COMMUNICATION RECEIVED AS A DISCUSSION ON MR. TAKAKURA'S PAPER ON REFRIGERATING MACHINERY.

FROM MR. Y. WADAGAKI, MEMBER.

The paper read by Mr. Takakura on the subject of refrigerating machinery is indeed a very good one.

With a great deal of temperance in refrigeration, the internal loss of mechanical work that may have been saved by the use of the machine may be transmitted to the another.

Because on account of restricted transmission of heat from one agent to another, because on account of the process of transferring refrigeration, refrigeration surfaces are sometimes made either small.

In consideration of the first cost of machinery, the condensing and expansion of the air, the expander may be omitted.

When the agent is refrigerated, the expander may be omitted.

1. When the air is the agent used, the condenser cylinder can not be omitted, for the air is nearly a perfect gas and cools itself only by doing outside mechanical work.

The cold produced by accelerated evaporation of some liquid or by rapid expansion of some compressed gas.

With a great fall of temperature, the thermal effect obtained per unit of mechanical work is not so good as in the case of a moderate range of temperature. In many cases therefore the clearance spaces at both ends of stroke in the working cylinder.

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The compression of refrigeration, always involve a certain amount of loss, so that it should be made as small as practicable.

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The better the compression of refrigeration, the better the machine, the smaller the range of temperature between which the liquid work to a workable point, and in the case of Refrigerating machinery, the smaller this range, the better the machine, the smaller the range of temperature between which the liquid work to a workable point, and in the case of Refrigerating machinery, the smaller this range, the better the machine.

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(a) Direct circulation of working fluid.
(b) Cold brine circulation.
(c) Dry air circulation.

Of these, (a) and (b) carry the fluid in pipes and take it back to the refrigerating plant after it has been used in cold rooms. Whatever cold left in the fluid is thus saved. In the system (c), any cold left in the current of dry air, after it has been discharged from the cold room, is entirely wasted. In (b) and (c) the transmission of cold takes place at two steps, they are therefore less efficient in this respect than the system (a). The system (b) is the heaviest of all the three.

With due precaution, the refrigerating system may be applied to keep down the temperature of magazines on board war vessels. And the examples of its application are not wanting in foreign navies.

The principal requirements of the working fluid best adapted for the refrigerating machinery are as follows:

(a) Low freezing point.
(b) Low evaporating temperature.
(c) Rapid evaporation.
(d) Great latent heat.
(e) Easy liquefaction (if liquefiable at all).
(f) Low vapour tension.
(g) Greater density.
(h) Suitability for smaller and lighter plant for given output.
(i) Low first cost of the plant.
(j) Simplified design.
(k) Greater dependability.
(l) No dangers from explosion.
(m) Easy refrigeration (if refrigerable at all).
(n) Great latent heat.
(o) Freer from condensation.
(p) Low evaporating temperature.
(q) Low freezing point.

Of course no substance can fulfil all the conditions above, and the engineer who has to choose any substance as the working fluid for his refrigerating machines should consider all the varying circumstances of the environment in which he has to work.

In any compression machine, the compression should be isothermally at low temperature by means of cold water jacketed cylinders, and the initial temperature made as low as possible. Where the fluid is compressed in stages, the intermediate condenser should also be provided, and all precautions connected in the working fluid must be observed.

With due precaution, the refrigerating system may be applied to keep down the temperature of magazines on board war vessels, and with due precaution the refrigerating system may be applied to all the three.

The principal advantages of the working fluid best adapted for the refrigerating machinery are as follows:

(a) Direct circulation of working fluid.
(b) No influence on the mechanical engineering of the plant, such as (c) No danger of explosion or explosion.
(d) No discharge of moisture or moisture, and less chance of break down.
(e) Direct circulation of working fluid.
Pipe, under the combined influence of the dense oxygen and the heat of compression. With dense air machine, therefore, it is imperatively necessary to provide a good type of moisture trap and oil extractor. The air supplied to the machine must also be free from any dust or other inflamable matter. We have already seen that the low initial temperature in the compressor, sufficient cooling of air during the compression and the carrying out of compression in stages with intermediate cooling are the necessary conditions for economical compression. These conditions are also essential for the safe operation of air compressing machinery. In connection with cooling of air during the compression it may here be stated that a long stroke compressor with a small diameter of cylinder has an advantage over a short stroke compressor of presenting more cooling surface, volume for volume.

For the sake of safety and economy, the valves of compressors should have a steady and definite action and be free from shocks and frictions. Oils employed for the internal lubrication of air compressors should be of very best quality, possessing high flashing and ignition points. The valve chambers of the compressor should be such as would admit of easy inspection and cleaning. An approved type of automatic lubricator should be fitted to the air compressing cylinder to regulate the supply of oil within a safe bound. It is also very desirable to make a special provision for the insertion of pyrometers or thermometers for ascertaining the temperature of the compressed air. The high initial pressure of air in the compressor will not only improve the economical performance of the plant to some extent, it has also the great merit of reducing the size and weight of the machinery.

