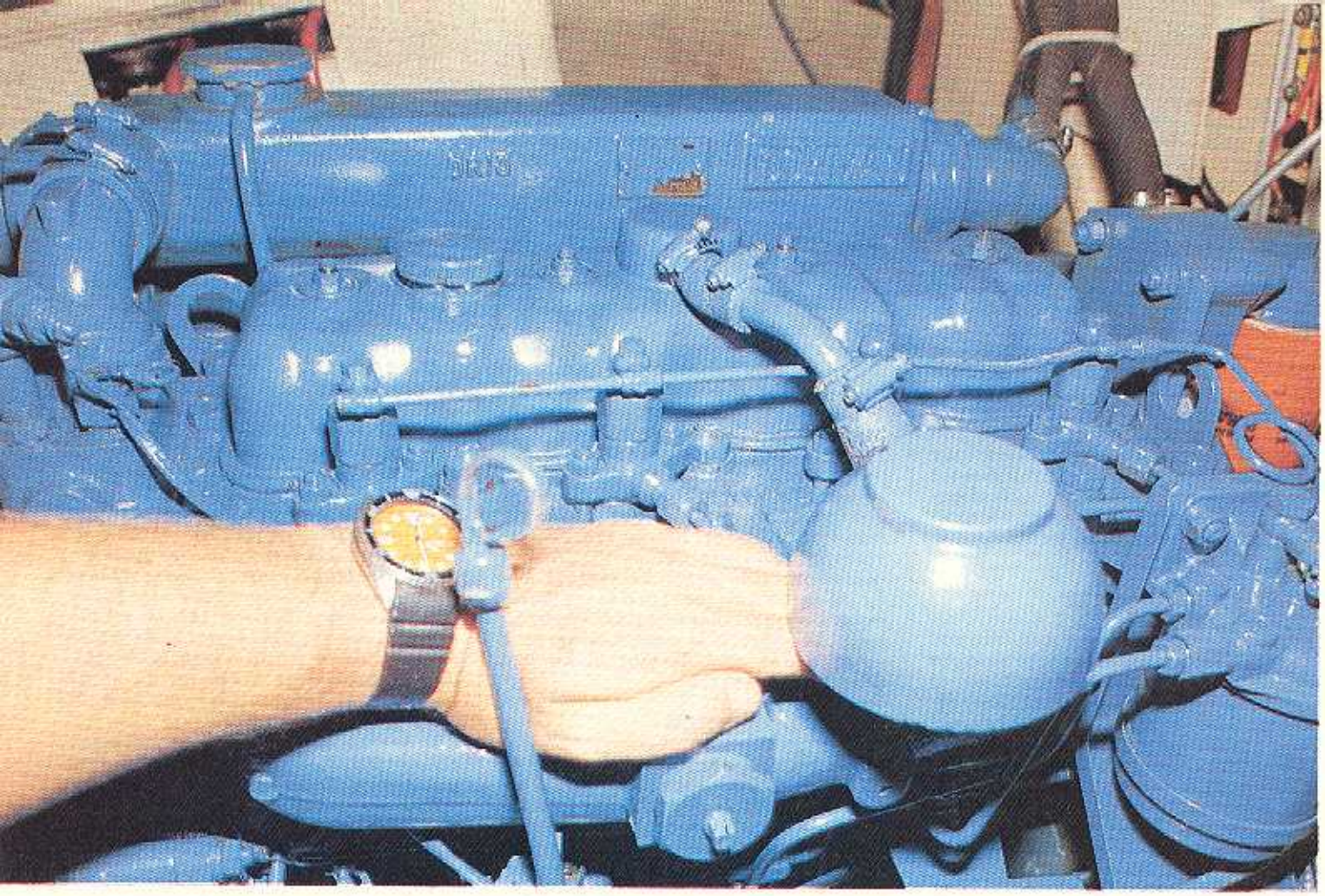

KEEP IT RUNNING

JOHN CAMPBELL offers some basic advice on diesel engines

A MODERN diesel engine is a very reliable and forgiving beast. Given just a little tender loving care, it will keep going almost for ever. If it refuses to start, or stops when it shouldn't, it is usually because it has been neglected. Let's look at some reasons why an engine may misbehave, and look at ways to get it running properly again.

