

Testing Method for Octane Number of Motor Fuel by Research Method

KES T – L332

(EST.) 1990 – 03 – 29

Contents

1. Scope of Application
 2. Definition of Words
 3. Definition of Test Method
 4. Apparatus
 5. Standard Fuel
 6. Driving Condition
 7. Starting and Stopping the Engine
 8. Adjustment of Knock Meter and
Tetonation Meter
 9. Determinant of Standard Knock
Strength
 10. Inspection of Engine
 11. Adjustment Compression Ratio and
Fuel & Air Ratio
 12. Adjustment of Knock Strength
of Sample and Inspection Knock
Meter Starter
 13. Calculation and Report
 14. Precise Ratio
- Additional table

1. Scope of application

This standard settles the knock ratio of spark plug engine about testing method under the condition which is relative low rotation.

2. Definition of words

Research method means the number of estimating the knock ratio of the engine. For example, integer of the nearest isooctane's volume(%) of mix standard fuel which is consist of isooctane(2,2,4-trimethyl pentane) which has same the knock ratio with the sample that was inspected by this method and n-heptane.

3. Definition of test method

Adjust the compression ratio and octane number to get the standard knock strength of the sample on 600 rpm condition, and decide after comparing the knock strength with the mixed standard fuel that you already know the octane number and sample. Calculation the octane number of the engine by insert knock meter starter between two mix standard fuel's seat, and the knock strength by using the determinat meter.

4. Apparatus

Apparatus must be consist of same structure, same size of power apparatus, same supplementary and inspection indicator such like figure 1. and table 2, must be mounted on the metal table.

Remark : The engine on the metal table is good when it is fixed on the non-vibration concret block (370 mm).

4.1 Power apparatus

Use the motor that can maintain the rotation of 600 ± 6 rpm and absorb the driving and the starting of the engine.

4.2 Supplementary

Important things are like below.

- (1) Ice tower (Note figure 2)
- (2) Cooling water condenser (Note figure 1)
- (3) Intake air heater and evaporator (Note figure 1 and figure 3)
- (4) Lubricant filter (Note figure 1 and figure 4)
- (5) Partial pressure adjusting tank

You can detach this at any direction which is over 250 mm for inner diameter, over 280 mm for outer diameter, over 28 ℓ for volume. But while inspecting the partial pressure, it is the good range between 0 and 250 mm. (Note figure 1)

- (6) Temperature meter
 - (a) Intake air temperature meter(16 ~ 71 °C)
 - (b) Cooling water temperature meter(-17 ~ 104 °C)
 - (c) Lubricant temperature meter(32 ~ 71 °C)

4.3 Inspecting indicator

It is consist of the knock meter, pick-up, static voltage apparatus and determination meter which have two type like 501 – AP and 501 – A.

5. Standard fuel

5.1 Standard fuel

- (1) Isooctane and n-heptane must be satisfied with following table 1.

Table 1

	Isooctane	n-heptane
Octane number (motor method)	100.0 ± 0.1	0.0 ± 0.2
Specific gravity(20/4 °C)	0.6918 ~ 0.6921	0.6836 ~ 0.6839
Winding ratio()	1.3914 ~ 1.3917	1.3876 ~ 1.3879
Solidifying point(°C)	More than - 107.5	More than -90.7
Evaporation		
50% ejection temperature(°C)	99.2 ~ 99.3	98.4 ~ 98.5
Distance of 20 ~ 80 % ejection temperature(°C)	Less than 0.1	Less than 0.2

