CLAIMS:

1. An externally heated thermodynamic engine having a closed working-fluid circuit, the engine comprising:

- a working fluid comprising at least two miscible, different boiling point constituent fluids, wherein the higher boiling point fluid constitutes up to 15% of the total working fluid.;
- a thermodynamic expander for extracting work from vaporised working fluid fed to a feed for it,
- a condenser downstream of the expander for condensing expanded vaporised working fluid exhausting from the expander,
- a liquid tank downstream from the condenser,
- pump means downstream from the liquid tank for pumping out condensed working fluid from it, and
- means for heating and at least partially vaporising working fluid pumped to it from the pump and feeding the heated working fluid to the expander,
    - the heating means having at least one inlet for working fluid pumped to it and at least one output from which the working fluid is fed to the expander;

wherein:

- ~~the engine is adapted and arranged for operation with a working fluid including at least two different boiling point constituent fluids,~~
- the pump means is adapted to pump from the liquid tank to the heating means both the different boiling point constituent fluids in a determined ratio as liquids and
- the relative boiling points of the different boiling point constituent fluids are such that in use:
    - on feeding of the working fluid to the expander, it is in at least partially vaporised state,
    - vapour and/or liquid of the higher boiling point fluid~~liquid~~ releases ~~latent~~ heat energy in the expander to vapour of the lower boiling point constituent fluid for production of work in the expander and
    - the higher boiling point fluid ~~liquid~~ is liquid on exit from exhaust of the thermodynamic expander.

2. An engine as claimed in claim 1 wherein the relative boiling points of the different boiling point constituent fluids are such that in use the vapour and/or liquid of the higher boiling point fluid releases latent heat energy in the expander to vapour of the lower boiling point constituent fluid for production of work in the expander.

~~2.~~3.An engine as claimed in claim 1, wherein the pump means is a single pump arranged in an arrangement:

- to draw from a single outlet from the liquid tank and
- to pump to a single inlet to the heating means,

the arrangement being suitable for the different boiling point constituent fluids being miscible as liquids and pumped to the heating means in proportion to their constituent proportions in the engine at the determined ratio.

~~3.~~4.An engine as claimed in claim 1, wherein the pump means is a single pump arranged:

- to pump to one or more inlets to the heating means and
- to draw from two outlets from the liquid tank or two respective liquid tanks:
  - the outlets or lines from them to the pump means having respective throttles, the throttles being such that the different boiling point constituent fluids are pumped as liquids in proportion to the determined ratio.

~~4.~~5.An engine as claimed in claim 1, wherein the pump means is a two-chamber pump or a pair of pumps arranged:

- to pump to one or more inlets to the heating means, and
- to draw from two outlets from the liquid tank or two respective liquid tanks:
  - the outlets or lines from them to the pump means, or lines from the pump means to the or each inlet, or each inlet where two are provided have respective throttles, the throttles being such that the different boiling point constituent fluids are pumped as liquids in proportion to the determined ratio.

~~5.~~6.An engine as claimed in claim 3 or claim 4, wherein the throttles are fixed for fixing the determined ratio or are adjustable for adjusting the determined ratio.

~~6. An engine as claimed in claim 3 or claim 4, wherein the throttles are adjustable for adjusting the determined ratio.~~

7. An engine as claimed in claim 1, wherein the pump means is a two-chamber pump, or a pair of pumps, arranged:

- to pump to one or more inlets to the heating means,
- to draw from two outlets from the liquid tank or two respective liquid tanks, and
- to pump with positive displacement in proportion to the determined ratio.

8. An engine as claimed in any one of claims 3 to 6~~7~~, wherein the closed cycle is such that the higher boiling point constituent fluid is passed through the condenser to a single liquid tank for it, and the condensed lower boiling point fluid from the condenser, the two outlets being arranged in the single tank at different levels in the liquid tanks to enable the pump means to draw the different boiling point constituent fluids as liquids from the tank via the respective outlets.

