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(54) Title: STEAM ENGINES WITH UNITARY EFFICIENCY

(57) Abstract: BEFORE and/or AFTER the ISOTHERMOBARIC phases ($dT=0$), ($dp=0$), of BOILING, the PHYSICAL STATE of a MIXTURE $M=(M'+M'')$, formed by a LIQUID (M') with its VAPOR (M''), is defined (GIBBS) by STATE EQUATIONS of the type $p=f(T,x)$ that include the PRESSURE (p), TEMPERATURE (T) and CONCENTRATION ($x=M''/M$) of (M). In particular, all the TRANSFORMATIONS $p=f(T,x_0)$ at constant concentration ($dx=0$) occur (fig.3) on the LINE of EQUAL CONCENTRATION (FC), ($dx=0$), between the two CURVE LIMITS (AC)3(BC), of the FIELD (ACBA). In these transformations we obtain the FIRST SIDES (OP), ($dx=0$), of the unexpected ENTROPIC CYCLES (O,P,3,4,5,O) where the EFFICIENCY increases $\forall (x_0>0)$, becoming UNITARY $\forall (x_0\geq x_5)$, from the CYCLE (5,M,3,4,5), (fig.5) to the CYCLE (N,3,4,5,N), (fig.7). These particular THERMAL CYCLE (figs 5,7), without CONDENSATION, may have a REMARKABLE application in the use of REFRIGERATOR FLUIDS at temperatures (e.g. FREON) where energetic EXCHANGES ($\delta Q, \delta L$) may almost be FREE, attaining (might we say) the utopist SECOND TYPE of PERPETUAL MOTION.



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DESCRIPTION of the Industrial Invention ENTITLED:

“STEAM ENGINES WITH UNITARY EFFICIENCY”

DESCRIPTION

In the Entropic-Plane $\Omega(T,S)$ the main Aggregation States (figs.1,2) of the Matter (e.g. H_2O), Solid (S), Liquid (L), Vapor (V), Gas (G), and the Field of Existence (ACBA) of the MIXTURE $M=(M'+M'')$ of CONCENTRATION $x=(M''/M)$, formed by a LIQUID $M'(x=0)$ with its VAPOR $M''(x=1)$, whose “PHYSICAL-STATE” depends (GIBBS) on two VARIABLES, therefore may be expressed by the following “CLAPEYRON-DIFFERENTIAL” as a function of the TRIPLET (Pressure-Temperature-Concentration), which is RESOLVED with INTEGRALS of type $p=f(T,x)$, the Specific Volumes $v(m^3/kg)$ being $v'(T), v''(T)$ $r(T)$ and the Transformation Heat $r(J/kg)$ of the two Phases (M', M''):

$$T \frac{dp}{dT} = \frac{dr}{dv''-dv'} \geq 0 \quad \Leftrightarrow \quad dp = \frac{dr}{dv''-dv'} \frac{dT}{T} \quad \Rightarrow \quad p = f(T, x) \quad (\alpha)$$

Furthermore we include the SATURATED VAPOR produced by the LATENT HEAT during “BOILING”, defined by the ISOTHERMOBARS ($dT=0$) and ($dp=0$) in the Subsets of the Interval ($0 \leq x \leq 1$) on the horizontals of (ACBA), where the pair of CONSTANTS (T, p) render the other variables (Enthalpy, Entropy, Concentration, Volume etc.) UNDETERMINED. ALL the Transformations $p=f(T, x)$ at constant CONCENTRATION ($dx=0$) occur on the lines of equal CONCENTRATION (FC), ($dx=0$) between the 2 Curve-Limits (AC) and (BC) of (ACBA), taking into account that in these CASES ($dx=0$) any ISOTHERMAL increase in PRESSURE ($dT=0$), ($\Delta p \neq 0$) requires an adequate ISOBARIC increase in TEMPERATURE ($dp=0$), ($\Delta T \neq 0$) until BOILING starts again, as long as $p=f(T, x)$ $\forall (x=x_0)$. To those lines of equal CONCENTRATION (FC), ($dx=0$) belong the FIRST-SIDES (OP), ($dx=0$), ($dp=0$) of new THERMAL-CYCLES (O,P,3,4,5,O) where the same WORK (4-5) CANNOT represent the different Enclosed Areas $\int \delta Q \geq 0$ due to the LATENT HEAT (5-O) that $\forall (x_0 \geq x_s)$ INVERTS ITSELF (changing sign) in the Interval (5-N) and thus the ISENTROPES (4-5), ($dS=0$) DO NOT coincide with the ADIABATICS ($\delta Q=0$). Indeed, the THERMAL EXCHANGE ($\int \delta Q \geq 0$) becomes the DIFFERENTIAL $dQ=TdS$ of particular INVERTIBLE ($dS=dQ/T$) $\Leftrightarrow$ ($dQ=TdS$) PRIMITIVE-THERMALS $\Delta Q = \int TdS$ with ENTROPY $dS=dQ/T$, which we have

RESOLVED in finite terms with STATE EQUATIONS $\Delta S=f(F,s)=g(p,V)$ in the MECHANICAL SYSTEMS $O(F,s), O(p,V)$. In these CASES the ISENTROPES ($dS=0$) form a SET of INTEGRAL CURVES $f(F,s)=g(p,V)=\text{Constant}$ NON-ADIABATIC ($\delta Q \neq 0$), while δQ is EQUAL to the INTERNAL-ENERGY $(\delta Q)_V=(dU)_V$ and/or the ENTHALPY $(\delta Q)_P=(dH)_P$ along the ISOCHORS ($dV=0$) and/or the ISOBARS ($dp=0$), in addition to in the VAPOR-GENERATORS where ($dV=0$), ($dp=0$).

