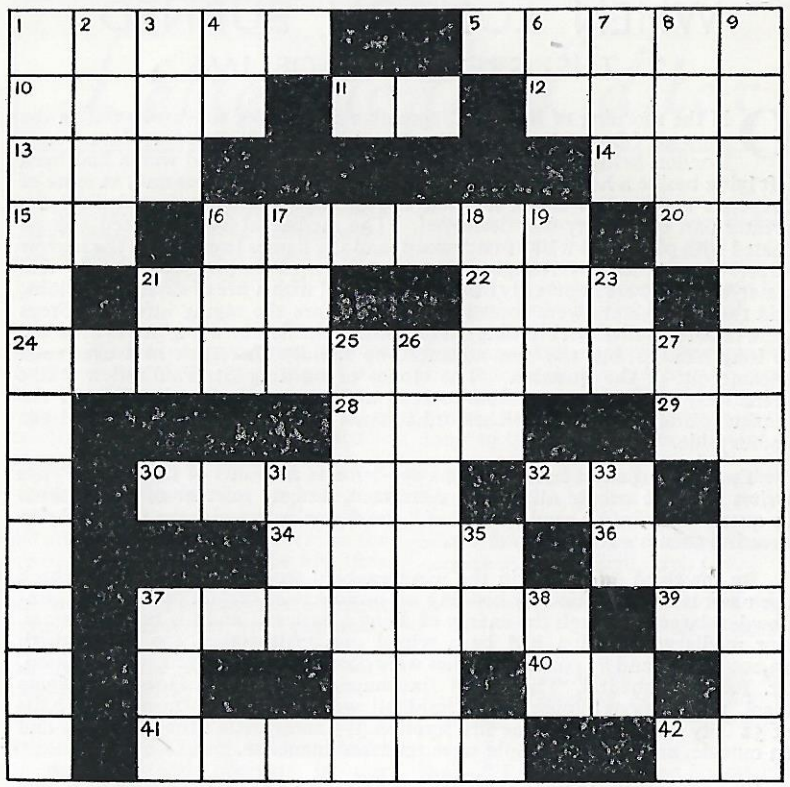
Requests for woollen garments which are urgently required by our troops have appeared in the press, and a number of knitting parties have been established.

Mrs. J. Y. Kirkup is anxious to form similar parties in the A.F.S. It is proposed that these parties be held one afternoon a week at Auxiliary Fire Stations where accommodation is available. All wool would be provided, together with a cup of tea and biscuits—and there might even be an opportunity for a chat !

One very successful party has already been formed, and it is hoped that every Station will endeavour to make this scheme an unqualified success.

Names of volunteers—WAFS, wives of Auxiliaries and friends—should be handed in to the station officer, and these should be forwarded to Chief Inspector Kirkup.

A.F.S. CROSSWORD



ACROSS

1—This cuts off the air.
5—Cause of many a fire.
10—You stop here.
11—In charge of Exercises.
12—Airman's sweetmeat.
13—Assistance, but not necessarily first.
14—Canute tried to do this.
15—This spells trouble with the addition of an A.
16—WAFS stop this with soap.
20—Us.
21—Atmospheric clue to 15.
22—Supplementary water supply.
24—Sometimes attacked with a cellar branch.
28—Four letters begin thus.
29—Reverse this for biscuits.
30—You should experience this when you hear the fire bell.
32—One white ring.
34—Also 31 down.
36—Be careful in the " black-out " or you may finish up here.
37—After the fire.
39—But not esquire.
40—Here we are.
41—This'll make 'em glisten.
42—On the pillar boxes.

DOWN

1—These will let you down lightly.
2—Never lose this at a fire.
3—These appliances are used for practice.
4—" K, k, k——, Beautiful——."
6—To keep off raiders.
7—Everything stops for this.
8—Without this a pump is useless.
9—Connected with the sands of time.
16—Absolutely wrong.
17—The Army does, but we don't.
18—I O him an item.
19—Part of your roof supplies a clue to this Service.
21—In the same degree.
23—Connected with the medical profession.
25—These are generally narrow.
26—Oxide which is used as an anaesthetic.
27—Correct abbreviation.
31—A crack in the air.
33—Entitled to the old school tie.
35—Busy man in an air raid.
37—Common, but incorrect, abbreviation of the Service.
38—Once upon a time militia, yeomanry and volunteers.

(*Solution will appear next month*)

WHEN LONDON BURNED

THE GREAT FIRE OF 1666

ON the morning of Sunday, September 2nd, 1666, fire broke out in the shop of Master Farryner, the King's baker, in Pudding Lane, near London Bridge. The cause was some faggots of wood which had been left lying beside a hot oven. A strong wind fanned the flames and, in spite of desperate attempts to check its progress, the fire gradually spread until the greater part of the city was destroyed. The mediaeval half-timbered houses, coated with pitch, burnt like matchwood, and the flames leapt across the narrow streets from their overhanging upper storeys. Primitive fire-squirts and water-buckets were hopelessly inadequate to deal with a fire of such dimensions, and the fire-fighters were forced to retreat before the raging inferno. Steps were taken to pull down buildings in the path of the flames, using hooks attached to long handles, but the fire advanced so rapidly that such measures soon became out of the question. The stones of burning St. Paul's flew "like grenadoes," and it was possible to read at Westminster by the light of the blazing cathedral. The stricken inhabitants crowded to the river and the countryside.

Two great diarists have given us eye-witness accounts of the fire. Pepys writes of "the people all almost distracted, and no manner of means used to quench the fire"; and Evelyn of "the dismal spectacle, the whole city in dreadful flames over the waterside."

