熔断器文献索引

（1906—1951）

第一机械工业部电器研究分所
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南京

說明

根据1965年3月在西安召开的电瓷专业情报工作会议的精神，我们将《Electric Fuse》A Review (H. Läpple, Butterworths Scientific publications, 1952) 一书所附的文献索引（1906－1951），計267条，翻印成册，並将题目译成中文。

这些文献，对从事熔断器設計与制造的同志，以及使用单位，有一定参考价值。既有期刊文献，也有会议报告，且大部份文献都有内容简介，这对了解全文很有帮助。

技术情报室

熔断器的理论

1 Meyer, G. J.: On the Theory of Fuses (Zur Theorie der Abschmelzsicherung). München (1906).

The book deals with the pre-arcing time of open-type fuses. Within these limits it tackles the problems both by calculations and by tests. The results are fundamental terms representing characteristic quantities and constants. They are given in tables and curves suitable for engineering practice.

熔丝的发热

2 Emde, F.: 'The Heating of a Wire Fuse Elements' ('Die Erwärmung eines drahtformigen Schmelzeinsatzes'). Elektrotech. u. Maschinenb. (E. u. M.), 25, 455-478 (1907).

This paper contains an analytical investigation of the temperature-rise and temperature distribution along a fuse-wire. The thermal capacity of the terminals between which the wire is clamped is assumed to be so great that their temperature-rise may be neglected. The general solution obtained is applied to the case of a tin fuse-wire. The paper concludes with some general remakrs on problems in heat. (Abstr. 1024/1907.)

熔断器理论及使用的研究

3 Meyer, G. J.: 'Theoretical and Practical Research on Fuses' ('Theoretisches und Praktisches über Abschmelzsicherungen'). Elektrotech. Z. (ETZ), 28, 430-435 and 460-464; Disc. 1136-1139 and 1158-1161 (1907).

The paper represents the report of a lecture in which the author outlines the application of his calculations and experiments for practical purposes. He specially describes the estimation of the temperature-rise for fuse-wires of different materials when loaded with currents up to the critical current. He also gives tables, which contain the characteristic constants of the metals generally used in fuses, and describes his observations made on fuse-wires blown under small overload conditions.

Following on his research, the author makes some proposals for the improvement of the German Standard Specification for fuses. The lecture was followed by an interesting and spirited discussion on two days, in which all important fuse-problems were tackled, and which thus amounted to a survey of the state of the art in those days.

熔丝的熔化試验

4 Edler, R., and Schuster, R.: 'Melting Tests of Fuse

Wires of Silver, Copper, and Lead Used in Porcelain Cartridges' ('Abschmelzversuche mit Silberdrähten, Kupferdrähten und Bleidrahten in Porzellanrohr-Patronen). Elektrotech. u. Maschinenb. (E.u. M.), 28, 619-629 and 641-645 (1910).

The object of these researches was to enable any one, from a few systematically-carried-out experiments, to determine rapidly and without calculation the dimensions of the fuse wires (number of wires, diameter, and length of wire) for a whole series of cartridges graded according to voltage and current. The experiments were made with a cartridge in the form of a vertical porcelain tube having terminals for 4 fuse-wires each approximately 250 mm. long. The currents were supplied from a 2 kW transformer. The critical currents I_g, viz. the highest that can be passed continuously without the wire melting, were taken from experimentally obtained curves showing the relation between current and time taken to fuse the wire for different diameters. This current may be expressed by the formula $I_g - Cd^x$ where C and x are co-efficients and d is the diameter of the wire. Taking the average of the experimental results obtained by the authors and by G. J. Meyer (Abstr. No. 644 (1907) (see also Meyer[1]), the following values are obtained:

$$\text{Silver, } I_g = 44 \cdot 5d^{1.558}; \text{ Copper, } I_g = 62.5d^{1.48},$$
$$\text{Lead, } I_g = 6.5d^{1.575}.$$

This formula enables the working current for a wire of any given diameter and material to be determined under any given conditions, e.g. that it shall be capable of bearing continuously an overload of 1/3 the normal current, but will fuse within two min., with double the working current (Regulation of the Vienna Elektrotechn Verein). A number of curves are included, giving the results of experiments on the relation between current and the time of fusing for currents lying between the critical current and a current equal to double the working current, The determination of the temperature of the wire when the working current is flowing is very fully worked out both for short and long fuse wires, the constants required in the several formulae being given in tabular form. Among the results obtained were the following: Copper wires are the most sensitive, that is to say, they melt more quickly than either silver or lead wires, silver being the slowest. High voltages have no appreciable influence on the cross-sectional dimensions of the fuse wires. (Abstr. 842/1910.)