In this way we obtain the ENTROPIC-CYCLES $(O,P,3,4,5,O)$ where the EFFICIENCY increases $\forall (x_0 > 0)$ becoming UNITARY $\forall (x_0 \geq x_5)$ from the CYCLE $(5,M,3,4,5)$, (fig.5) to the CYCLE $(N,3,4,5,N)$, (fig.7), which assume a REMARKABLE importance with the application of "REFRIGERATOR-FLUIDS" at low temperature (e.g. Freon) that in OPTIMAL conditions (with respect to the external temperature) allow almost "FREE" ENERGETIC EXCHANGES ($\delta Q, \delta L$). Here we are dealing with unusual INTUITIVE HYPOTHESES of which we will try to check the presumed RELIABILITY. In every Transformation $p=f(T,x)$, the ENTHALPIC POTENTIAL $dH=\delta Q+vdp$ defines the ISOBARS ($dp=0$), the ADIABATICS ($\delta Q=0$), the lines of equal concentration (Q_{OP}), and finally the THERMAL BALANCE (Q_1, Q_2) with its EFFICIENCY:

$$\begin{cases} (dp=0) & \Rightarrow & dH = \delta Q \\ (\delta Q=0) & \Rightarrow & dH = dL = vdp \end{cases} \quad (1)$$

$$Q_{OP} = \int_O^P dH = (H_P - H_O) \quad (2)$$

$$\begin{cases} Q_1 = H_4 - H_O \\ Q_2 = H_5 - H_O \end{cases} \Rightarrow \begin{cases} L = H_4 - H_5 \\ \eta = L / (H_4 - H_O) \end{cases} \quad (3)$$

In these CASES (figs.3,5,7) the THERMAL-EXCHANGE (δQ) becomes the DIFFERENTIAL $dQ=\delta Q=TdS$ defined by its INVERTIBILITY ($dS=dQ/T \Leftrightarrow dQ=TdS$) with ENTROPY $dS=\delta Q/T$. Indeed, displacing the FIRST-SIDE (OP), ($dp=0$), ($dx=0$) of the Curve-Limit of the LIQUID (AC), ($x=0$) to that of the VAPOR (BC), ($x=1$), the LATENT HEAT decreases $Q_2=(H_5-H_O)$ INVERTING itself $\forall (x_0 \geq x_5)$ (changing SIGN), as the BALANCE (3) of the CYCLE $(N,3,4,5,N)$ demonstrates with the following EQUIVALENCE ($Q=L$) that produces a UNITARY EFFICIENCY ($\eta=1$):

$$Q = (H_N - H_5) + \int_N^3 dH + (H_4 - H_3) = \left[(H_N - H_3) + \int_N^3 dH \right] + (H_4 - H_5) \quad (4)$$

$$Q = (H_4 - H_5) = \int_5^4 dH = \int_4^5 v dp = L \Rightarrow \eta = \frac{L}{Q} = 1 \quad (5)$$

Apart from the UNITARY-EFFICIENCY, the EQUATION (5) represents the EQUIVALENCE ($\Leftrightarrow$) between the HEAT (Q) and WORK (L), that is "JOULE'S LAW", common to all THERMAL ENGINES where:

$$Q = (Q_1 - Q_2) = (H_4 - H_1) - (H_5 - H_1) = (H_4 - H_5) = L \quad (6)$$

We suppose that the EQUIVALENCE (6) represents the Enclosed Areas of ALL the THERMAL CYCLES. In effect this is TRUE in the Enthalpic Cycles (of the previous Patent) but NOT in the ENTROPIC CYCLES (O,P,3,4,5,O), (figs.3,5,7) as the following INTEGRALS of ENTHALPIC HEAT (Q_E) and ENTROPIC HEAT (Q_S) demonstrate (2), extended to the FIRST-SIDES (OP) $\in$ (FC),(dx=0), obtaining $Q_E=Q_S$ only for (OP) $\in$ (AC),(x=0) while instead $Q_E \neq Q_S \forall$ (OP) $\notin$ (AC),(x=0), as the MEAN-INTEGRAL $Q_{OP} \neq T_m(S_P - S_O)$ also CONFIRMS (see tables):

$$Q_E = \int_O^P dH = (H_P - H_O) \quad Q_S = \int_O^P T dS = T_m(S_P - S_O) \quad (7)$$

For these reasons the EFFICIENCY increases in the Interval ($0 < x \leq 1$), becoming UNITARY $\forall (x_0 \geq x_5)$ from the "CYCLE" (5,M,3,4,5) (figs.5,6) to the "CYCLE" (N,3,4,5,N) (figs.7,8). In these particular "ENTROPIC CYCLES" (figs.5,7) without CONDENSATION, it is therefore WORTHWHILE employing "REFRIGERATOR-FLUIDS" at Low-FUSION (NH_3 , CO_2 , SO_2 , CH_4 , C_2H_4 , C_2H_6 , C_2H_8 , CH_3Cl , FREONS etc.), which in "OPTIMAL Conditions" (with respect to the environmental temperature) allow almost "FREE" ENERGETIC EXCHANGES (δQ , δL).

Unlike other STATE-FUNCTIONS, the Postulates of "CARNOT-CLAUSIUS" define the ENTROPY (S) with the DIFFERENTIAL $dS = \delta Q/T$, including the unusual REVERSIBILITY $dS \Leftrightarrow \delta Q$ that also TRANSFORMS the THERMAL-EXCHANGE δQ into the DIFFERENTIAL $dQ = T dS$. As this occurs ONLY in CERTAIN CASES, we deduce that the ENTROPY does NOT always represent the "SECOND-LAW-OF-THERMODYNAMICS", or PERHAPS, taking into account (as we will do), the ENGINE that PERFORMS the "CARNOT CYCLE".

Let as describe briefly from the generic (O,P,3,4,5,O) (figs.3,4) to the two most representative CYCLES (5,M,3,4,5) (figs. 5,6) and (N,3,4,5,N) (figs.7,8), taking into account possible errors, Gains (fig.4) and Vapor leaks etc.