By the third day a lull in the wind enabled troops and citizens to check the terrible conflagration by blowing up buildings at certain points with gunpowder, largely through the energy of King Charles II and his brother James. But mediaeval London had been wiped out. Altogether 400 streets with 13,200 houses and 87 parish churches were completely destroyed. In addition, St. Paul's Cathedral, The Royal Exchange, the Custom House, Newgate Gaol, the Sessions House and Guildhall were burned down, and the halls of 52 City Companies. The fire levelled 373 acres within the city walls and 63 outside, and 200,000 people were rendered homeless.

The spot where the conflagration ended is marked by the figure of a boy at Pye Corner and can still be seen. The Monument, which stands 200 feet from the site of the ill-fated baker's shop, was designed by Wren and erected in 1677.

In the course of rebuilding various improvements were made in the way of new streets, and brick and stone took the place of timber and plaster as construction materials. Unfortunately no attention was paid to a far-sighted town-planning scheme by Sir Christopher Wren, which would have solved many of London's present-day traffic problems. Had this plan been adopted, London would have risen (to quote Wren's own words) "with that beauty by the straightness and regularity of buildings and convenience for commerce, by the well disposing of the streets and public places and the opening of wharfes, etc., which the excellent situation, wealth and grandeur of the metropolis of England doth justly deserve." All efforts for a logical reconstruction proved fruitless and in their own interests people were allowed to develop new building schemes in a most unexpected manner.

There is no doubt that the Great Fire brought about the revolution of fire-fighting. Many people devoted their energies to discovering new methods for extinguishing flames and paved the way to the invention of the first fire engine.

Letters to the Editor

(All Correspondence in connection with this Magazine should be addressed to The Editor, A.F.S. Headquarters, Rupert Street, Bristol, 1.)

SIR,—"Whilst congratulating you on the fine issue of *The Jet*, may I also draw your attention to the omission of a subject which lies very close to all of us. It is that of a religious article being inserted in the magazine.

Many Auxiliaries are deprived of attending their usual places of worship, and from being active members in the life of their Churches, for the first time in their lives. This, of course, being due to the fact of Sunday and all-night duty. That they are still extremely interested in the work for Christ is evidenced by the talks I have had with many of my colleagues.

May I respectfully suggest that articles by our Church leaders would be welcome and popular in our magazine, possibly leading to discussion circles being formed, and so deepening the existing fellowship amongst the men of the Service. A/F 2146.

(This matter is receiving consideration. —EDITOR)

SIR,—"With the knowledge that a dance band is being formed in the A.F.S., may I suggest that the more serious musicians be given a chance. Nothing so ambitious as a symphony orchestra, but a brass band is what I have in mind.

I am quite sure that, with the number of instrumentalists available in the A.F.S., this would not be out of the question, and a band worthy of the Service could be established.

P/O VICKERY.

(The possibilities of forming such a band are being considered.—EDITOR)

SIR—"Now that the majority of stations seem to be settling down in new quarters and table tennis, darts and skittles teams, etc., are being formed, it seems a good chance for a competition with perhaps a small prize. I say a small one, because the honour of being top station, say for one month or two months as the case may be, would be ample reward. This idea can be greatly enlarged upon, there being no limit to the opportunities provided.

The possibility might arise, when a team or teams, picked from all stations in Bristol, would play other towns. It would be fine to see Bristol beat all comers in pump drill, etc.

Now then, stations, what about it?

A/F 1808.

(Other letters on this subject have also been received, but space does not permit their publication.—EDITOR)

SIR,—"I think the earliest opportunity should be taken to express the appreciation of the A.F.S. to the 'Regulars.'

During training and since hostilities commenced, we have been swarming about the 'holy of holies,' and could have been the butt of many sarcastic remarks, but the way in which they have received us is deserving of the highest praise. Not once have I seen any display of superiority or trace of impatience on their part, and at fires they are helpful and informative.

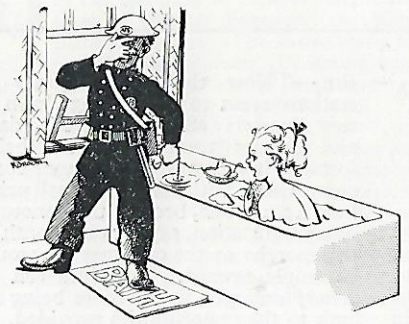
I am sure the majority of the A.F.S. will agree with me that the 'Regulars' are really decent fellows, and form a Brigade which is second to none, and we shouldn't grumble at having to just shovel up the soot and make up the hose.

As I can hear, 'Hullo, somebody's after stripes,' I will just sign myself

APPRECIATION."

(Many thanks.—EDITOR)

And Yet I don't know—



Orders is orders—I've been told to draw the plug.

Teacher : " Now put up your hands all boys who want to go to Heaven."

All hands were raised except Tom's.

Teacher : " Don't you want to go to Heaven, Tom ? "

Tom : " Not with that mob."

* * *

" I can't understand how you manage to keep so calm whatever happens ? "

" Oh well it's just a matter of training. You see, I've a wife, five children, two dogs and a cigarette lighter."

Schoolmaster : " Correct this sentence—'Before any damage could be done the fire was put out by the Auxiliary Fire Service.' "

Boy : " The fire was put out before any damage could be done by the Auxiliary Fire Service." —*Daily Mirror.*

* * *

Policeman : " How did you come to knock him down ? "

Motorist : " I didn't. I pulled up to let him get across and he was so surprised he fainted."

There must be some way of getting it in.

Methinks, if the world had fewer gas-bags it would need fewer gas-masks.—F. Murray Milne.

An Auxiliary Fireman took his pumps to a dance, but there wasn't a fire.

* * *

Answer to Medical Query : " No, the stirrup handpump cannot be used as a stomach pump."