9. An engine as claimed in any one of claims 3 to 6~~7~~, including:

- a separator, preferably a cyclone separator, is provided in the closed cycle upstream of the condenser,
- a first said liquid tank for receiving condensed liquid of the lower boiling point constituent fluid, and
- a second said liquid tank for receiving separated liquid of the higher boiling point constituent fluid:
  - the respective tanks having the two outlets for the respective liquids.

10. An engine as claimed in any one of claims 3 to 6~~7~~, including:

- a separator, preferably a cyclone separator, is provided in the closed cycle upstream of the condenser, and
- a single said liquid tank for receiving condensed liquid of the lower boiling point constituent fluid and separated liquid of the higher boiling point constituent fluid,

with the two outlets being arranged in the single tank at different levels in the liquid tanks to enable the pump means to draw the different boiling point constituent fluids from the tank via the respective outlets.

~~11. An engine as claimed in any preceding claim, wherein:~~

- ~~the heating means has one section from a single inlet to a single output to the expander, and~~

- the heating means is adapted to heat the two constituent fluids to the same temperature and pressure, whereby the lower boiling point constituent fluid is at least partially or all in vapour state on output to the feed to the expander and the higher boiling point constituent fluid is all or partially vaporised or completely liquid on output to the feed.

12. An engine as claimed in any one of claims 4 to 7, wherein:

- the heating means has two sections, the one for one constituent fluid pumped to one heating means inlet for output to the feed into the expander, and the other for the other constituent fluid pumped to another heating means inlet for output into the feed to the expander, and
- the heating means is adapted to heat the two constituent fluids to different temperatures, whereby they are at least partially vaporised on output at substantially the same pressure from the heating means and feed to the feed to the expander.

13. An engine as claimed in claim 8, wherein the two sections of the heating means are heat exchangers in series for use of a common externally circulated heating medium passed from a first section to a second, the first being arranged to receive the higher boiling point constituent fluid and heat it to a first temperature, and the second being arranged to receive the lower boiling point constituent fluid and heat it to a second, lower temperature.

14. An engine as claimed in any one of claims 4 to 7 wherein:

- the heating means has two sections, the one for one constituent fluid pumped to one heating means inlet for output to the feed into the expander, and the other for the other constituent fluid pumped to another heating means inlet for output into another feed to the expander, and
- the heating means is adapted to heat the two constituent fluids to the different temperature and pressures, whereby at least the lower boiling point constituent fluid is at least partially vaporised on output from the heating means to the feed into a high pressure end of the expander, and the higher boiling point constituent liquid is vaporised or liquid at an intermediate pressure feed into the expander.

11~~15~~. An engine as claimed in any preceding claim, including a heat exchanger acting as a regenerator between the working fluid passing from the expander to the condenser and the working fluid passing from the condenser to the heating means.

12. An engine according to any one of claims 1 to 11 wherein the lower boiling point fluid is methanol and the higher boiling point fluid is water.

13~~16~~. A method of operating an externally heated thermodynamic engine having a closed working-fluid circuit, the engine comprising:

- a thermodynamic expander for extracting work from vaporised working fluid fed to a feed for it,
- a condenser downstream of the expander for condensing expanded vaporised working fluid exhausting from the expander,
- a liquid tank downstream from the condenser,
- pump means downstream from the liquid tank for pumping out condensed working fluid from it, and
- means for heating and at least partially vaporising working fluid pumped to it from the pump means and feeding the heated working fluid to the expander (,
  - the heating means having at least one inlet for working fluid pumped to it and at least one output from which the working fluid is fed to the expander;
  - the engine being adapted and arranged for operation with a working fluid including at least two miscible, different boiling point constituent fluids, wherein the higher boiling point constituent fluid constitutes up to 1% of the total working fluid; and
  - the pump means being adapted to pump from the liquid tank to the heating means both the different boiling point constituent fluids in a determined ratio as liquids;

wherein the method includes the operating steps of:

- the working fluid is fed to the expander in at least partially vaporised state,
- vapour and/or liquid of the higher boiling point fluid~~liquid~~ is caused to release ~~latent~~ heat energy in the expander to vapour of the lower boiling point constituent fluid for production of work in the expander and
- the higher boiling point ~~liquid~~ fluid is caused to be liquid on exit from exhaust of the thermodynamic expander.