A) ENTROPIC CYCLE (O,P,3,4,5,O) (figs.3,4). The Feed Pump (P_A) compresses the Mixture (p_1), (T_1), ($x=x_O$) at the Starting-Point O, (p_2), (T_1), ($x=x_O$) so that it heats (p_2), ($T_1 \rightarrow T_2$), ($x=x_O$) along the line of equal concentration and pressure (OP), ($x=x_O$) until the new Isothermobar (P-3), (p_2), (T_2), ($x_O \leq x \leq 1$) comes into play (in P), so that the Mixture becomes Vapor on the line (P-3), (p_2), (T_2), ($x=1$), Superheats (3-4), (p_2), ($T_2 \rightarrow T_4$), ($x=1$), Expands (4-5), ($p_2 \rightarrow p_1$), ($T_4 \rightarrow T_1$), ($x=x_5$), Condenses (5-O), (p_1), (T_1), ($x_O \leq x \leq x_5$), and finally is transported by the Pump (P_E) into the Well (Z) so that it may return to (P_A).

B) ENTROPIC CYCLE (5,M,3,4,5) (figs. 5 & 6). The Pump (P_A) compresses the Mixture (p_1), (T_1), ($x=x_5$) at the Starting-Point (O=5), (p_2), (T_1), ($x=x_5$), so that it heats (p_2), ($T_1 \rightarrow T_2$), ($x=x_5$) along the line of equal concentration and pressure (5-M), ($x=x_5$).

Then it Evaporates (p_2), (T_2), ($x=1$) on the Isothermobar (M-3), Superheats (3-4), (p_2), ($T_2 \rightarrow T_4$), ($x=1$), Expands (4-5), ($p_2 \rightarrow p_1$), ($T_4 \rightarrow T_1$), ($x=x_5$), and finally is transported by the Pump (P_E) into the Well (Z) so that it may return to (P_A).

C) ENTROPIC CYCLE (N,3,4,5,N) (fig. 7 & 8). The Feed Pump (P_A) compresses the Vapor (M'') (p_1), (T_1), ($x=1$) at the Starting-Point (O=N), (p_2), (T_1), ($x=1$) so that it heats (p_2), ($T_1 \rightarrow T_2$), ($x=1$) along the line of equal concentration and pressure (N-3), ($x=1$) until it reaches the new Isothermobar at the Point (P=3), (p_2), (T_2), ($x=1$) thus Superheating on the line (3-4), (p_2), ($T_2 \rightarrow T_4$), ($x=1$), Expanding in (4-5), ($p_2 \rightarrow p_1$), ($T_4 \rightarrow T_1$), ($x=x_5$), being transported by the Pump (P_E) to the Well (Z), finally completing (in G) the Isothermobaric Evaporation (5-N), (p_1), (T_1), ($x=1$), before returning to (N), (P_A). At this point we might consider the research at an end, all applications being easily realizable. However, certain of the reliability of the above, it is worthwhile examining further the choice and use of the most suitable fluids, especially those used in REFRIGERATORS, and how these fluids might be used in various systems. We will though proceed briefly with the analysis of the CYCLE (N,3,4,5,N) (figs. 7 & 8) with the employment of 4 FLUIDS (Plates 1,2,3,4); Water (H_2O), Freon-12 (CF_2Cl_2), Ammonia (NH_3) and Carbon-Dioxide (CO_2) in normal Thermodynamic Conditions. In order to simplify the calculations we will apply the following Comparative-Equations for the main variables; Saturated Vapor, Concentration (x_5), Entropy (S_5), Enthalpy (H_5); with a hypothetical Flow $m=10(\text{kg/s})=0.1(\text{kg/Cycle})$, at for example 100 (Cycles/s), that serves only to evaluate the probable mean Power $N=mL$ (kW) and the order of magnitude of the Systems, confirming the respective UNITARY Efficiencies.

$$x_5 = \frac{S_5 - S_1}{S_N - S_1} = \frac{H_5 - H_1}{H_N - H_1} \quad (8)$$

1) H₂O (Water), ENTROPIC CYCLE (N,3,4,5,N) (Table A, Plate 1, figs. 7 & 8). The Mixture (M), ($x=x_5$) becomes Vapor (M''), ($x=1$) on the Isothermobar (5-N), so that it heats along the line of equal concentration and pressure (N-3)∈(BC), Superheats in (3-4), (p_2), (T_4), and finally Expands in T(4-5). We assign (Table A) $T_1=20$ (°C), $H_1=84$, $H_N=2537$, $S_1=0.296$, $S_N=8.666$, $T_2=200$ (°C), therefore (not included in the table) $T_4=400$ (°C), $H_4=3254$, $S_4=S_5=7.243$, in addition to the values (8) of (x_5) and (H_5) and the Flow $m=10$ (kg/s), in order to obtain the Thermal Balance (3) of the Cycle, that is the Work (L) with its Unitary Efficiency ($\eta=1$):

$$x_5 = \frac{S_5 - S_1}{S_N - S_1} = 0.83 \quad ; \quad H_5 = x_5 (H_N - H_1) + H_1 = 2120 \text{ (kJ/kg)} \quad (9)_0$$

$$Q = (H_N - H_5) + (H_3 - H_N) + (H_4 - H_3) = (H_4 - H_5) = L \quad (9)_1$$

$$\begin{cases} Q = (H_4 - H_5) = L = 1134 \text{ (kJ/kg)} \\ \eta = L/Q = 1 \quad ; \quad N = mL = 11340 \text{ (kW)} \end{cases} \quad (9)$$

Displacing the First-Side (N-3), ($x=1$) on the Curve-Limit of the Liquid (1-2)∈(AC), ($x=0$) we obtain the corresponding HIRN-CYCLE (1,2,3,4,5,1) where the Condensation (5-1) allows the same WORK $L=(H_4-H_5)=1134$ (kJ/kg) with an EFFICIENCY ($\eta=0,36$) inferior by $(1-0,36)=64\%$ compared with the previous ($\eta=1$):

$$\begin{cases} Q_1 = (H_4 - H_1) = 3170 \text{ (kJ/kg)} \\ Q_2 = (H_5 - H_1) = 2036 \text{ (kJ/kg)} \end{cases} \Rightarrow \begin{cases} L = (Q_1 - Q_2) = 1134 \text{ (kJ/kg)} \\ \eta = L/Q_1 = 0,36 \quad ; \quad N = 11340 \text{ (kW)} \end{cases} \quad (10)$$