The favourite cause of problems is in the fuel supply. A diesel engine works by fuel squirting through very small holes in the injector into the combustion chamber. The fuel is under very high pressure. Water or dirt in the fuel will cause problems.

Most fuel lift pumps have a little lever on them to enable the pump to be worked manually. Slacken one of the fuel pipes going to an injector, and pump the fuel through. If fuel doesn't flow, then probably the fuel filter is blocked or the pump is US.

If any air bubbles are seen coming out with the fuel, then the fuel system must be bled. Any air in the system will prevent the injection pump pressurising the fuel properly. Try to find out where the air came from; check for loose fittings, deteriorated seals, or a cracked fuel pipe. A cracked low pressure pipe can be temporarily fixed by sleeving it with a piece of plastic tube hose-clamped in place.

A sensible owner will learn at leisure how to bleed the fuel system, and won't wait until 2a.m., with a lee shore threatening, when the only torch has been dropped in the bilge! Most engine manufacturers, and many of the larger distributors, run owner's courses that cover such things as bleeding the fuel system and basic maintenance. It would be a good investment to search out and attend such a course that is specifically about your engine.

Most fuel problems can be alleviated by installing an extra filter between the tank and the engine. Fit a good big filter that is combined with a water separator. Any water that is seen to collect in the bowl should be drained off. The filter element should be changed annually, or more often if the engine gets a lot of use, or if the fuel is known to be contaminated.

Spare elements for this filter, and for the filter on the engine should be carried. However, if caught out with clogged filters and no spares, try washing the elements with clean fuel. It is usually possible to clean them enough for a few more hours running. If all else fails, it is possible to run the engine without the elements in place, but that could risk damage to the injector pump and/or the injectors.

In cold climates, water condensing in the fuel can be a problem. A first precaution is to keep the fuel tank as full as possible; the less air in the tank, the less moisture that can condense. In warmer climates, there can often be a problem of algae growing in the fuel. The remedy for this is to treat the fuel with one of the proprietary biocides.

It is possible for the fuel lift pump to fail. These pumps are usually of the diaphragm type, and a possible indica-

A Perkins 4-154 being decompressed by holding one's hand flat across the air intake, after the air filter is removed. *(Others might find a suitable piece of plywood safer. — Editor)*

tion of a leaking diaphragm is if the oil level in the sump is found to rise. If the oil is a milky colour, then probably it is being contaminated with water, but otherwise, it could be diesel leaking into the sump from the lift pump if it is integral with the engine.

The spares locker should contain a spare diaphragm or perhaps, for the less mechnical, a complete lift pump. Again, if caught out without the spare parts there is a get-you-home trick. With a suitable piece of plastic pipe and a jerry can, it should be fairly easy to arrange a gravity fuel feed to the engine, by-passing the lift pump.

It is worth removing the injectors on an annual basis, if only to ensure that they don't get 'frozen' into the cylinder-head. While they are out, have them tested for correct performance. If you do this, then it is most unlikely that an injector will fail in service, but if you want to carry a comprehensive spares kit, then a spare injector will do no harm.

Overheating is a common problem

The next most common problem is one of over-heating. If an air-cooled engine overheats, then either the engine is being overworked, the air flow over the engine is obstructed, or the lubrication system has failed. The remedies to the first two are obvious, so keep your fingers crossed that it is not the lubrication system. A lubrication problem, other than an obvious leak or low oil level, is likely to be beyond the scope of an easy fix.

Water-cooled engines on boats are basically of two types. The engine may have sea water pumped directly through it, or it may be cooled with fresh water. The fresh water in turn will be cooled with sea water pumped through, or flowing past a heat exchanger. In either case, unless the heat exchanger is fitted outside the hull as a so-called keel cooler, then there will be a pump for the sea water part of the system.