熔断器的理论

5 Jasse, E.: 'On the Theory of Fuses' ('Zur Theorie der Schmelzsicherungen'). Elektrotech. u. Maschinenb. (E.u.M.), 28, 999-1004 and 1030-1035 (1910).

The author develops the equation for the current-heating of fuse-wires when the heat-emission is proportional to the temperature-rise. The result is discussed with regard to the technical designs of fuses and their time/current characteristics. For engineering purposes approximate formulae are outlined and some research is described showing the influence of the different material constants on the time/current characteristics.

熔断器的标准化

6 Kefford, H. W.: 'Standardization of Fuses'. F. Inst. Elect. Engrs., 45, 620-642 (Discussion, 642-648) (1910).

This paper deals with the subject from a practical rather than an academic point of view, and considers each of the following points, which the complete specification of a line of fuses will embrace: (A) A definition of 'marked' or 'rated' current in terms of the 'limiting' current (also called 'normal fusing' current'). (B) A standard range of current rating values and voltages. (C) A definition of one of more points on the 'time-overload' curve of each fuse. (D) Regulations as to non-interchangeability, temperature rise, freedom form deterioration, and perfect operation under all conditions. (E) Specifications for the standard method of carrying out short-circuit, temperature-rise, and overload tests. The following suggestions are put forward as a basis for the discussion of a specification for standard fuses: I (A) Material for fuse wire. The fuse wire must not corrode or permanently change its conductivity or physical structure. (B) Non-interchangeability. Fuses up to 50A. rated current should be provided with a simple arrangement by means of which the capacity of the fuse which can be inserted by a non-technical user is restricted within definite limits. (C) Type of fuse recommended. To facilitate compliance with (A) and (B) above and generally to render standardization practicable and useful, an enclosed cartridge type of fuse is recommended. (D) Indication of fusion. All fuses must be provided with a simple means for detecting fusion simply by inspection of the fitting. 2 (E) Rating. The rated current marked on the fuse shall bear a definite relation to the limiting current or least current which will produce fusion within four hours. The minimum value of the ratio a (limiting current/rated current) shall be 1.54 and the maximum value shall not be higher than 30 per cent above the minimum. In a correctly proportioned line of fuses a should decrease from the maximum to the minimum values specified, as the size of the fuse increases from the lowest to the highest capacity. This regulation is based on the assumption that silver is the best metal for fusible links, taking into consideration its permanent character, the small volume required, and its 'clean' action when breaking the circuit. (F) Sluggishness of action and time element. Standard fuses shall be so rated and constructed that when loaded with 50 per cent above the limiting current they will fuse within one min. The actual time required for fusion shall be taken as a measure of the 'time element' of the fuse. (G) Standard rated currents and voltages. Every fuse shall be clearly marked with its rated current and the maximum voltage for which it is suitable. The standard rated currents and voltage suggested are as follows:

Maximum Voltage, 250-2,4, 6 and 10A. Maximum voltage, 500-2,4,6, 10,15,20,30,40 and 50A.

3 (H) Temperature rise. When loaded continuously with 80 per cent of the limiting current no exposed part of any fuse fitting shall attain a temperature exceeding 100° C above atmospheric. (K) Insulation. Fuse fitings shall be tested for insulation between terminals with the fusible portion removed and between the live parts and 'earth' with the fusible portion in place. (L) Operation. Fuses shall be tested for satisfactory operation on overload and short circuit in accordance with the specified arrangements for carrying out such test. (Abstr. 1056/1910.)

熔断器理论的补充

7 Meyer, G. J.: 'Suppements to the Theory of Fuses' ('Nachträge sur Theorie der Abschmelzsicherungen'). Elektrische Kraftbetriebe und Bahnen, 7, 124-127 (1911).

In this paper, the author gives a report of the development in the theoretical knowledge about fuses since the publication of his book[1] and of his lecture[3]. He discusses the papers of Emde[2] and Jasse[5].

For engineering practice he develops a specific time/current characteristic inherent for any metal and he defines the 'absolute delay constant' of a material. Special attention is given to the 'time-constant' which he feels does not exist inpractice.