2) CF₂Cl₂ (Freon-12), ENTROPIC CYCLE (N,3,4,5,N) (Table B, Plate 2, figs. 7 & 8). The Mixture (M), ($x=x_5$) Evaporates (M''), ($x=1$) along the Isothermobar (5-N), then heats on the line of equal concentration and pressure (N-3)∈(BC), Superheats (3-4), and finally Expands (4-5). We assign (Table B) $T_1=-70$ (°C), $H_1=359$, $H_N=539$, $S_1=3.938$, $S_N=4.842$, $T_2=+10$ (°C), in addition to (not included in the table) $T_4=+30$ (°C), $H_4=590$, $S_4=S_5=4.790$, and finally the Flow $m=10$ (kg/s)= 0.1 (kg/Cycle) with the following results:

$$x_5 = \frac{S_5 - S_1}{S_N - S_1} = 0.94 \quad ; \quad H_5 = x_5 (H_N - H_1) + H_1 = 528 \text{ (kJ/kg)} \quad (11)_0$$

$$\begin{cases} Q = (H_4 - H_5) = L = 62 \text{ (kJ/kg)} \\ \eta = L/Q = 1 \quad ; \quad N = mL = 620 \text{ (kW)} \end{cases} \quad (11)$$

3) NH₃ (Ammonia) ENTROPIC CYCLE (N,3,4,5,N) (Table C, Plate 3, figs. 7 & 8). The Mixture (M),(x=x₅) Evaporates (M''),(x=1) along the Isothermobar (5-N), Heats on the line of equal concentration and pressure (N-3)∈(BC), Superheats (3-4),(in S), and finally Expands (4-5). We assign (Table C) T₁=-60(°C), H₁=151, H_N=1591, S₁=3.084, S_N=9.842, T₂=+100(°C), in addition to (not included in the table) T₄=150 (°C), H₄=1890, S₄=S₅=8.25, and finally the Flow m=10(kg/s)=0.1(kg/Cycle):

$$x_5 = \frac{S_5 - S_1}{S_N - S_1} = 0,76 \quad ; \quad H_5 = x_5 (H_N - H_1) + H_1 = 1245 \text{ (kJ/kg)} \quad (12)_0$$

$$\begin{cases} Q = (H_4 - H_5) = L = 645 \text{ (kJ/kg)} \\ \eta = L/Q = 1 \quad ; \quad N = mL = 6450 \text{ (kW)} \end{cases} \quad (12)$$

4) CO₂ (Carbon-Dioxide) ENTROPIC CYCLE (N,3,4,5,N) (Table D, Plate 4, figs. 7 & 8). The Mixture (M)(x=x₅) Evaporates (M'')(x=1) on the Isothermobar (5-N), Heats on the line of equal concentration and pressure (N-3)∈(BC) and Superheats (3-4). Then it Expands T(4-5). We assign (Table D) T₁=-50(°C), H₁=314, H_N=651, S₁=3.777, S_N=5.288, T₂=+10(°C), in addition to (not included in the table) T₄=50(°C), H₄=709, S₄=S₅=5.192, and finally the Flow m=10(kg/s)=0.1(kg/Cycle) as follows:

$$x_5 = \frac{S_5 - S_1}{S_N - S_1} = 0.936 \quad ; \quad H_5 = x_5 (H_N - H_1) + H_1 = 629 \text{ (kJ/kg)} \quad (13)_0$$

$$\begin{cases} Q = (H_4 - H_5) = L = 80 \text{ (kJ/kg)} \\ \eta = L/Q = 1 \quad ; \quad N = mL = 800 \text{ (kW)} \end{cases} \quad (13)$$

The research supposes the effective possibility of realizing all the ENTROPIC CYCLES (figs. 3,5,7) described in this Patent and Summarized in A), B) and C), with any possible apparatus suitably modified, for example an apparatus that facilitates the Transformations of equal concentration and pressure of the First Sides (OP)∈(FC), (dx=0), taking into account the Gains (fig. 4) obtained by the transmission of Heat from the Upper Zone (S) to the Lower Zone (E) of the Generator (G). These new THERMAL CYCLES concern all "VAPOR SYSTEMS", including "DISTILLERS" and in particular "REFRIGERATION-SYSTEMS" that function by inverting several Transformations. The characteristic principal of these systems consists in the fact that in the FIRST SIDES

(OP) $\neq$ (AC),(dx=0) we obtain $dH=\delta Q\neq TdS$, and thus (see tables) $\Delta H\neq T_m\Delta S$. This means (figs. 3,5 & 7) that the same WORK $L=(H_4-H_3)$ cannot represent the Enclosed Areas ($\delta Q\neq TdS$) and therefore does NOT DEPEND on the "ENTROPY" ($dS=\delta Q/T$) of the Fluid. In every case the EFFICIENCY increases $\forall(x_0>0)$ reaching the UNITARY value ($\eta=1$), $\forall(x_3\geq x_0)$ from the "CYCLE" (5,M,3,4,5),(figs. 5,6) to the "CYCLE" (N,3,4,5,N),(figs. 7,8) where the ENERGETIC EXCHANGE (Heat δQ and Work δL) becomes practically "FREE" with the employment of suitable "REFRIGERATOR FLUIDS" at low temperature, positioning (at least partly) the respective "ENTROPIC DIAGRAMS" at temperatures under the External Temperature (T_E). Furthermore, by using suitable MECHANISMS the position of the extreme ISOTHERMOBARS (1-N), (2-3) with respect to the External Temperature (T_E) and the Critical Point (C) can easily be OPTIMIZED in REAL-TIME, in order to transform instant by instant all the ABSORBED HEAT into FIRST ORDER ENERGY. We repeat that here we are concerned with an authentic "ABSOLUTE TRUTH" essentially based on the TRUE "Concept of ENTROPY", a STATE FUNCTION $S=f(F,s)=g(p,V)$ incompatible with the POSTULATES of "CARNOT" and "CLAUSIUS", that is to say with the "SECOND-LAW-OF-THERMODYNAMICS", an extraordinary unforeseen result that realizes (let us say it) the so-called "SECOND TYPE of PERPETUAL MOTION".