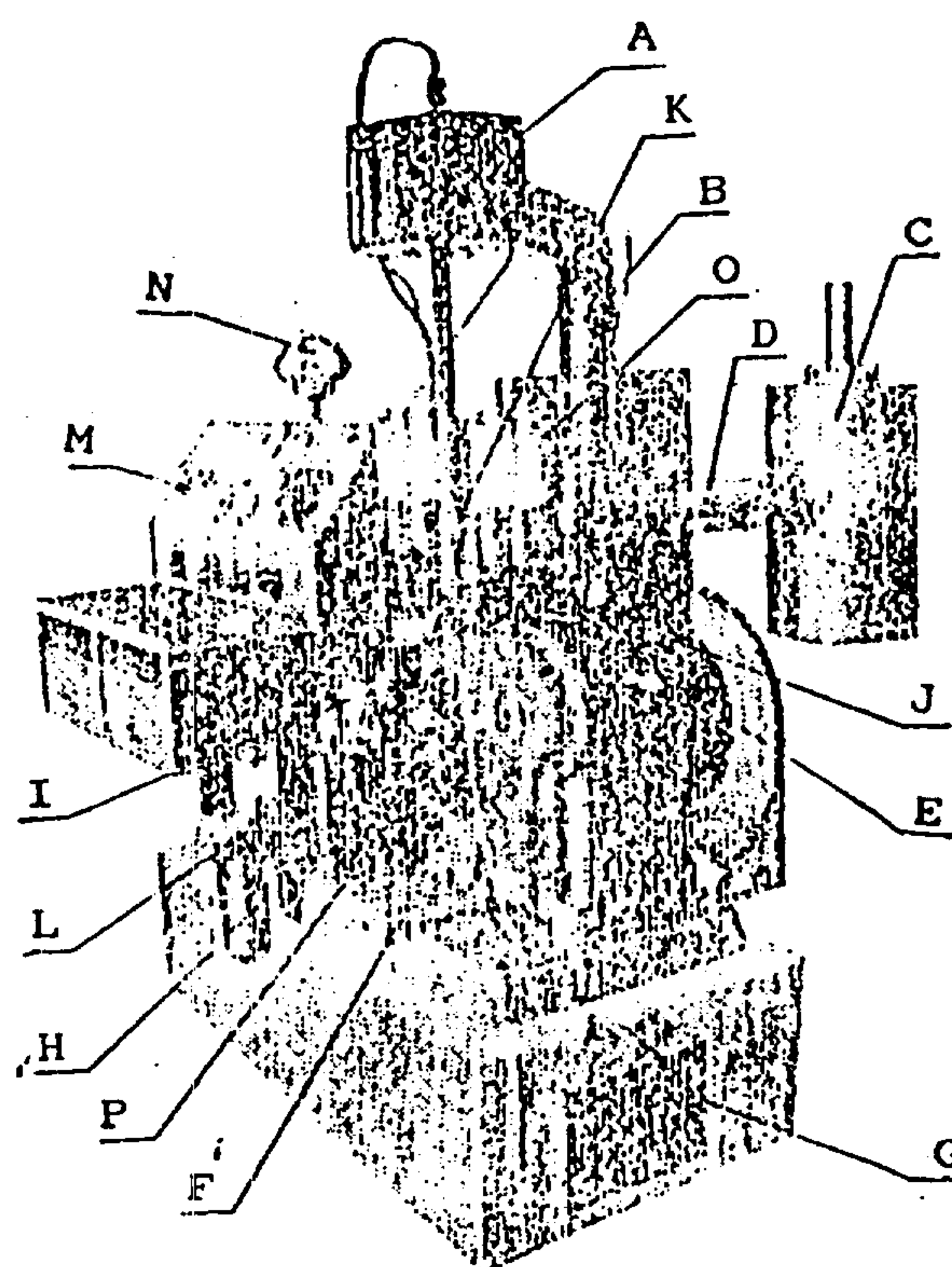
(2) Mixed standard fuel

Use the mixed standard fuel that was mixed isooctane with n-heptane. For example, the octane number of the mixed standard fuel which is consist of 80 % of isooctane volume and 20 % of n- heptane volume, is 80.

5.2 The fuel for inspecting the engine

Use below that to inspect whether the engine is right or not.

- (1) Toluene mixed fuel is mixture of toluene, n-heptan and isooctane. You can see the relation of the mix ratio and the octane number on the table 3. use toluene for the test.