* * *

An Auxiliary Fireman entered a cafe and asked for coffee without milk.

After a few minutes the waitress returned and said : " Will you have your coffee without cream, we are short of milk."

Two minutes fifteen seconds—not a bad turnout.

The one advantage of always speaking the truth is that you never have to remember what you said last time.—*Ian Hay.*

Cook : "And what will you have to follow chum ? "

A/F (morbidly) " Indigestion, I expect."

* * *

Old Lady (watching a cricket match) : " What a clever bowler. He hits the bat every time."

* * *

Two Turks met in a cafe in Istanbul.

1st Turk : " I don't know your name, but the fez seems familiar."

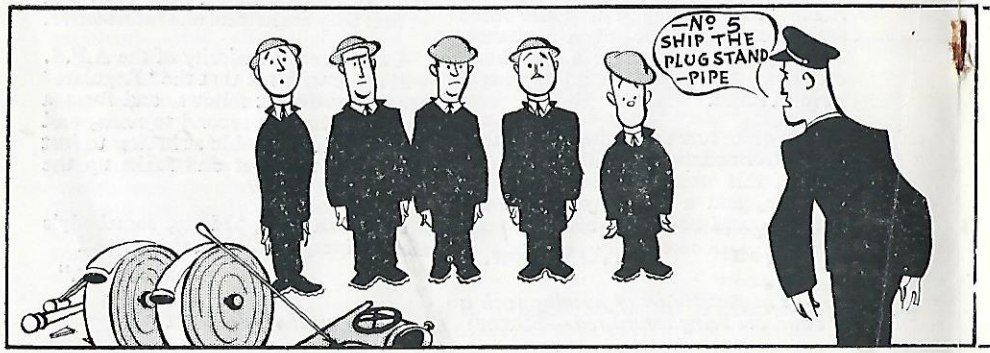
* * *

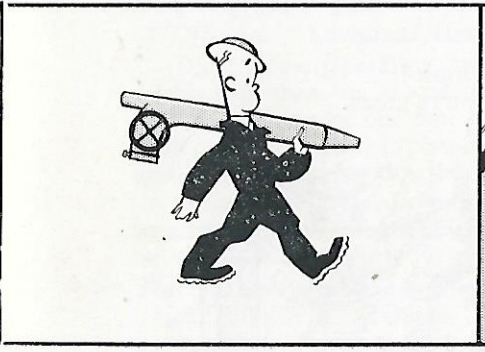
The story of La Pompadour proveth that a cat may not only look at a King but may also sleep with him.

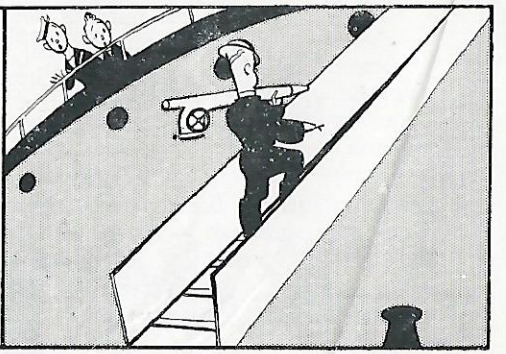
F. Murray Milne

ADVENTURES OF "SMOKEY"

By Allan Baird







"ALL FRIENDS, SIR!"

By Mervyn Millward

"One of the happiest features in connection with National Service is the excellent relationship which exists between the regular and the auxiliary bodies. The regular fire brigades, for example, work in complete harmony with their 'amateur' colleagues and are affording them every opportunity of acquiring a sound knowledge of practical fire-fighting."—(extract from newspaper article.)

WHEN standpipe (plug) has to be shipped
Have regular firemen cursed
Because the A.F.S. have slipped
Along and got there first?

Of course not! Why they're always pleased
To find the lads are quicker.
They act just like a kindly dad
And let *them* wield the "pricker"!

They let them carry all the gear
And make up all the hose,
Manhandle pumps and fetch the beer
And goodness only knows.

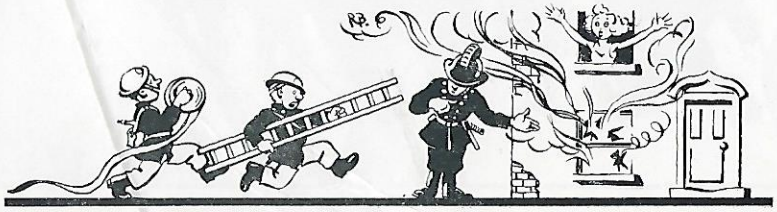
How many other kindly acts
They do for "amateurs."
And this (it's obvious from the facts)
A comradeship ensures.

When ladies of uncertain age
Stand faint, afraid and weak
Amid the flames that roar and rage,
And cry and yell and shriek,

The regular fireman stands aside
And, with a courtly bow,
Says:—"Now then, George, you've had a ride,
Jump off and show them how."

But when a charming little maid
Is trapped amid the roar
And stands, with tear-dimmed eyes, afraid
To cross the burning floor

The A.F.S. are never seen.
Where are they? Prithee hush!
You ought to know—unless you're green.
Why, trampled in the rush!



MALPRACTICE EXERCISE

By P/O C. K. Ashman

THERE is a story going round of the station officer who, being anxious that at all times his men were on the alert for fire calls, surpassed himself in his endeavour to be assured that they could get away promptly under all circumstances. The following story contains an element of truth.

It was the practice on the station concerned to give test calls at odd times, advising the driver of No. 1 pump crew and the watchroom duty man of the fact so that they would not get away from the station without further instructions. Under these conditions the turnouts were highly satisfactory, so much so that it seemed probable that the station personnel were all being tipped off by these two gentlemen!