PATENT CLAIMS

1) The **ENTROPIC CYCLES** with **UNITARY EFFICIENCY** specified above, of which we **CLAIM** all possible **MODIFICATIONS** and **APPLICATIONS** concern an **ABSOLUTE NOVELTY INCOMPATIBLE** with the **SECOND LAW OF THERMODYNAMICS** where the First Sides $(OP), (dp=0), (\Delta T \neq 0)$ belong to the lines of equal concentration $(FC), (dx=0)$ between the Curve-Limits (AC) and (BC) of $(ACBA)$, while the **THERMAL EXCHANGE** (Q_{OP}) produces an **ISOBARIC** increase of **TEMPERATURE** $(dp=0), (\Delta T \neq 0)$ until **BOILING** starts again which **OCCURS** on the **ISOTHERMOBARS** $(P-3), (dp=0), (dT=0), (x_0 \leq x \leq 1)$ of the **SATURATED VAPOR**. In these **CASES** the **LATENT HEAT** $(5-O), (dp=0), (dT=0), (x_0 \leq x \leq 1)$ **INVERTS** itself (changing **SIGN**) at the **POINT** $(5), (x=x_5)$ while the **EFFICIENCY** increases $\forall (x > 0)$ becoming **UNITARY** $\forall (x_0 \geq x_5)$ from the **CYCLE** $(5, M, 3, 4, 5)$ (fig. 5) to the **CYCLE** $(N, 3, 4, 5, N)$ (fig. 7). In particular, the First Side $(1-2), (dp=0), (\Delta T \neq 0)$ of the **RANKINE-HIRN CYCLE** does not occur as one **EXPECTS** in the **LIQUID Zone (L)** but on the First adjacent line of equal **CONCENTRATION** $(AC), (dp=0), (\Delta T \neq 0)$ of $(ACBA)$.

2) The **ENTROPIC CYCLES** of the previous **CLAIM** as described in the **EXAMPLES A), B) and C)** are above all characterized (figs. 3, 5 & 7) by the **Transformations** of equal **CONCENTRATION** $(FC), (dx=0)$ of the **FIRST SIDES** $(OP), (dp=0), (\Delta T \neq 0)$ where the **MIXTURE** $(M), (x=x_0)$ is **SUBMITTED** to an **ISOTHERMAL COMPRESSION** $(\Delta p > 0), (dT=0)$ at the **STARTING POINT (O)** and then the corresponding **ISOBARIC HEATING** $(\Delta T > 0), (dT=0)$ on the line of equal **CONCENTRATION** $(OP), (dp=0), (\Delta T \neq 0)$, as **OCCURS** in the **FIRST SIDES** $(1-2), (dp=0), (\Delta T \neq 0)$ of the previous **ENTHALPIC HIRN CYCLES**, taking into account that at the **STARTING-POINT** $(O=5)$ of the particular **CYCLE** $(5, M, 3, 4, 5)$, (fig. 5) the **SATURATED VAPOR** becomes **DRY**.

3) The **ENTROPIC CYCLES** of the previous **CLAIMS** are characterized by the fact that the **ENGINES** (figs. 4, 6, 8) can be transformed into **DISTILLERS** or **REFRIGERATOR SYSTEMS** by suitably modifying the **TRANSFORMATIONS**, the **APPARATUS** and the positions of the extreme **ISOTHERMOBARS** $(1-N)$ and $(2-3)$.

IV) The **ENTROPIC CYCLES** of the previous **CLAIMS** are characterized by the fact (figs. 3, 5 & 7) that displacing the **FIRST SIDE** to the right $(OP) \in (FC), (x=x_0)$ the **Changes of State** $(5-O)$ diminish thus increasing the **EFFICIENCY**.

5) The **ENTROPIC CYCLES** of the previous **CLAIMS** are characterized by the fact (figs. 5 & 7) that $\forall (x_0 \geq x_5)$ they occur without **CONDENSATION** and therefore have **UNITARY EFFICIENCY**, from the **Cycle** $(5, M, 3, 4, 5)$

(fig. 5) to the Cycle (N,3,4,5,N) (fig. 7) where the Absorbed Heat (Q_1) becomes almost FREE with the employment of REFRIGERATOR FLUIDS at low temperature.

6) The **ENTROPIC CYCLES** of the previous CLAIMS are characterized by the fact (figs. 7 & 8) that they can be easily realized in the VARIOUS ways A), B) and D) including the particular CYCLE (N,3,4,5,N), which we consider the most SUITABLE, because they also occur without CONDENSATION ($Q_2=0$) and thus have UNITARY EFFICIENCY ($\eta=L/Q=1$), taking into account that we have ADOPTED the same SYMBOLOGY used in the most common TECHNICAL MANUALS.

7) The **ENTROPIC CYCLES** of the previous CLAIMS are characterized by the fact (figs. 3, 5 & 7) that the employment of Refrigerator Fluids at Low Fusion Temperature (NH_3 , CO_2 , SO_2 , CH_4 , C_2H_4 , C_2H_6 , C_2H_8 , CH_3Cl , Freons etc.) allow the positioning of the cycles (at least partly) under the Environmental Temperature ($T_2 < T_A$) so that the corresponding Energy Exchanges (of Heat δQ and Work δL) with the External become practically Free.

8) The **ENTROPIC CYCLES** of the previous CLAIMS are characterized by the fact (figs. 5 & 7) that, by using appropriate mechanisms, the collocations of the two extreme Isothermobars (1-N) and (2-3) with respect to the Environmental Temperature can be Optimized in Real-Time so that the total Transformation of the Absorbed Heat occurs in Mechanical Work, realizing in this way the so-called "SECOND TYPE of PERPETUAL MOTION".

9) The **ENTROPIC CYCLES** of the previous CLAIMS are characterized by the fact that in Heat Gains from High to Low Temperature, valid for every Cycle, it is convenient to apply an Autonomous Circuit in parallel (fig. 4) where the Circulating Liquid, oriented by a Director (N) and facilitated by a Lung (M) of Inert Gas, is introduced by the Pump (P) at a Pressure (p^*) high enough ($p^* > p$) with respect to that $p=f(T)$ of the Saturated Vapor.

