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Classic Connectors, Inc.

Transmission & Distribution Hardware

(Part 1, The Beginning)

By Waymon P. Goch

Transmission and distribution hardware (or Hi-Line hardware as it is commonly known) dates back to around 1882 with construction of the first electrical transmission lines in North America. The history and development of T&D hardware is also a history of insulators. The two are inseparable and both had their foundation in communications as early as 1755 when B. Martin began experimenting with conductors suspended from silk thread to insulate them from ground. Thus, it is fair to say that the forerunner of modern suspension insulators was silk thread.

Early insulators were primarily made of glass and dry process porcelain. They were of rather poor quality and failures were common. The first glass and porcelain pin type insulators were developed in the 1850's. As transmission voltages increased above 20 kV, it was found the single pin types were no longer suitable and multi-part porcelain pin type insulators, consisting of two or more shells either glazed or cemented together were developed and applied. A 55 kV transmission line was successfully built and operated in the U.S. in 1902 using 4 layer multi-part porcelain insulators. About the only T&D connection hardware required for these early systems was tie wire to attach the conductor to the insulators.

This type of construction continued to be used for transmission voltages up to 90 kV. However, pin type insulators were already becoming too large to be used for transmission voltages over 100 kV and were quickly becoming impractical for use on transmission lines. This was a very dynamic time period in the insulator and hardware industry when insulator manufacturers also typically supplied the hardware for use with their insulators.

The era of modern suspension insulators and hardware really began in 1903 with the invention of the world's first suspension insulator by Fred Locke, founder of the Locke Insulator Mfg. Company. Duncan, Hewlett, DeWitt and others devised several different suspension insulator shapes and connecting means. In 1910 two significant but independent events would come together to create what has become the standard suspension insulators and associated hardware of today. Fred Locke developed the clevis suspension insulator connection and in January, 1910 Arthur O. Austin of the Ohio Brass Company was granted a patent covering the basic ball and socket connection.

Increasing transmission voltages and longer spans meant longer suspension insulator strings, higher static and dynamic mechanical loads and higher strength conductor and hardware. The strength limitations of copper as a transmission line conductor were recognized early on as it progressed from solid to stranded in attempts to increase its strength and flexibility. Use of stranded aluminum conductor began around 1895 and ACSR in 1910. Not only was ACSR less costly than its predecessors, but its greater strength permitted higher stringing tensions and longer spans resulting in its immediate acceptance and widespread use. However, this also increased the need for higher strength hardware, clamps and fittings.

Although manufacturers formed several different organizations, beginning in about 1905, they were primarily social rather than standards making bodies. It wasn't until NEMA (National Electrical Manufacturers Association) was formed on September 1, 1926 that serious attention was paid to developing standards for insulator connections and hardware. NEMA and EEI (Edison Electric Institute) standards 140 and TDJ-52 ultimately evolved into the ANSI C29 standards that are in use today.

It is interesting that early insulator and hardware manufacturers' catalogs do not discuss or assign mechanical strengths but ultimate tensile strengths were most likely on the order of 5,000 – 8,000 lbf and there were numerous failures of some designs.

The following are from the various sources including O-B Hi-Tension Porcelain Insulator Catalog No. 10, published by The Ohio Brass Company in July, 1910.

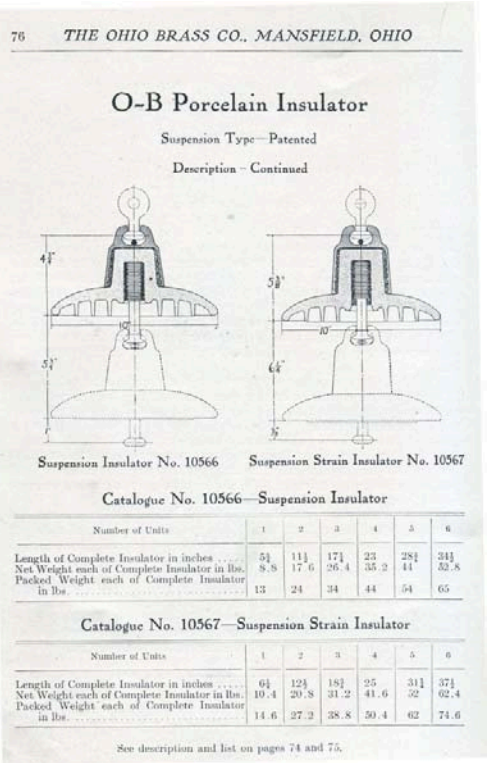
74 THE OHIO BRASS CO., MANSFIELD, OHIO

O-B Porcelain Insulator

Suspension Type—Patented

Two O-B Units connected; lower Unit shown in section

OB Catalog No. 10 (July, 1910)