Now there happens to be a telephone quite near the station which seemed to open up possibilities in the direction of overcoming this difficulty. The officer in question therefore proceeded to the said telephone and put a call through to the watchroom to the effect that there was a large fire at a well-known danger spot on the patrol. He did not give any further information, but hung up before his watchroom duty man had time to enquire who was giving the call and any further particulars, and hurried back to his station—just in time to see his first pump crew disappearing round the corner! This was bad enough, but not really serious; the worst was still to come. He proceeded to the watchroom to compliment the duty man on taking no chances in spite of the scanty nature of the information he had received.

Officer: "That's the way to turn 'em out."

Duty Man (rather puzzled): "I've had a call of fire and have had to send the first pump crew away without you. The call came by telephone, and the person giving the call seemed excited and hung up without giving all the details. From what I gathered we have a serious fire on hand."

Officer: "That's all right—I gave the call—they got away smarter than I expected."

Duty Man (enlightenment dawning): "Oh! Well, I don't know what you are going to do about it, but Divisional Headquarters wish to speak to you."

Officer: "Divisional Headquarters, whatever for?"

Duty Man (sparkling with efficiency). "Well, of course, I telephoned them in accordance with official instructions, advising of the departure of our No. 1 pump crew. I thought they seemed rather doubtful when I 'phoned them, but they are taking no chances and have all men standing by."

Officer takes receiver rather tremulously, and perhaps it would be advisable to draw a veil over the remainder of the scene. It would be sufficient to say that he now evades the Divisional Officer's eye!

This is the prize-winning entry for last month's Competition for which P/O C. K. Ashman (141), *Hospital A.F.S. No. 3, will be awarded half-a-guinea.*

(For particulars of this month's Competition, turn to page 35.)

· Sport & Social ·

CENTRAL.—A.F.S. Headquarters "Do" on Dec. 20th went with a bang from start to finish. The programme, compered by A/F Woodberry, consisted of a short play, songs and instrumental turns and community singing. Mrs. Tribe charmed everyone with her singing and items by A/F Boyce, Press, Godfrey and Manning met with much approval. After a brief, but much appreciated, speech by Chief Inspector Kirkup, a very jolly evening concluded with "Auld Lang Syne."

Bristol North Sub-Station held its first Smoking Concert and Supper at the Station on Dec. 30th, 1939.

The guests of honour included Chief Inspector Kirkup, D/O Osborn and Part Time D/O Pegg, and the whole time personnel.

An entertainment followed, including items by "The Two Jets" (A/F Crease and A/F Anderson), A/F Poole (tenor), Bert Gillette and his boys, Fred Cook and various other artists. Compere was A/F Ludgate.

A Christmas Party was held at Trinity Road Station on Dec. 28th. Sketches, monologues and vocal items were features of the evening, and everyone present enjoyed the music of Auxiliary Fireman Thomson and his "Swingsters." The party was honoured with the presence of D/O Osborn.

Association Football.—A match was played against Redland "B" Platoon on Jan. 3rd, on the Downs, resulting in a win for Central by 3 goals to 2.

January 10th, Central Division los by 3 goals to 1 against North Bristol.

Table Tennis.—On Jan. 3rd Fire Constable Gibson skippered a team of "Regulars" against the Central A.F.S. Manners and Saunders gained "Possibles," paving the way to the Auxiliaries' eventual success by 14 games to 11.

REDLAND—D.H.Q. held their Christmas Party on Dec. 28th. The evening began with dancing, Bert Gillette and his boys providing the music. Guest artist was Randolph Sutton, whose songs tickled everyone's fancy. A clever conjuring act was also given by A/F Downes.

Association Football.—A team from this Division played A.A. Signals, Clifton, on Dec. 20th, the result being a win for the Army by 4 goals to 3. Redland also lost the return match on January 10th, by 5 goals to 3.

Horfield A.F.S. were played on Jan. 13th, on the Downs, resulting in a win for Redland by 8 goals to 3.

Any challenge? "B" Platoon, Redland D.H.Q., are throwing out an open challenge to all comers. They have succeeded in raising a team from their platoon, and would like to meet a team of Auxiliaries on the same platoon from another station.

This team gave a good account of itself against Central on Jan. 3rd, and are not ashamed to report their defeat by 3 goals to 1.

Table Tennis.—A team from the Division played the "Regulars" on Jan. 19th at Bridewell. Unfortunately the match had to be abandoned owing to a fire call being received, but not before an A.F.S. victory had been assured.

Whiteladies Station (No. 16) staged a very successful Christmas Party on Dec. 27th. Games, competitions, etc., kept everyone busy until 10 p.m., when a halt was called for supper.

A fitting climax was provided when a fire call was received at 11.25 p.m.

Table Tennis.—A team from "B" Platoon, Redland D.H.Q., visited Whiteladies on Jan. 16th. The visitors succeeded in winning 16 out of a possible 25 games.

Berkeley Square (No. 17).—Another of this Station's exceedingly enjoyable Dances, in aid of Bristol's Own Fund, has been arranged for Monday, Feb. 26th (7.30—1.0), at the Berkeley Cafe. Freddy Williamson's Band, with Santos Casani M.C. Tickets, price 2/6, can be obtained

from Headquarters or any Station in the Redland Division. Lounge suits.

Billiards and Snooker.—A team from Redland D.H.Q. ("A" Platoon) visited this Station on Jan. 15th, and returned victorious in both games.

Southmead (No. 29). — Auxiliary Firemen from this Station spent a very enjoyable evening at a concert given at the Hospital by E.N.S.A. Concert Party on Jan. 18th.