- A. Intake air heating tank
- B. Cooling water condenser
- C. Ventilation pressure adjustment tank
- D. Ventilation pipe
- E. Handle for adjusting the compression ratio
- F. Lubricant Exit
- G. Used fuel tank
- H. Lubricant filter
- I. Ignition inter-lock
- J. Clamp for fixing the pipe of the engine
- K. Intake air temperature meter
- L. Ignition coil
- M. determination (type 501-AP)
- N. knock meter
- O. Fuel tank
- P. Indicator plate for ignition point

Fig.1 (Example) inspecting apparatus with research method for octane number

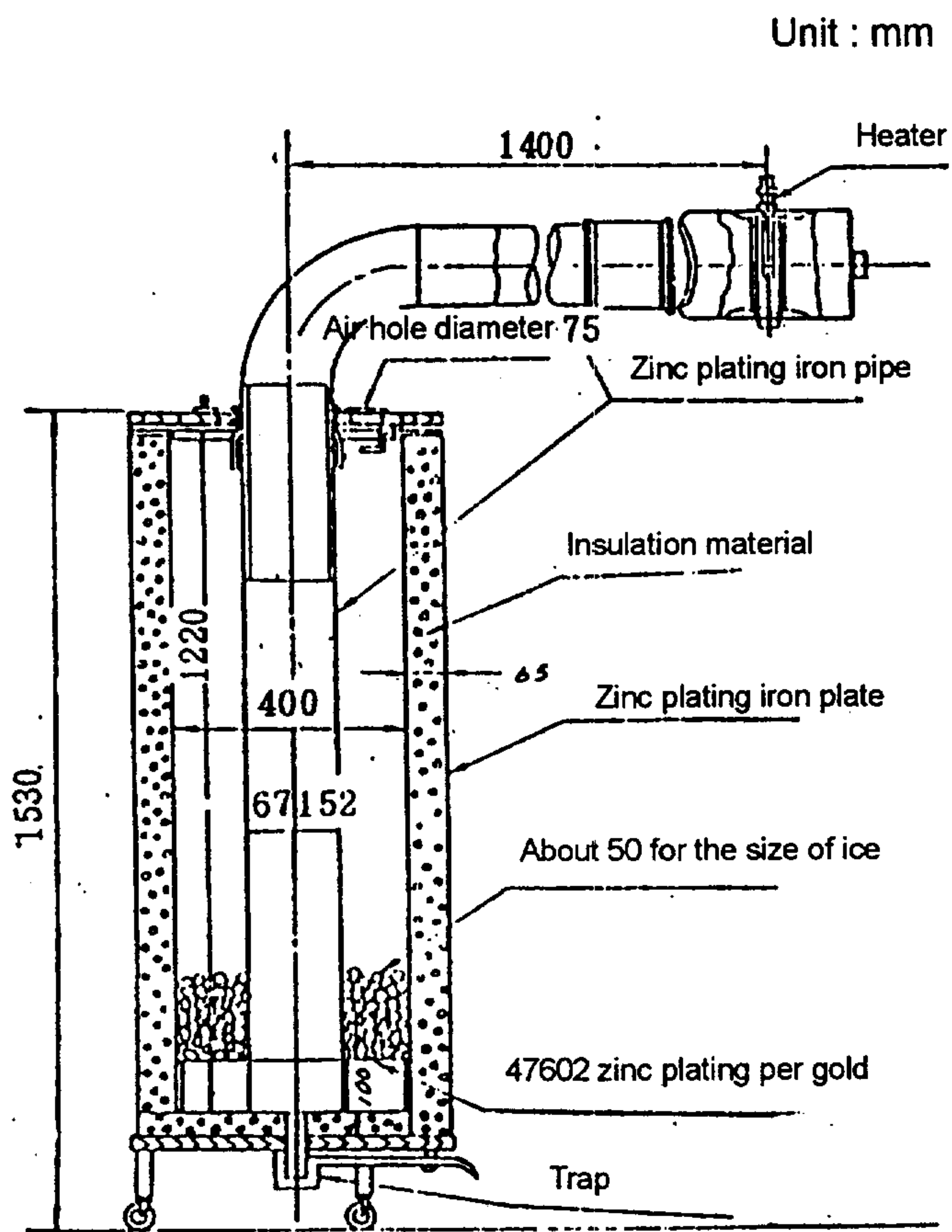
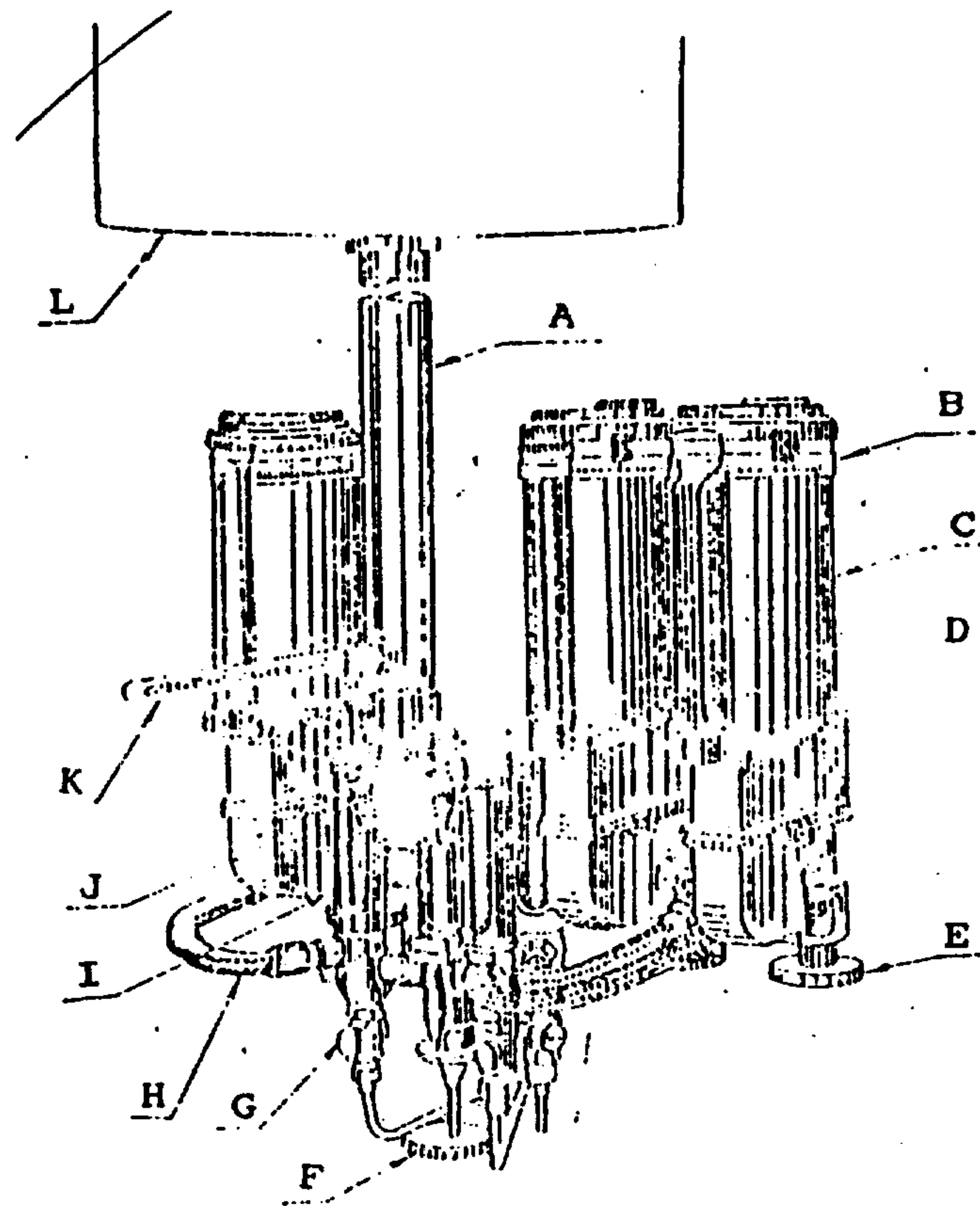
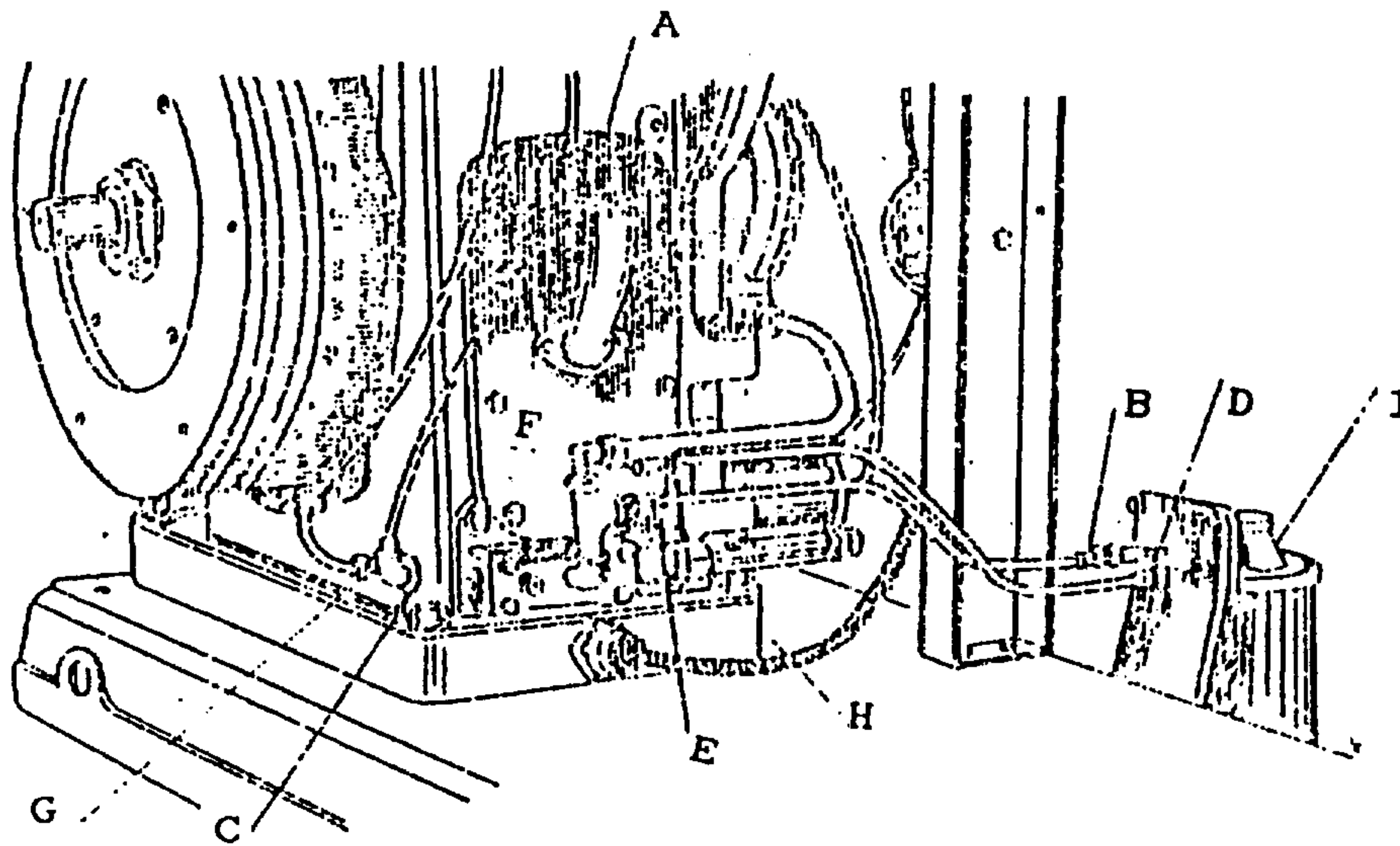