线路开断和单相开断过程的工频过电压

8 Petersen, W. (Thesis Darmstadt): 'Overvoltages of Normal Frequency Due to Breaks in Lines and Single-pole Switching Processes' ('Uberspannungen mit der Betriebsfrequenz bei Leitungsbruchen und einpoliger Schaltvorgängen'). Elektrotech. Z. (ETZ), 36, 353-356; 366-368; 383-385 (1915).

The article--the first on this subject--gives a basis for the explanation and calculation of the overvoltages that can be caused in distribution netweorks by single-phase interruptions or connections.

金属融化时电阻的变化

9 Tsulsumi, H.: 'On the Variation of Electric Resistance During the Fusion of Metals.' Toho Univ. Science Report, 7, 93-105 (1918).

After reference to previous work on variation of electrical resistance and other physical properties during the fusion of metals, the author describes an investigation to obtain exact data on the subject and to contribute material on the electron theory of conduction through metals which requires that the ratio of thermal and electrical conductivity should be independent of the material, e.g. through change of state from solid to liquid. Varvous special precautions taken in the tests are mentioned as well as the methods adopted. The results for several metals are discussed with some calculations on electronic theory and atomic structure.

插塞式熔断器的可靠性

10 Höpp, W. (AEG Berlin): 'Reliability of Performance of Plugtype Fuses' ('Die Betriebssicherheit der Schmelzstöpsel'). Elektrotech. Z. (ETZ), 42, 454-459 (1921).

The paper deals with the behaviour of fuses with enclosed fuse-elements (Plug-type fuses, cartridge-fuses) in practical application. The breaking characteristic, which gives the limit of permissible voltage plotted against breaking current, is a means of showing the differences in the performance of fuses in d.c. and a.c. circuits and the varying ability of different makes. Reference is made to the effects that occur when two or more cartridges are used in series or when several fuse-wires are connected in parallel. The author considers the influence of the main structural features and materials of common fuses, and gives some fundamental suggestions concerning the breaking-process.

熔断器用的銀銅合金

11 Edler, R.: 'Silver-Copper Alloys for Fusible Cut-outs' ('Silber-Kupfer-Legierugen für Schmelzsicherugen'). Elektrotech. Z. (ETZ), 45, 1397-1398 (1924).

Copper fuses are open to the objection that their carrying capacity is gradually reduced by corrosion of the surface, which occurs even when thewire is silvered and is more rapid the higher the temperature of the wire in service. Silver is immune from such deterioration, but its high cost is a serious consideration. Particulars are given concerning a serie of tests made on silver-copper alloys with a view to finding an inexpensive alloy which would combine the merits of both constituents. The maximum current in amps which a wire of diameter d mm. and length not less than 250 mm. will carry indefinitely when mounted in a vertical tube, open top and bottom, is given by $I = \sqrt{a d^3}$, where a has the average values shown in the table for wires from 1 to 2 mm. diameter. The rating of the fuse wire in amps is given by $I_{nom} = \sqrt{b d^3}$, where b has the values given in the table, these values being such that the fuse will carry indefinitely 1.6 times the rated current of the fuse, i.e. $b = a/1.6$.

A curve plotted between a and the percentage of silver in the alloy s regular until the silver content is reduced to 20 per cent, but when the proportion of silver is further reduced the character of the curve changes, and it is about this point (say 15 per cent of silver) that metallurgical investigations show non-homogeneities to exist in the alloy. From the electrical and metallurgical points of view, however, 'Zeus' wire, containing 20 per cent silver and 80 per cent copper, is a cheap and satisfactory substitute for pure silver fuses. (Abstr. 515/1925.)

Silver-Copper Alloy Per cent, Ag.	Per cent, Cu.	Value of a	Value of b	Name of Material
100	0	44.5	27.8	Pure Silver
50	50	49.9	31.2	'Herkules' wire
30	70	49.6	31.0	--
20	80	51.0	31.9	'Zeus' wire
10	90	55.3	34.6	--
0	100	60.0	37.5	Pure Copper

由於接地线圈前面的熔断器熔断所造成装置故障

12 Kocher, H. (Brown Boveri et Cie.): 'Disturbances in Installations due to Blowing of Fuses in Front of Earth-Coils' ('Strorugen in Anlagen infolge Durchbrennens von Sicherungen an Erdungsdrosselspulen (Kippuberspannun gen). BB-Cie-Mitteilungen, II, 114-116 (1924).