BEDMINSTER.— The first Divisional Dance was held on Dec. 27th, at Wills Hall, Charlotte Street. Among the large number of guests present were Chief Inspector and Mrs. Kirkup, together with all the Divisional Officers.

Music was provided by Freddie Downs and his Commanders.

By request, a Repeat Dance will be held at Wills Hall on Wednesday, Feb. 14th, 7.30 to midnight. Tickets 1/3. Lounge suits. Come to Bedminster and enjoy yourself!

Auxiliaries at Bedminster D.H.Q. held their Christmas Party on Jan. 6th, and an excellent entertainment was provided.

D/O Duggan thanked Supt. A. W. Williamson, Chief Inspector Kirkup, Inspector H. Horton, and their wives, in addition to Divisional Officers of the A.F.S. and members of the Regular Brigade, for their presence, and extended seasonable greetings to all. Supt. A. W. Williamson and Chief Inspector Kirkup suitably replied.

Afterwards the men were entertained to tea, followed by dancing, etc.

Skittles.—A match between Bedminster D.H.Q. and Messrs. Ferris and Co. resulted in a victory for the latter by 4 pins.

Chief Inspector Kirkup and Mrs. Kirkup were guests of honour at a Christmas Party held at South Central Station (No. 12), Bedminster Down, on Dec. 23rd. D/O Duggan, Sergt. Cains and other Officers from the Bedminster Division were also present.

Each child received a present, and entertainments were provided.

This Station has now formed a Sports Club, and desires to challenge any other station at Skittles, Darts, etc.

St. Anne's A.F.S. (No. 14) Christmas Party, held on Jan. 9th, was presided over by the Rev. Smart, Vicar of St. Anne's Church.

After tea musical items were rendered by the Station Piano Accordion Band, and also a number of variety items.

Father Christmas arrived during the evening, and children and wives were given presents from the Christmas tree.

Bristol Motor Co. (No. 9) Station attended a Social Evening at Ashton Gate Methodist Church on Dec. 13th.

Members of the A.F.S. were thanked for their part in the entertainment by Mr. F. Dusley, President of the organization, and A/F Truman suitably responded. Supper was then served and a very sociable evening ended with a sing song.

Henly's, Victoria Street (No. 2) held their Christmas Party on Jan. 13th, over 200 being present. A cabaret show was introduced through the courtesy of Miss Ruxton of Stapleton Road. Many other talented items were given, and the whole company, which included D/O Duggan, S/O's Stallard, Powell and Nutt, expressed the popular opinion that the show was a real credit to the A.F.S.

ST. GEORGE. — Skittles. — This Division met the Police (D Division) on Jan. 11th. After an exciting game the Auxiliaries lost by 41 pins.

Lysaghts Station (No. 20) organized a successful Social Dance at Catholic Hill, Trinity Street, on Dec. 29th.

On Jan. 27th, 1940, a Carnival Dance was held at All Hallows Hall, Easton Road, which was also a great success.

This Station met Hemplow House at both table tennis and skittles on Jan. 3rd. H.H. were beaten by 24 games to 1 and 36 pins.

On Jan. 4th, Eastville Sub-Station challenged Lysaghts to table tennis and skittles. Lysaghts won by 22 games to 2 and 39 pins.

Eastville Station (No. 21) held a Christmas Party at St. Thomas' Parish Hall. Gifts were distributed to the children, and the company, which numbered over 200, was entertained by Mr. Percy Upton's concert party.

Fishponds Station (No. 22) held a highly successful Children's Party on Jan. 6th. Approximately 70 children and parents attended and were entertained with games, singing, musical and conjuring items.

(The Editor regrets that, owing to the limited space available, it has been impossible to include reports of social and sporting events in full.)

· Your Queries ·

QUESTION.—Is a stirrup handpump a single or double-acting pump?

ANSWER.—*The Home Office pattern of stirrup handpump, which is used in the Auxiliary Fire Service, works on the bucket and plunger principle and expels water on each stroke of the plunger. On the first upward stroke of the plunger a vacuum is created in the pump barrel, and atmospheric pressure on the surface of the water opens the ball valve (which is fitted at the base of the barrel) and allows water to fill the barrel. On the downward stroke of the plunger, the inlet valve is closed by the weight of water in the barrel, and the pressure which is exerted upon the water opens the ball valve (which is fitted in the pump plunger) and allows the water to pass through the plunger. At the same time, the plunger and rod displaces a quantity of water, roughly about half the capacity of the barrel, and expels it through the delivery hose.*

On the next upward stroke, water again enters the barrel by way of the inlet valve, and at the same time the water which is above the plunger is lifted up and expelled through the delivery.

Therefore this type of pump has two delivery flows to each suction flow, and should be termed double-acting.

QUESTION.—Why are branches and nozzles used?

ANSWER.—*A branch forms the connection between the hose and nozzle and provides a hand hold for the fireman It is tapered so as to increase the velocity of the water as it approaches the nozzle with the least possible loss of pressure due to friction.*

A nozzle is used to increase the velocity of the water up to the velocity required at the jet, and is shaped and polished inside to reduce the loss of pressure to a minimum. Small dents and abrasions in the bore of a nozzle will spoil the jet and cause it to break up very quickly.

QUESTION.—Why is celluloid so inflammable and difficult to extinguish?

ANSWER.—*Celluloid is composed mainly of cellulose, nitric acid and camphor, and is sometimes known as nitrate of cellulose. All nitrates contain a very high percentage of oxygen, and celluloid is no exception. Therefore, when celluloid is burning the heat is sufficient for it to give off a continuous supply of oxygen, which feeds the fire and makes it very difficult to extinguish. In fact, there is sufficient oxygen in its composition to enable it to burn without deriving oxygen from any outside source. Consequently it is useless to endeavour to extinguish celluloid fires by the use of ordinary extinguishers, inert gases, foam or C.T.C.,*

etc. When celluloid is burning in large quantities it is even possible for it to continue burning under water. Copious supplies of water may eventually cool the celluloid to below its ignition point, and sand, inert gases, C.T.C. or methyl-bromide will help to control the fire.