If the engine is overheating, then check to see if the sea water is still being discharged. This water is often mixed with the exhaust gas to cool it, and is discharged through the exhaust pipe. If water is still coming out in quantity, and the engine is not being excessively overworked, then the problem is likely to be an airlock in the heat exchanger, or a lack of fresh water in that part of the cooling sytem. Most heat exchangers have provision for bleeding trapped air. If your engine has a heat exchanger, take a look now at how to bleed it.

Be very careful when checking the fresh water level in a hot engine: the water is under pressure in the system, and can squirt out if the cap on the header tank is removed suddenly. Cover the cap with a towel, and remove it slowly, releasing the pressure gradually. A leak in the fresh water system is most likely to be in one of the rubber hoses. One of the best ways to fix such a leak is to use self-amalgamating rubber tape. Such tape forms a good seal which will withstand boiling water. Include some in your spares kit.

If no water is being pumped out by the engine, then either the sea water inlet is blocked, or there is a problem with the sea water pump. Look first to see if the pump is still being driven by the engine. Most engines use a pump with a rubber or neoprene impeller, often driven by a 'V' belt, like the fan belt on a car. If the belt has failed, then we all know how to make a temporary belt using several turns of string, a necktie, or a nylon stocking. What is even easier is to fit the spare belt you have in your locker.

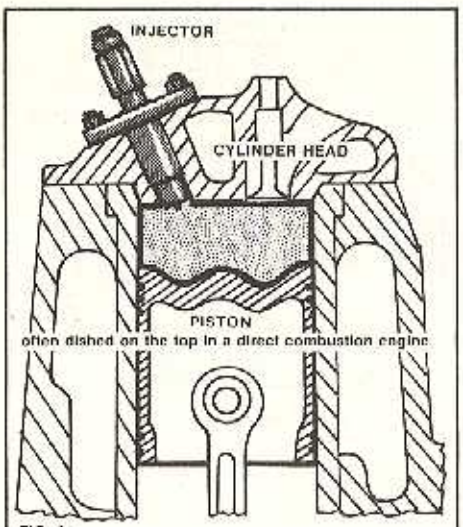

FIG. 1.

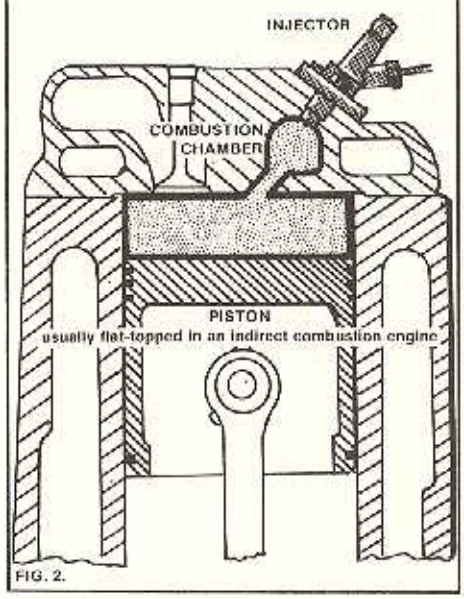

FIG. 2.

FIG. 1. Direct combustion engine. Fuel burns in space directly above piston.

FIG. 2. Indirect combustion. Almost no space between piston and cylinder head. The fuel/air spray starts to burn in the separate combustion chamber

The impeller on a pump of this sort does not like to run dry; it is water-lubricated. A plastic bag sucked up the intake will usually result in a burnt-out impeller before the engine can be stopped. When fitting a new impeller, first check that the sea water inlet is no longer blocked. Then try to find all the 'teeth' from the damaged impeller. Bits of rubber will often be sucked back into the sea water strainer when the impeller fails. These bits can then be drawn back into the pump, wrecking the new impeller in the first few minutes of its life! Pieces of impeller may also lodge in the heat exchanger causing a partial blockage of water flow, which will result in further over-heating problems.

When fitting the new impeller, it should either be lightly greased, or well covered in soap. This is to lubricate it until water is drawn into the pump. If it is put in dry, there is a sporting chance that it will burn out before any water reaches the pump.