Fig.2 Ice tower(Example)



- | | |
|---|--|
| A. Intake air pipe | G. Fuel exit valve |
| B. Point of octane number | H. Intake fuel pipe |
| C. Fuel tank | I. Fuel surface gauge |
| D. Indicator plate for adjustment fuel tank surface | J. Junction for evaporator intake air pipe |
| E. Handle for adjusting fuel surface | K. Intake air temperature meter |
| F. Fuel valve | L. Intake air heating tank |

Fig. Evaporator



- A. Crank room bleeder
- B. Lubricant filter pipe (in)
- C. Lubricant pressure meter junction pipe
- D. Lubricant filter pipe (Exit)
- E. Sending fuel pump junction
- F. Pipe D junction
- G. Hole for inserting the lubricant temperature meter
- H. Adjusting handle for lubricant pressure
- I. Lubricant filter

Fig. 4 Lubricant system schema diagram

Table 2. Size of part of the engine

Unit : mm

	CFR – 18 type engine	High speed engine	Low speed engine
Pressure ratio	4. ~ 10	4. ~ 10	4 ~ 10
Cylinder inner diameter	8.25	8.25	8.25
Stroke	11.43	11.43	11.43
Volume (cm ³)	611.8	611.8	611.8
Law outside inner diameter	3.01	3.01	3.01
Connection pipe bearing			
Diameter	6.35	6.35	5.72
Length	4.13	4.13	4.43
Main front bearing			
Diameter	7.62	6.35	5.72
Length	6.35	5.72	5.08
Main rear bearing			
Diameter	7.62	6.35	5.72
Length	7.70	5.72	10.80
Piston part			
Diameter	3.18	3.18	3.18
Length between center connections	25.40	25.40	25.40
Timing gear pace	2.50	2.54	2.54
Number of piston ring	5	5	5
Diameter of valve board	More than 3.18	More than 3.18	More than 3.18
Size ignition plug (mm)	18	18	18
Weight of engine part (kg)	About 399	About 295	About 216
Weight of all (kg)	About 1,217	About 1,143	About 975
Legth between piston			
End of up-part		0.03556 ± 0.00251	
Part of center		0.01778 ± 0.00251	
Skate part		0.00762 ± 0.00127	
Length of ring's			
Pressure ring		0.01778 ~ 0.01318	
Fuel contacting ring		0.0254 ~ 0.04572	

Table 3. Toluene mixed fuel and its octane number

Motor method octane No.	Toluene volume(%)	Isooctane volume(%)	n-Heptane volume(%)	
57.8	50	0	50	65.2
60.1	52	0	48	67.8
62.2	54	0	46	70.3
64.4	56	0	44	72.9
66.5	58	0	42	75.5
68.5	60	0	40	77.9
70.5	62	0	38	80.3
72.5	64	0	36	82.7
74.4	66	0	34	85.0
76.1	68	0	32	87.3
77.9	70	0	30	89.5
79.5	72	0	28	91.5
81.1	74	0	26	93.4
82.7	74	2	24	94.8
84.1	74	4	22	96.0
84.9	74	5	21	96.7
85.5	74	6	20	97.2
87.0	74	7	18	98.3
88.5	74	10	16	99.6
90.0	74	12	14	101.0
91.7	74	14	12	102.5
92.5	74	15	11	103.3
93.4	74	16	10	104.2
95.1	74	18	8	106.1
96.8	74	20	6	108.0
98.2	74	22	4	109.9
99.5	74	24	2	111.8
100.8	74	26	0	113.7

Table 4. Inflammable mixed fuel and its octane number

Motor method octane No.	Isooctane volume(%)	n-Heptane volume(%)	4 Ethlyne top $\frac{ml}{l}$	Research method octane No.
61.9	30	70	0.528	57.9
63.4	32	68	0.528	59.6
64.8	34	66	0.528	61.2
66.3	36	64	0.528	62.8
67.7	38	62	0.528	64.4
69.1	40	60	0.528	66.0
70.4	42	58	0.528	67.6
71.8	44	56	0.528	69.2
73.1	46	54	0.528	70.8
74.4	48	52	0.528	72.3
75.7	50	50	0.528	73.8
77.0	52	48	0.528	75.3
78.3	54	46	0.528	76.8
79.6	56	44	0.528	78.2
80.8	58	42	0.528	79.6
82.1	60	40	0.528	80.9
83.3	62	38	0.528	82.3
84.6	64	36	0.528	83.7
85.8	66	34	0.528	85.1
87.1	68	32	0.528	86.5
88.4	70	30	0.528	87.8
89.8	72	28	0.528	89.4
91.2	74	26	0.528	90.4
92.7	76	24	0.528	91.7
94.2	78	22	0.528	93.0
95.7	80	30	0.528	94.2
97.2	82	18	0.528	95.4
98.8	84	16	0.528	96.6
100.0	85.5	14.5	0.528	—
—	86	14	0.528	97.8
—	88	12	0.528	98.9
103.9	90.0	10.0	0.528	100.0
76.4	60	40	0.264	73.0
84.2	60	40	0.792	84.3