Celluloid gives off inflammable gases at quite low temperatures and ignites when it is raised to a temperature of between 310 and 360 degrees Fahrenheit without the application of a flame. Great care must be exercised when dealing with celluloid fires, as the gases given off are very poisonous, being carbon monoxide, nitric and nitrous fumes, and hydrocyanic acid, better known as prussic acid.

There is now another form of celluloid on the market which is known as cellulose acetate. This is not readily inflammable, and is used largely for the production of home cinematograph films, and also for the windows of civilian gas masks.

QUESTION.—How does the pressure gauge of a pump operate?

ANSWER.—*Attached to the inlet of the gauge is a flat copper expansion pipe (about $\frac{5}{8}$" wide and $\frac{1}{4}$" thick according to the size of the gauge) shaped like a question mark. This pipe follows round the shape of the gauge, and attached to the free end is a small arm which is joined to a pin which allows free movement to a small ratchet. The teeth of this ratchet engage with a cog-wheel at the base of the indicator spindle.*

When water enters the copper pipe the pressure tends to straighten it, causing the ratchet to revolve the cog-wheel, which automatically moves the indicator arrow around the face of the gauge.

QUESTION.—What is the cylinder attached between the suction pipe and the priming system on the F.S.M. type Light Coventry Climax Pump?

ANSWER.—*It is a water trap, and its function is to prevent water entering the venturi tube and hot exhaust pipe. When a vacuum is created, water enters the impeller casing and commences to build up pressure (which is shown on the outlet gauge). During this period water has to fill the trap before entering the pipe line above the cylinder, thus enabling the pump operator to see the reading of the outlet pressure gauge and release the priming lever before water can enter the priming system.*

At the bottom of the cylinder are drain holes which allow trapped water to run back into the suction chamber.

QUESTION.—In what order are the jacks on a pump fixed, when placing it in position for pumping?

ANSWER.—*When the pump is in the required position the front should be lowered a little. Nos. 3 and 4 then drop the rear jacks and screw them tight. Nos. 1 and 2 lift up the front of the pump as high as possible, and No. 3 drops the front jack and screws tight.*

The reason for this is that the weight of the pump is taken off the tyres and transferred to the jacks.

(*NOTE.—The Editor will welcome further queries on the above lines*)

With the W.A.F.S.

TAKING into consideration the excellence of the A.F.S. cooks, the few hints outlined in this article may be unnecessary. However, they may prove helpful to firemen who are daily dabbling in the mysteries of Mrs. Beeton's art, with varying degrees of success.

All suggestions for dishes will be very welcome. As you will realize, it is very difficult to please everyone when the menu has to be the same for all.

ROASTING MEAT.—The meat should be put in a baking tin with dripping and placed in a hot oven. After ¼ hr. the heat should be slightly lowered. The times taken for the various joints are as follows :—

Beef.—15 mins. to the lb. and 15 mins. over.
Mutton.—20 mins. to the lb. and 20 mins. over.
Pork.—25 mins. to the lb. and 25 mins. over.

STEWS.—A stew should be allowed to cook as long and as slowly as possible. As soon as the liquid has been brought to the boil, the stew should only be allowed to simmer. Always remember that a good stew should have plenty of seasoning in it—all good cooks get fat from tasting their cooking !

VEGETABLES.—Old potatoes should be put in cold salt water and, when brought to the boil, should cook for about ½—¾ hr. Green vegetables or root vegetables should be placed in boiling salt water. Greens take about ½ hr. to cook : roots about ¾ —1 hr. Potatoes and root vegetables should be cooked with the lid on the saucepan—greens with the lid off.

Each of the following recipes is intended to serve 10 people :—

SAVORY PUDDING

¾ large loaf.
3 eggs.
6 onions (previously boiled).
6 tablespoonfuls oatmeal.
9 oz. suet.
1½ tablespoonfuls sage.
salt and pepper.
¾ pint milk.

Cut up bread and soak in cold water until the crusts are soft. Drain water away and squeeze the bread as dry as possible. Chop cooked onions, add to bread with all other ingredients—last of all beaten egg and milk. Make some dripping hot in a baking tin and spread the mixture evenly in the tin. Bake in a hot oven for about one hour until crisp and brown. Cut into squares and serve with gravy.

MIXED VEGETABLE SOUP

5 lb. mixed vegetables.
5 pints water.
1 pint milk.
seasoning.

Cook the vegetables (cut up small) in the water until quite tender. Mix 3 tablespoonfuls flour with a little of the milk until there are no lumps in the mixture, add the rest of the milk. Mash the vegetables, add the milk mixture to the vegetables and liquid in pan. Bring to the boil and cook for a minute or two.

APRICOT CHARLOTTE

¾ lb. dried apricots.
9 oz. sugar.
½ large loaf.
3 oz. margarine.

Soak apricots overnight. Put alternate layers of fruit, sugar and breadcrumbs in a pie dish, making breadcrumbs the top layer. Put the margarine in small pieces on top. Bake in moderate oven, about ¾—1 hr.

DUST EXPLOSIONS

By Fire Constable Gibson, Grad. I. Fire E.