76 THE OHIO BRASS CO., MANSFIELD, OHIO

O-B Porcelain Insulator

Suspension Type—Patented

Description—Continued

Suspension Insulator No. 10566 Suspension Strain Insulator No. 10567

Catalogue No. 10566—Suspension Insulator

Number of Units	1	2	3	4	5	6
Length of Complete Insulator in inches	5¼	11¼	17¼	23	28¼	34¼
Net Weight each of Complete Insulator in lbs.	8.8	17.6	26.4	35.2	44	52.8
Packed Weight each of Complete Insulator in lbs.	13	24	34	44	54	65

Catalogue No. 10567—Suspension Strain Insulator

Number of Units	1	2	3	4	5	6
Length of Complete Insulator in inches	6¼	12¼	18¼	25	31¼	37¼
Net Weight each of Complete Insulator in lbs.	10.4	20.8	31.2	41.6	52	62.4
Packed Weight each of Complete Insulator in lbs.	14.6	27.2	38.8	50.4	62	74.6

See description and list on pages 74 and 75.

OB Catalog No. 10 (July, 1910)

O-B HI-TENSION INSULATORS 77

Suspension Eye and Wire Clamps

No. 10594 Suspension Eye

Suspension Wire Clamp. Patent Applied For

Anchor Wire Clamp. Patent Applied For

Suspension Eye for O-B Suspension Insulator

Diameter of hole in eye is ¾ inch; center of eye to center of ball is 2 inches. Drop forged steel, galvanized.

Code Word	No.	List per 100
Handcuff.	10594—Suspension Eye, galvanized	$25 00

Suspension and Anchor Wire Clamps

THE Suspension Clamp need not be taken apart to install, as by allowing the wire to enter the vertical slot the clamp can be turned so as to drop the wire into the groove where it may be securely fastened in place by drawing down the clamping casting by means of the bolts.

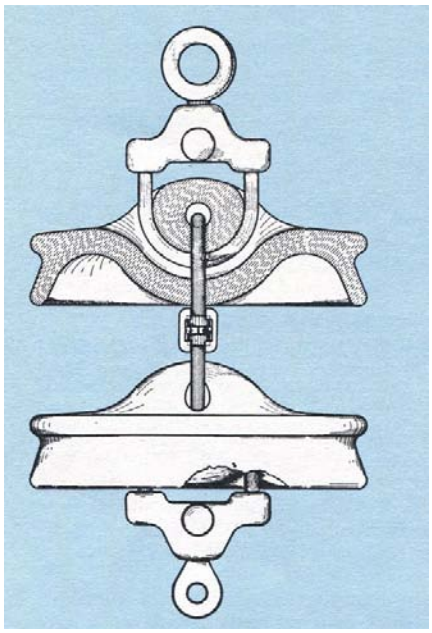
The Anchor Clamp is intended for use with aluminum cable, and a split aluminum sleeve is placed between the body and the clamping casting to protect the cable.

It is not necessary to remove either the bolts or nuts to install these Clamps.

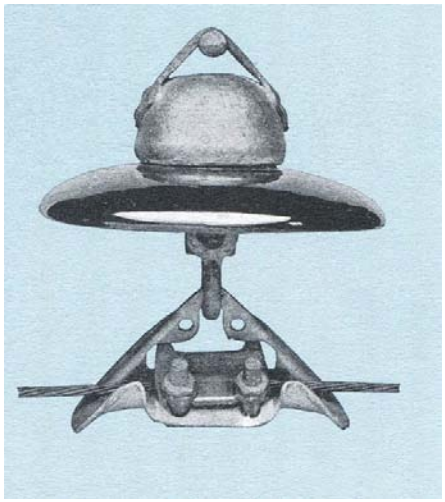
We can furnish both Suspension and Anchor Clamps for any size and kind of wire and in a variety of designs to meet various requirements.

OB Catalog No. 10 (July, 1910)

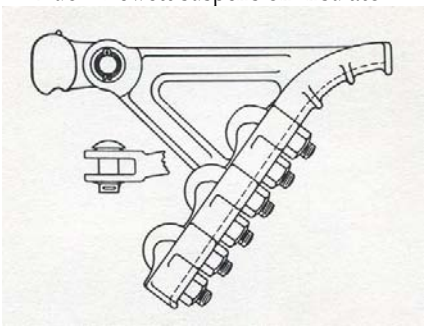
Early suspension insulator strings



Buck-Hewett suspension insulator



Typical early suspension clamp



1920s u-bolt strain clamp

(Part 2 of this series will continue in next month's newsletter).

References:

1. Building for Tomorrow, Ohio Brass Company Publication No. 2778-H

2. The History of Hi-Line Hardware, The Brewer-Titchener Corporation, Cortland, NY, 1960.

3. Porcelain Insulators and How They Grew, Brent Mills, published privately by Brent Mills, LeRoy, NY, 1970.