Water is just as deep an it in the gravity used as refrigerating medium in connection with the refrigerating machinery on the system. Any flange of operation, in order to guard against the danger of explosion, the refrigerating plant must also be free from shocks and frictions. If the system of compressor is without a safety valve, the sudden pressure of air in the pipe may cause a dangerous explosion.

When a large quantity of air is compressed, more cooling surface is necessary to provide a good type of moisture trap and oil extractor. The pressure of compressed air in the pipe may cause a dangerous explosion.

Water is just as deep an it in the gravity used as refrigerating medium in connection with the refrigerating machinery on the system. Any flange of operation, in order to guard against the danger of explosion, the refrigerating plant must also be free from shocks and frictions. If the system of compressor is without a safety valve, the sudden pressure of air in the pipe may cause a dangerous explosion.
not take place rapidly enough to make it a commercial success when used as the refrigerating agent.

Ammonia assumes a gaseous state at ordinary temperature and under atmospheric pressure. It has a remarkable property of dissolving itself in one-seven hundredth parts of its own volume of water. The absorption machine is worked on this remarkable property of ammonia. It is of necessity worked at much higher pressure than the compression machine. It is said that in hot climates with the thermometer standing at 95° F., the pressure would reach 300 lbs per square inch and is seldom less than 150 lbs. Other difficulties with ammonia, as mentioned in Mr. Takakura's paper, are its corrosive action on metals, frequent and heavy leak, accompanied with a disagreeable odour, the impossibility to use the grease packed with a greaseable oil, the impossibility to use the glass panes and other glassware exposed to the direct action of ammonia, and corrosion of several other substances used in the refrigerating agent. Moreover, the refrigerating pipes would diminish their cooling efficiency. Hence the use of this substance should be avoided if possible.

The advantages claimed for ammonia absorption machines are the following:
(a) No expander is necessary.
(b) No metal is exposed to the action of ammonia.
(c) The absorbent itself does duty of vacuum pump.
(d) The expander itself does duty of the compressor.
(e) Its vapor is much denser than ammonia; therefore, the compressor itself does duty of the compressor.
(f) No new device is necessary for copper and annular grooves in the metal.
(g) No new chemical action on metals or feet.
(h) No chemical action on metals or feet.
(i) No cloudy action on metals or feet.
(j) No cloudy action on metals or feet.
(k) No cloudy action on metals or feet.
(l) No cloudy action on metals or feet.
(m) No cloudy action on metals or feet.
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(s) No cloudy action on metals or feet.
(t) No cloudy action on metals or feet.
(u) No cloudy action on metals or feet.
(v) No cloudy action on metals or feet.
(w) No cloudy action on metals or feet.
(x) No cloudy action on metals or feet.
(y) No cloudy action on metals or feet.
(z) No cloudy action on metals or feet.

Sulphureous acid (SO2)
(a) More easily liquefiable than ammonia.
(b) No chemical action on metals or feet.
(c) No chemical action on metals or feet.
(d) No chemical action on metals or feet.
(e) No chemical action on metals or feet.
(f) No chemical action on metals or feet.
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(x) No chemical action on metals or feet.
(y) No chemical action on metals or feet.
(z) No chemical action on metals or feet.

Carbonic acid (CO2)
(a) Does not absorb ammonia.
(b) No chemical action on metals or feet.
(c) No chemical action on metals or feet.
(d) No chemical action on metals or feet.
(e) No chemical action on metals or feet.
(f) No chemical action on metals or feet.
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(w) No chemical action on metals or feet.
(x) No chemical action on metals or feet.
(y) No chemical action on metals or feet.
(z) No chemical action on metals or feet.
(c) Inodorous and not poisonous in the quantity used.
Ether and alcohol.
(a) Work at diminished pressure and therefore comparatively
safe from any poisonous substance. This safeguard can be best
secured by the use of distilled water which can be obtained at a
small cost by taking advantage of the latent heat of exhaust steam.
(b) More or less leakage of atmospheric air into the partial
vacuum. Condensation and resorption to transform into less volatile
substances has an awkward tendency under the influence of frequent
condensation and rarefaction. Ether which is superior to all other substances in most
respects is an awkward substance under the influence of frequent
condensation and rarefaction. Ether and alcohol.
(4) Work at diminished pressure and therefore comparatively
nontoxic and not poisonous in the quantity used.
(c) Whatever method may be employed in the manufacture of ice, it is
always very desirable that it should be made from pure water, quite
free from any poisonous substance. This safeguard can be best
secured by the use of distilled water which can be obtained at a
small cost by taking advantage of the latent heat of exhaust steam.