ALTHOUGH the dust explosion does not rank with the common causes of fire, yet in certain industries it presents a grave and ever present danger. That a cloud of seemingly innocuous dust is capable of causing a major catastrophe, with explosion, fire, and sometimes loss of life, is almost incomprehensible to the layman, but the history of coal-mining and flour-milling, to mention only two of the major industries exposed to the risk, is blotted with the tragedies which have been caused by the ignition of dust. Collieries have always been the greatest sufferers from this form of disaster.

The modern method of preventing dust explosions in coal mines is known as " Stone-dusting." This consists of periodically covering the roof, walls and floor of dusty " roads " in the mines with fine inert stone or clay dust so that the coal-dust is diluted with at least an equal weight of inert dust.

Other industries which are exposed to the risk of dust explosions are those where flour, grain, wool, cork, celluloid, etc., are dealt with. In modern premises elaborate systems for the extraction of dust are installed, and regulations prohibiting the use of naked lights are rigidly enforced. In spite of all precautions, however, dust explosions still occur.

Certain conditions govern the risk of dust explosions. The dust itself must be of a carbonaceous nature, and in finely-divided particles. The second condition is that absolute dryness must prevail and, lastly, there must be the means of ignition. What causes the dust to explode ? The answer is contained in the peculiar property of the dust to select the oxygen in the atmosphere and to absorb and retain it. The somewhat trite phrase " Oxygen is a supporter of combustion " is to be found in almost every elementary book on chemistry, but this scarcely describes the effect that pure oxygen has on fire. If you open the valve of an oxygen cylinder and place a lighted cigarette in the jet of gas, you will get some idea of the kind of support that oxygen gives. The cigarette burns with intense rapidity and is consumed in a flash. That a particle of dust will absorb dust is understandable, but that it should, as it were, have the power of selection and occlude only the oxygen from the atmosphere, is food for thought. Some authorities say that it is due to the greater density of oxygen as compared with the nitrogen in the atmosphere (16 as against 14). Others consider that it is due to the charge of electricity running through the cloud of dust due to the friction of the particles. Be that as it may, in the cloud of dust, each particle of which is laden with oxygen, the first condition for a dust explosion is provided. A scientist has estimated that a puff of cigarette smoke contains 4,000,000,000 particles of dust. This figure will serve to give some idea of the number of oxygen carriers contained in a large dust cloud. When the dust is ignited, the high rate of combustion caused by the reaction of the oxygen and the carbonaceous materials produces a large volume of hydrocarbon gases under high pressure ; great heat is liberated during the reaction, with the result that the gases are still further expanded. The gases are then fired by the flaming dust and the explosion follows.

In conclusion, it may be of interest to study the effect of a manufactured explosive of the liquid oxygen type. Naturally, there is a dissimilarity in conditions between an accidental explosion and a manufactured one, and there would be a difference in the effect, but note that the ingredients of each are exactly similar. The liquid oxygen explosive consists of an absorbent cartridge filled with charcoal dust, cork dust or other carbonaceous material. The cartridge is soaked in liquid oxygen until it will hold no more. The explosive is fired by detonation. Under suitable conditions, the explosion waves travel through the mixture at the rate of between 3,000 and 6,000 metres per second, and the efficiency is about 95 % that of an equal amount of dynamite.

BRISTOL'S WATER SUPPLY

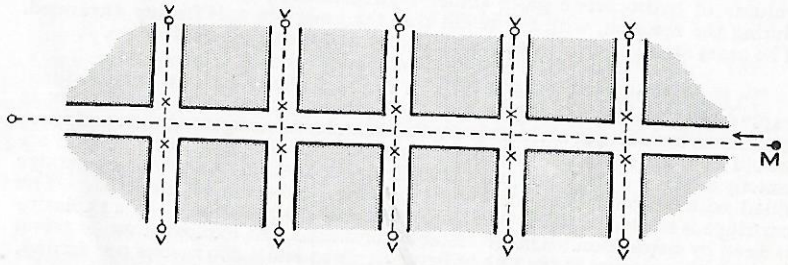
(I) DETECTION OF WASTE

By R. W. Melvin, B.Sc., A.M.Inst.C.E.,
Bristol Waterworks Company

THE AUXILIARY FIRE SERVICE has brought many men into more intimate contact with water—at any rate in greater volumes—than before. So I was pleased to accept the invitation to contribute to *The Jet* in the hope that some problems of the collection and distribution of water before it reaches the fire hose might be discussed with some interest to readers. Should Bristol ever be subjected to an air attack, the Waterworks A.R.P. organization would automatically take an important place side by side with other Services concerned with Civil Defence, and one of its principal functions would be to maintain as far as possible a continuous supply of "Raw Material" for the A.F.S. It is hoped that various aspects of Water Supply may be touched upon in this magazine, and this month the system of detection and prevention of water leaking to waste from the City's distribution system is briefly outlined.

Waste detection is a problem which faces all water suppliers. One can easily imagine that neglect in the tracing and repairing of leakages might in the end result in more water being consumed by burst mains and faulty fittings than through domestic or trade requirements.

For the purposes of waste detection, the City is divided into 86 areas and the network of water distribution pipes in each area can be completely isolated by means of valves from the rest of the distribution system. These areas are called "Waste Water Districts," one of which can be shown diagrammatically as follows :



The dotted lines represent water mains supplying streets. An "isolation" of the district is effected by passing water into the district only through the meter at M and closing the valves marked V. This is done to each district once a month.