All this pre-supposes that we remembered to put a spare impeller on this ever growing list. If caught out without a spare, what then?

Getting round the water pump. . .

It is quite feasible to connect the discharge of a bilge pump to the cooling system, on the engine side of the now defunct pump. If the flow of water into the bilge is regulated according to the capacity of the pump, this system will work well for many hours. However, we did discover one thing the hard way. The pump should be stopped before the engine is stopped; otherwise, if the pump keeps pumping, without the exhaust blowing the water out, there is nowhere for the water to go except into the innermost workings of the engine.

On some engines it may be possible to rig up a gravity feed of cooling water, even if someone does have to pour bucket after bucket into a funnel lashed to the rail.

The examples so far deal with problems that arise while the engine is running. What happens if the engine refuses to start?

If the engine is turning over fast, but refuses to start, the first thing to check is that the stop control is not in the stop position. This sounds basic, but it can be overlooked in the heat of an exciting moment.

Next check the fuel system, along the lines we have already discussed.

If the engine is a little long in the tooth, it could be that the compression is not all that it ought to be. The rings and the cylinder liners may be worn. A little oil squirted into the air intake will help the pistons get a better seal, resulting in better compression. Some engines, such as the Sabbs and some of the Petters, have a little gadget on the cylinder head specially for injecting oil before starting.

On some engines, it is possible to use

one of the proprietary 'easy start' fluids. These fluids are usually nothing more than ether. However, before resorting to this remedy, find out whether the engine manufacturer approves.

Many current diesel engines are of the direct combustion type, where the spray of diesel fuel burns directly above the piston. Such an engine is unlikely to be harmed by a starting fluid (see Fig. 1). But there are engines which are termed indirect combustion, where the fuel spray actually starts to burn in a separate combustion chamber, usually in the cylinder head. An example of such an engine is the Perkins 4-108. Starting fluid must never be used on such an engine, because if it explodes in the combustion chamber, there could be sufficient force to blow a hole through the top of the piston. But check with the maker if in doubt. (See Fig. 2).

Applied heat may help starting

In cold weather, a little heat applied to the air intake is most effective, but be careful not to set the whole thing on fire if using a naked flame.

If the engine turns too slowly, perhaps because of low batteries, then try decompressing it to let it spin faster. Many small engines are fitted with a decompression lever that holds the exhaust valves partially open. This lets the engine build up speed while using the starter. The lever is then closed abruptly, and the inertia of the flywheel hopefully will keep the engine turning fast enough to fire.

In a multi-cylinder engine, it is often worth trying to isolate the lever for each cylinder. Then, if only one cylinder is put on compression, the starter is more likely to be able to keep the engine turning. Most engines will start on just one cylinder. As soon as it fires, release the other lever or levers, and hopefully, away it will go.

Fine, you say, but your engine has no decompression control. Well, most non-turbocharged engines can be decompressed. All that is required is to block off the flow of air to the engine. If no air gets in, the engine does not have to work to compress it. Often it is possible (on a small diesel) to remove the air intake, and cover the hole with the flat of your hand, or a piece of plywood. You will feel the suction build up as the engine turns over. As the partial vacuum increases, the engine should start to spin faster. When it is spinning fast enough suddenly remove your hand There will be a satisfying plop, and the engine will gulp air, and with a bit of luck, it will start.

If the battery is completely flat, all need not be lost. A few years ago we met an old shark fisherman in the Pacific. He had a boat that looked at least as old as himself, powered by a big three-cylinder slow-revving engine, on the front of which was a gigantic flywheel. Like many engines of this type, it was started by using compressed air rather than electricity.