10) The **ENTROPIC CYCLES** of the previous CLAIMS are characterized by the fact that in the Heat Gain (fig. 4) it is convenient to RECYCLE the Superheated Vapor (4, 4') that should increase the Isentropic Work (4, 5).

H₂O (Water) T_F=0(°C), T_C=374.15(°C)

TABLE A

T (°C)	p (K _p /cm ²)	H' (kJ/kg)	H'' (kJ/kg)	H''-H' (kJ/kg)	S' (kJ/kgK)	S'' (kJ/kgK)
374.15	225.6	2100	2100	0	4.430	4.430
340	150.0	1595	2622	1027	3.661	5.336
300 (400)	87.6	1345	2749 (3117)	1404	3.255	5.705 (6.293)
250 (400)	40.6	1086	2801 (3212)	1715	2.793	6.072 (6.774)
200 (400)	16.0	852	2793 (3254)	1941	2.331	6.432 (7.243)
100	1.033	419	2676	2257	1.307	7.355
30	0.043	126	2556	2430	0.437	8.452
20	0.024	84	2537	2453	0.296	8.666

CF₂Cl₂ (Freon-12), T_F=-155(°C), T_C=115.5(°C)

TABLE B

T (°C)	p (k _p /cm ²)	H' (kJ/kg)	H'' (kJ/kg)	H''-H' (kJ/kg)	S' (kJ/kgK)	S'' (kJ/kgK)
115.5	40.88	564	564	0	4.612	4.612
100	33.61	529	597	68	4.519	4.701
50	12.39	468	593	125	4.352	4.738
10 (30)	4.31	428	578 (590)	150	4.220	4.750 (4.790)
0	3.15	419	574	155	4.187	4.754
-25	1.26	396	562	166	4.101	4.768
-50	0.400	375	549	174	4.012	4.793
-70	0.126	359	539	180	3.938	4.842

NH₃ (Ammonia) T_F=-77.9(°C), T_C=132.4(°C)

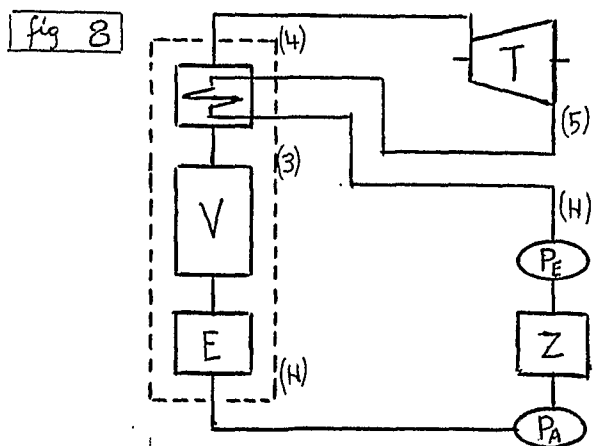
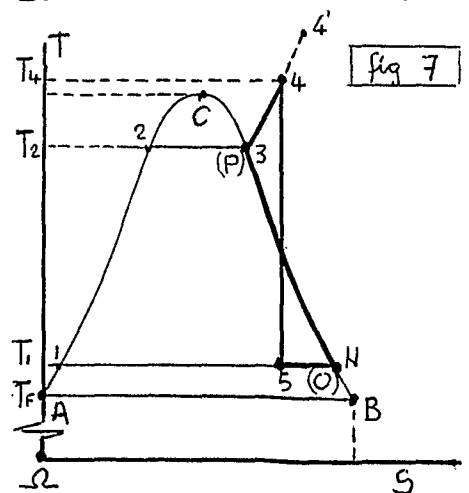
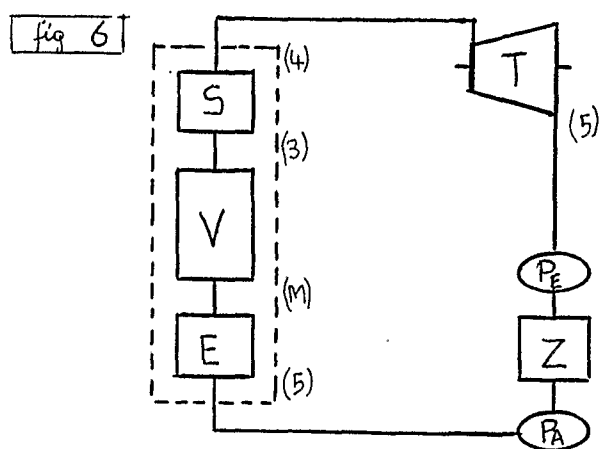
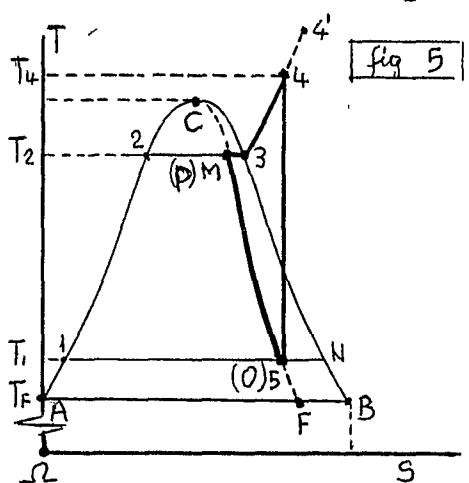
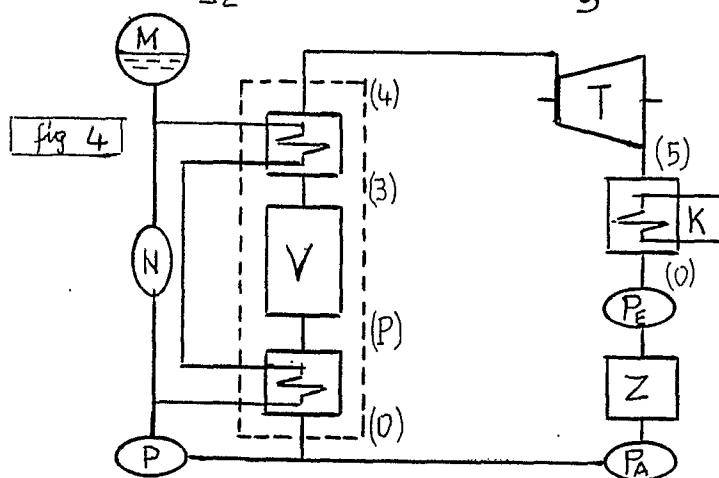
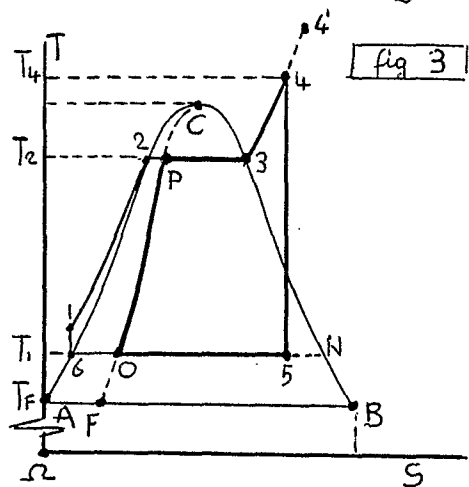
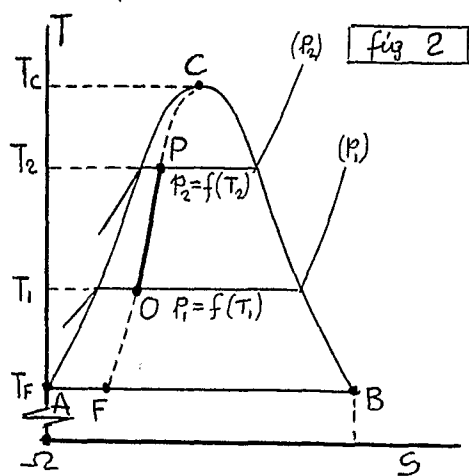
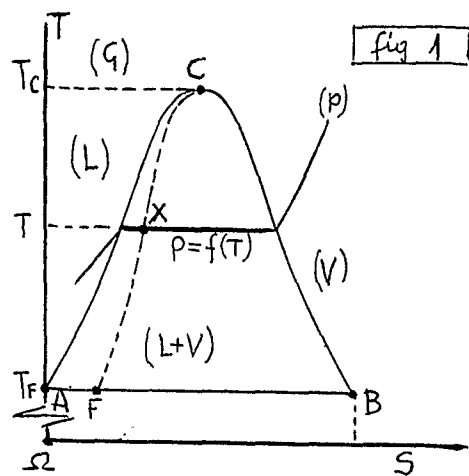
TABLE C