The meter is a recording one (*i.e.*, it is fitted with a chart which visibly records the flow of water). After midnight, when domestic consumption practically ceases, there should be little or no water passing through the meter into the isolated district. If, therefore, the meter shows a substantial flow continuing throughout the night, there must be a leakage somewhere in the district to account for it. Should this occur, a second and more detailed test called "Night Inspection" is carried out. In this test water is passed through the meter at M as before and the valves V are closed. In the small hours of the morning the valves marked with an X are then closed in turn, one by one, at regular intervals, thus gradually isolating each street from the supply. As soon as the street containing the leakage has been thus isolated from supply, the meter record chart at M will show a sudden drop in the amount of water entering the district. Even a tap left running at night can be traced in this way. Now that the leakage is known to exist in a definite street, a Waste Department squad visits it during the day, when the water is turned on again. By sounding the roadway with stethoscopes they can trace a burst main or service pipe by the noise of water leaking through it. They also examine each house for faulty fittings. In Bristol our Waste Department has a personnel of about twenty who are constantly engaged in this work.

The strict control of waste water in this way adds to the efficiency of the undertaking by preventing overload of the pumping stations and by the conservation of available supplies.

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ANSWERS TO PROBLEMS ON PAGE 38

1—Generally attributed to Dr. John Bull.
2—Chinese.
3—Suez (100 miles).
4—Union of South Africa.
5—Land, 55,214,000 sq. miles. Water, 141,050,000 sq. miles.
6—Neither.
7—100 degrees Fahrenheit (July 15, 1881 ; August 9, 1911).
8—E.
9—Syrius.
10—Red, white, blue (an additional yellow ring if the plane is camouflaged).

FIRST AID TO THE INJURED

(continued from last month's " Jet ")

By Section Officer Elson

THE FRAMEWORK OF THE BODY

THE human skeleton, composed of two hundred and six bones, is designed for the purpose of giving support, shape and protection to the body. Without it our resemblance might be more like that of a jelly-fish than of a gorilla, which has the same number of bones in its construction as the human being, similar in shape and main characteristics.

The main bones of the body are the skull, divided into the cranium and face, the bones of the vertebral column or spine, and those of the upper and lower limbs.

The bones of the spine, thirty-three in number, are divided into five sections. The first seven bones, known as the cervical vertebrae, the bones of the neck ; the next twelve, the dorsal or thoracic, from which twelve pairs of ribs encircle the thorax or chest, giving protection to the lungs and heart and necessary to the act of breathing. The next five vertebrae are members of the lumber region, the following five the bones of the sacrum, and the last four, bones of the coccyx. Had we any more of the latter, we should be caused the embarrassment of not knowing what to do with a tail when on parade !

Bones of the upper limbs are two collar bones (often fractured when a rugby footballer does a swallow dive over an opponent's back), the shoulder blade, at its end a ball and socket joint, and the shoulder joint, from which leaves the bone of the upper arm or humerus. At the elbow is a hinge joint ; there are two bones in the forearm and twenty-seven bones in the wrist and hand.

The bones of the lower limbs are the haunch bone, the thigh bone or femur, which extends from hip to knee joint, and a hinged joint with a little bone in front known as the patella. The shin bone or tibia forms the main bone of the leg, while the fibula, a brooch bone, runs down the outside of the leg. In each ankle and foot are twenty-six bones, one less than in the wrist and hand.

In childhood the bones of the body are very flexible, but as a person ages the bones become more and more brittle, therefore becoming more prone to damage from breaking. Fractures may occur in three ways : from a direct blow (the skull is often fractured in this manner, but any bone can be fractured by a high speed missile coming in contact with it) ; from an indirect blow—the most common of any cause of fracture, the bone breaking some distance from the blow ; and from muscular action, as often occurs in the knee-cap from the rapid contraction of a strong muscle attached to a bone.

Fractures are classified into two groups : one, according to the injury the broken bones have done to the tissues of the body, and two, according to the injury sustained by the broken bone.

My next article will describe treatment of the various fractures, and it is hoped that a sketch of the human skeleton will be included.

FIRE PREVENTION AND CAUSES OF FIRE

(continued from last month's " Jet ")

GARAGES AND MOTOR CARS.—Owners of cars should remember that it is dangerous to smoke in garages, or anywhere in the vicinity of petrol. It is difficult to believe that motorists have been known to strike matches to see how much petrol there was in their tanks !

It is preferable that a garage should be built entirely separate from the dwelling house, but where one adjoins a house and is connected to the dwelling by doors, these should be of asbestos sheeting or other fire-resisting material.

Always keep an extinguisher suitable for putting out petrol fires handy, or, failing this, a good supply of sand.

Avoid piles of oily rags, which might probably give rise to a fire through spontaneous combustion.

Do not overfill the petrol tank—this is practically impossible under present conditions—but if this should occur, wipe up the spilled liquid. When draining the tank, spirit should only be drawn off into a container intended for this purpose. Cases have occurred where petrol has been drawn off into a pail, and the liquid later mistaken for water.

Tanks or other vessels which have been used as petrol containers should always be thoroughly cleansed and completely free of vapour, otherwise application of heat in effecting repairs, etc., may quite easily result in an explosion. Caps of cans containing petrol should be tightly screwed down.

OIL LAMPS AND STOVES.—Instructions are generally issued with every good lamp or stove, and it is a golden rule to follow out these details to the letter.

A large number of fires have resulted from lamps overbalancing and catching fire to curtains and other inflammable materials, also through the spilled oil igniting and causing the flames to spread quickly. Oil lamps should always be placed on a base of incombustible material, such as asbestos sheeting, and care should be taken that they stand in a position where it is unlikely for them to be accidentally overbalanced.

On no account should an oil lamp be filled while it is alight. Observe the same precautions for lamp oil as recommended for petrol, namely, store in substantial cans with screw tops and keep well away from naked lights.

Never operate a primus stove unless you are perfectly certain of the correct procedure. Petrol should never be used, and when using methylated spirit always remember that it is highly inflammable ; also that, when ignited, its flame is not readily discernible.