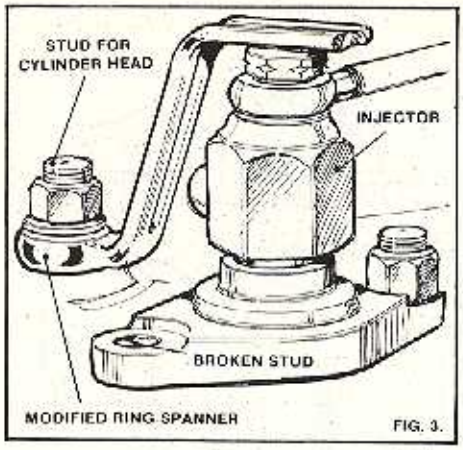

FIG. 3. The injector clamped in place despite a broken stud.

The problem occurred when our man was anchored off Cocos Island, a little uninhabited Pacific island a thousand miles from anywhere. He came to start the engine — no air. The compressed air had leaked out. He and his crew could have survived for a while on shark meat, there was water ashore, but instead, he made up his mind to start the engine and get home.

He cut a hole in the engine room deckhead. A rope was wrapped several times around the flywheel, then led through the hole over a block at the masthead. They then hoisted up two anchors, several containers of water, and as you might say, other heavy articles too numerous to mention. This lot was secured to the rope from the flywheel and suspended from a second rope. At the appropriate moment, the second rope was cut and everything came down. A certain amount of damage was done to the deck, but the rope turned the flywheel, and the engine started — so the tale goes . . .

Hand starting must be easy

Our engine is somewhat more modest, and it is electrically started. It has a hand-start mechanism, but the proximity of a water tank stops the handle from being fitted. Remembering our man in Cocos Island, I have bolted an extra pulley on the front of the crankshaft pulley. The engine is fitted with decompression levers on each of its two cylinders. With the levers held open, the engine can turn quite freely. Using the extra pulley, a piece of rope and a lot of adrenalin, it is possible to spin the engine as if it were a big Seagull outboard. However, if both decompression levers are released, then the engine comes to a wrist-breaking halt. If the linkage to the two levers is removed, and only one lever is released, then, in our case, we are trying to start a 7½hp single, instead of a 15hp twin.

Often, an engine is left stopped, in gear, to prevent the propeller turning while sailing. I have heard of two cases where the engine has started itself from the torque on the propeller when sailing fast. If you have a large three-blade propeller, and can decompress the engine, see if the propeller can turn the engine over. Once it is turning over, release the levers, and it may start.

If your engine can only be started electrically, it would probably be a good investment to carry a spare starter motor, if venturing far offshore. An alternative would be to carry an air pressure starter. This consists of a unit that bolts onto the engine in place of the starter motor and a pressure tank. The tank can be pumped up using a hand pump, then the pressure is released suddenly into the starter unit, which turns and hopefully starts the engine. There are several variations on this theme, and they have the advantage of not requiring any electrical power, which could prove to be an asset at times.

'Enginuity' can pay off. . .

Let me relate one last tale to show you that if you are resourceful, nothing is impossible. Recently, a boat in the middle of a charter had engine problems. The charter company sent out a mechanic to fix it. The problem was a loose injector letting smoke blow into the engine room. The mechanic should have removed the injector and replaced the copper sealing washer upon which the injector sits. Unfortunately, he did not do this, but tried just tightening the nuts down, and broke off one of the studs. Now the engine could not be run at all.

It was not feasible to remove the cylinder head and take it to a workshop to drill out the broken stud. The mechanic was determined to fix it on the spot, and he came up with an ingenious solution.

He took a ring spanner and heated the ring end on the galley stove, then bent it at right angles to the handle. The other end he sawed off with a hacksaw. Then with more heat he bent the handle part through a right angle, to make a sort of 'Z' shaped piece of steel, with a ring at one end.

Next he took off the nut from one of the cylinder head bolts, slipped the ring of his new creation over the stud, and tightened the nut. Lo and behold, the other end pressed firmly on the top of the injector and held it tightly in place (see Fig. 3).

So, give your engine reasonable care, and it should never let you down. If it does, don't give up. With a few spares and a little imagination, you can probably get it going again. Check over your spare parts and try to keep a few of the pre-metric British Admiralty charts on board. The paper stock used for these charts makes excellent gaskets if you can't get the real thing! ●