T (°C)	p (k _p /cm ²)	H' (kJ/kg)	H'' (kJ/kg)	H''-H' (kJ/kg)	S' (kJ/kgK)	S'' (kJ/kgK)
132.4	115.2	1320	1320	0	6.700	6.700
100 (150)	84.5	945	1655 (1890)	710	5.680	7.620 (8.250)
50	20.73	659	1711	1052	4.984	8.241
10 (50)	6.27	465	1691 (1790)	1226	4.353	8.684 (9.040)
0	4.38	419	1681	1262	4.181	8.809
-25	1.546	305	1649	1344	3.751	9.167
-50	0.417	194	1608	1414	3.300	9.620
-60	0.223	151	1591	1440	3.084	9.842

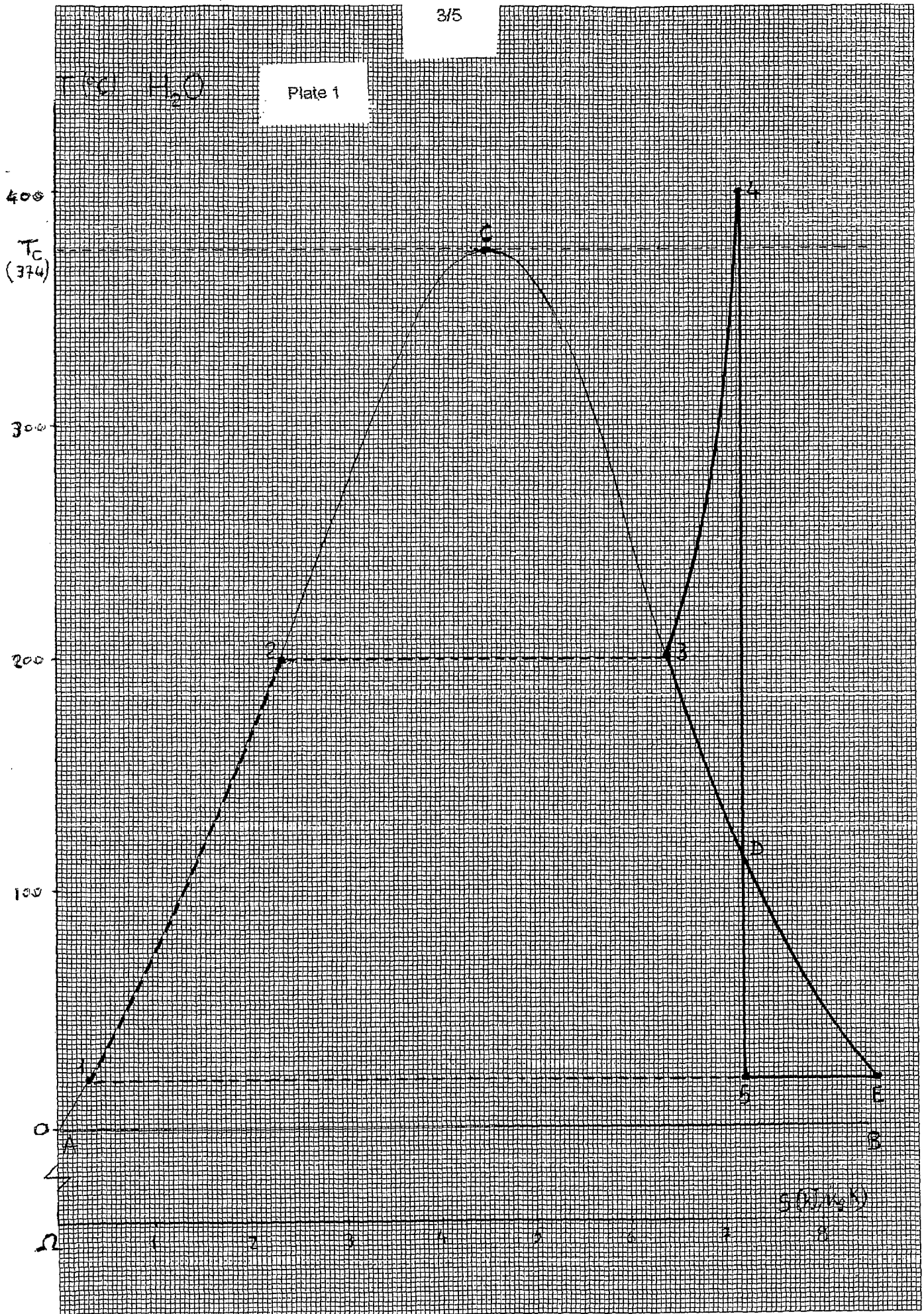
CO₂ (Carbon Dioxide) T_F=-56.6(°C), T_C=31(°C)

