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INSULATED COATINGS OF ELECTRIC MOTOR COILS DEVELOPED BY VEREINGTE LACKFABRIKEN, HAMBURG.

September 1945

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To : Chief of Naval Operations (OP-16-PT).

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TECHNICAL REPORT No. 369-45.

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INSULATED COATINGS OF ELECTRIC MOTOR COILS DEVELOPED BY VEREINGTE LACKFABRIKEN, HAMBURG.

SUMMARY

Vereingte Lackfabriken manufacture paints, coatings, lacquers and varnishes for specialized uses and is considered to be one of the foremost German Firms in this field.

This report discusses their most recently developed varnish for use in insulating electric motor, rotor and stator coil windings, and the two methods recommended for its application. The vacuum method of application herein described is reported to be a new development.

September 1945

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INSULATED COATINGS OF ELECTRIC MOTOR COILS

DEVELOPED BY VEREINGTE LACKFABRIKEN, HAMBURG.

1. General Description.

(a) Vereingte Lackfabriken is located at 185 Hindenburg Street in Williamsburg (suburb of Hamburg, Germany).

(b) This company is engaged in the manufacture of specialized coating compounds. Some of these products and their uses are impregnating varnish for insulating electric motor coils, petroleum resistant coating compound for concrete floors, synthetic concrete tank linings, weather resistant temporary coating for metal, and water proof coating for electrical cables.

(c) The firm has been operating for a number of years and is considered one of the foremost in their respective field. The present company was formed thru the combining of Gran Reluis and Wilhelm Carstens and Company.

(d) Dr. Morgenroth, the Chief Chemist for the plant, cooperated very well during his interrogation and spoke freely on the many details concerned.

(e) The rotor and stator coils which have been coated with the following described varnish are claimed to be positively resistant to saltwater, ammonia and sulphuric acid. It is therefore, ideal for refrigerator electric motors where the coils are subjected to ammonia gases, along with its shipboard uses where it is exposed to salt water and sulphuric acid fumes. Due to the chinawood oil content, the resistance to heat was stated to be very high. The heat developed will not cause the coating to be thrown off by the centrifugal force of the rotation. The coating is highly resistant to the passage of electrical energy.

(f) It was stated that this varnish was sold in large quantities to the German Forces.

2. Method of Preparation of Impregnating Varnish for electric motor coils.

Diagramatic manufacturing process:

Heat Following to 200°C

19.50 Kgo - Raw Chinawood Oil.
13.50 Kgo - Blown Linseed Oil.
2.60 Kgo - Boiled Chinawood Oil.
- heavy consistency, before adding, boiled to heavy viscosity at 260°C.
3.75 Kgo - Colophonium Resin.
3.75 Kgo - Resin Ester.

Following form paste, heat to 220°C (neutralize acids):

1.05 Kg - Calcium Carbonate.
2.70 Kg - Raw Chinawood Oil.
2.00 Kg - Boiled Chinawood Oil.

Boil Combination to 230°C

Add cold to bring down temp. from 280°C.

13.1 Kg - Boiled Linseed Oil.

Heat to 100° - 120°C before adding.

75.0 Kg - Benzine (100/140)

9.0 Kg - Dryer (cobalt, lead manganate).

(Sample included with orginal report)
(Impregnating Varnish).

3. Methods of applying insulating coatings.

(a) Thermal - Dipping Method.

It is first necessary to remove all dirt and foreign

3. Methods of applying insulating coatings (a)(cont'd.)

matter from the unimpregnated rotor or stator coils by any accepted method. The coil is then heated to approximately 60 to 80 degrees centigrade and immersed in the varnish. Remove and allow to drip and then place in oven and bake at 100 - 120 degrees centigrade. The process is then repeated, or in other words, it is dipped twice and baked twice.

(b) Vacuum Method of Applying Insulating Varnishes.

The vacuum method of applying the varnish, was stated as being a very recent development in this line of endeavor, and an improvement over the other methods of processing coil coatings.

The description follows of the Vacuum Process, as translated from a treatise received from Vereinigte Lackfabriken:

(1) Drying Out.

It is first necessary to remove any moisture that may be present in the unimpregnated coils as the moisture would retard the drying. This is accomplished by heating the parts under a vacuum at 60 to 80°C until no further moisture accumulates in the condenser. In order to gain time, some firms do this drying in the regular drying ovens, the time being approximately 4 to 6 hours at 80 to 90°C. After this, the parts are given a final drying of about 30 to 45 minutes in the impregnating chamber at approximately 70 cm. vacuum. Generally the moisture is dryed out in the ovens to the point where no further moisture appears in the condenser at this step.

(2) Impregnation.

Impregnation under vacuum can now be started. Care must be taken to have the parts containing the windings, cool down to approximately 40 to 50°, before introducing the impregnating lacquer into the vacuum chamber. There must be no break in the vacuum, so that

3. Methods of applying insulating coatings (b)(cont'd.)

all pores in the parts to be impregnated are devoid of air and the lacquer can penetrate to the innermost sections. The cooling to 40 to 50°C is very important, because at higher temperatures there will be strong bubbling in the lacquer. As a result the parts lying in the upper sections under certain conditions will either not be impregnated at all or very poorly. At the lower temperatures the impregnation proceeds practically without foam formation. It is best to hold the temperature of the lacquer at approximately 30 to 40°C. Once the lacquer is sucked in, the vacuum is broken in order to have the atmospheric pressure force the impregnating compound into the pores. Upon completion of impregnation, the lacquer is drained off and the parts permitted to drip from 3/4 to 1 hour. During this time the vacuum pump is operated so as to immediately suck off the gases formed by the evaporation of the solvents. However, no vacuum is created. The dripping of the winding sections takes place at normal atmospheric pressure.

The connecting line between the impregnation chamber and the container in which the lacquer is stored, can be closed only after the dripping process is completed. Otherwise the lacquer draining off during this time will clog the line.

(3) Drying.

Actual vacuum drying, as such, is basically not possible with insulating lacquers. The vacuum treatment serves only the complete and quick removal of the solvents from the windings which generally is accomplished in from 3 to 4 hours. To this end, all the parts, after completion of the dripping, are reheated to 40 to 50°C, and put under a vacuum of 70 to 72 cm. The next step is the actual drying process. The parts are placed in a normal drying cabinet with a temperature of 90 to 100°C. The exhaust vent on this cabinet is opened and a constant supply of fresh air is maintained. Drying can also be done in the

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3. Methods of applying insulating coatings (b)(cont'd.)

impregnating chamber, however, only at atmospheric pressure with the lid open.

(4) Lacquer Consistency.

Impregnating lacquers for the vacuum process, are furnished in viscosities for use at the various temperatures as shown in the following tables:

Quality:	at: 15°C	20°C	25°C	30°C	SECONDS
No. 310	44-46	32-34	23-39	24-26	"
No. 355	43-45	32-34	27-29	23-25	"
No. 3006	31-33	25-27	22-24	20-22	"
No. 3054	31-33	25-27	22-24	20-22	"
No. 3011	31-33	26-28	23-25	20-22	"

The indicated viscosity times were measured with the DIN cup. This cup is obtained from the Hugo Kayl Company, Dresden, A1. Marienstr 24.

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