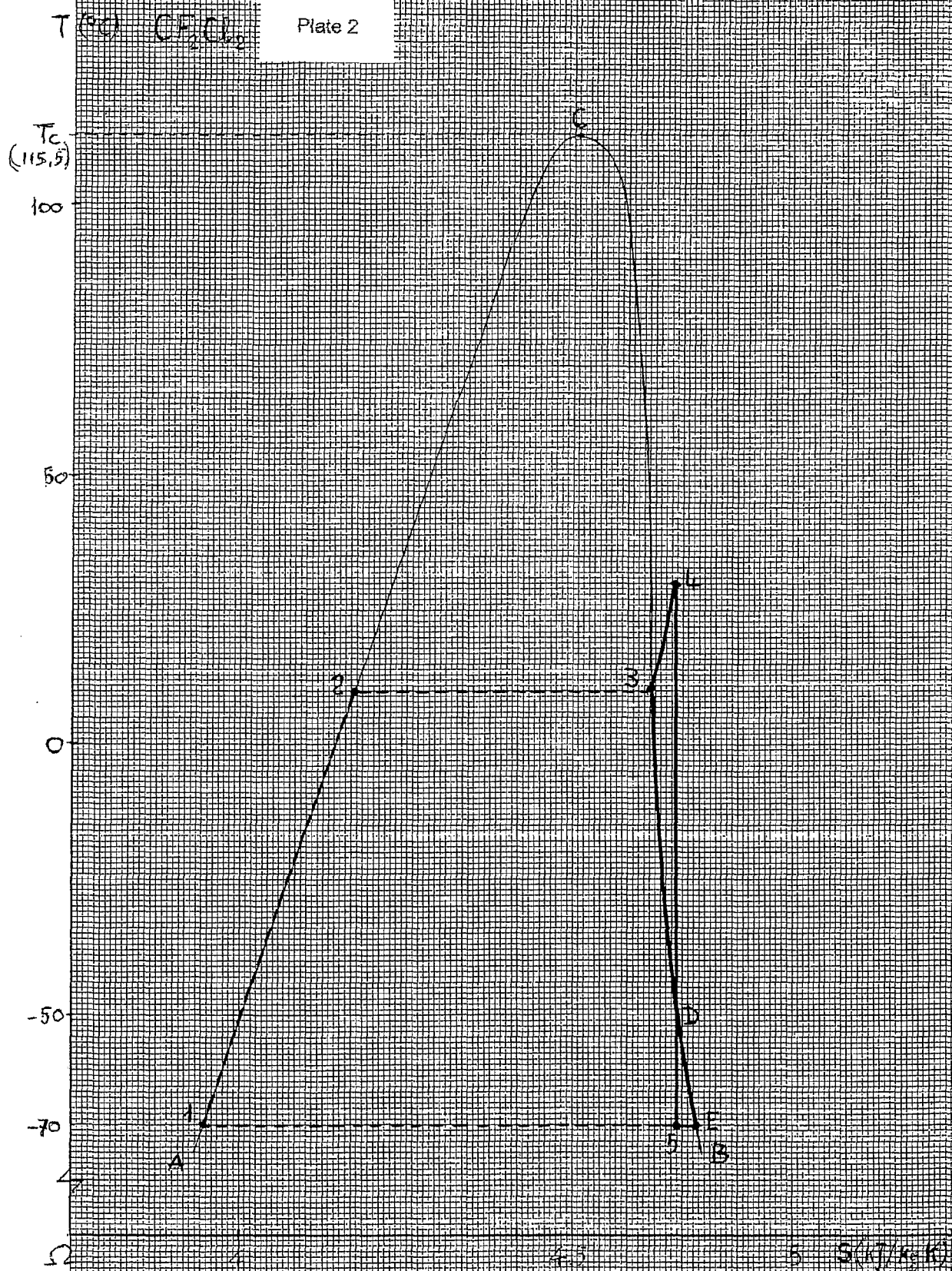
TABLE D

T (°C)	p (k _p /cm ²)	H' (kJ/kg)	H'' (kJ/kg)	H''-H' (kJ/kg)	S' (kJ/kgK)	S'' (kJ/kgK)
31	75.00	559	559	0	4.646	4.646
20	58.46	477	633	156	4.383	4.913
10 (50)	45.95	446	647 (709)	201	4.278	4.989 (5.192)
0	35.54	419	654	235	4.187	5.047
-10	26.99	394	656	262	4.098	5.092
-20	20.06	372	656	284	4.017	5.138
-30	14.55	352	655	303	3.939	5.185
-50	6.97	314	651	337	3.777	5.288



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