The author points out that over-voltages tenerally occur when in three-phase systems two conditions are simultaneously fulfilled, i.e. when only one of the three fuses in front of the earth-coil has blown and when the last feeder is sweitched off. Field tests in a 45 kV plant are described and the results are discussed. The conclusion when the firm drew from this investigation was to omit fuses in front of earth-coils.

用熔断器11.5千伏线路

13 Horr, E. N.: 'Fuses on 11.5 kV Lines.' Elect. World, N. R., 83, 384 (1924).

In view of corrosion difficulties with copper, iron, and brass due to high atmospheric humidity and contamination by industrial plants such as acid works, which also produced insulator troubles, a horn-gap fuse was tried.

The aluminium fuse wire used soon became oxidized and corrosion-resistant, and instead of the former need for extensive replacements all that was required was rewiring.

应用熔断器以获得精确的时限

14 Wilson, W.: 'The Use of Fuses for Obtaining an Exact Time Element,' World Power, 83, 91-99 (1924).

Its capability of interposing an exact inverse time element between the occurrence of an overload and the opening of the circuit has secured the adoption of the fuse to balanced schemes of protection, in order to enable them toconfer protection against overload conditions, in addition to their initial function of protecting against faults. The most direct use of a fuse for introducing a time element is met when it is connected in shunt with t e trip coil of a circuit breaker. The fuse carries practically all the current until it melts, when the current then passes through the trip coil which operates the breaker instantly. Tin has been found the most satisfactory metal for the fuse and the time element charactrristics of eight sizes of tin wire from 15 to 24 s.w.g. are plotted in the article for periods up to 60 sec. It is recommended to use the fuse wire in glass tubes 3 in. long. By including a time-element fuse in the path of the circulating current of balanced protective schemes, tripping will also be effected for overload besides leakage faults. A further use for these fuses occurs in connection with transformer protection, in preventing the relay from tripping out as soon as the main circuit is closed, due to the very high initial current peak that frequently flows for an instant into the windings. It is shown that the time-element conditions are better fulfilled by the fuse than by the dashpot type. The deatils of the experimental determination of the time-element curves are given, and also the equation for plotting the curves. (Abstr. 629/1924.)

电压互感器用熔断器的试验

15 Hess, P.M.:'Potential Transfromer Fuse Tests.' Elect. World, N.Y., 83, 467-471 (1924).

This is a description of tests on 13,200V Westinghouse cartridge fuses and G.E.C. (America) cartridge and expulsion fuses, with their respective potential transfromers. Complete data of 48 tests are given. In the first series of tests the short circuit was placed on the low tension side of the transformers, the fuses being on the high tension side. With the

Westinghouse equipment the fuse cleared in 14 cycles, but with the G.E.C. equipment the fuse did not blow. This is accounted forby the different values of reactance and resistance of the two makes which are given in the article. The second series of tests were made with their resistances in series with the fuses, and a short circuit on the high tension side. Both types of enclosed cartridge fuse cleared satisfactorily, but with the expulsion type there was a great deal of flame which shot out with a fairly loud report. The third series were similar to the last, but without the resistance in series. Again, both types of enclosed cartridge fuse cleared satisfactorily, generally in 0.5 cycle, but in two cases the Westinghouse fuse was blown from the clips entirely, and in one case landed 40 fe t away. For both types a good deal of powder was blown from the ends, and in almost every case of short circuit the Westinghouse fuses had the entire ends of the clips blown open. The expulsion type was very unsatisfactory on this type of short circuit for the same reason as in the previous series and also becasue it was almost impossible to retain the fuse in the clamps owing to the recoil set up by the gases. An added danger is the risk of flash-over on adjoining apparatus.

From the oscillograms it was noted that on all dead short-circuit tests, the recovery voltage shows a very promin nt high frequency surge, but with the resistances in circuit the recovery voltage was almost perfect in every case and never increased to above normal. Some further tests were made with the expulsion type of fuse with a concrete-covered iron plate near it. The arc set up on blowing the fuse found imperfections in the concrete and became earthed. (Abstr. 792/1924.)

熔丝的计算

16 Zickler, K.: 'On the Calculation of Fuses' (Zur Berechnung der Schmelzsicherungen'). Elektrotech. u. Maschinenb. (E.u.M.), 44, 437-446 (1926).

Meyer's formula for the limiting current which a fuse wire will carry permanently without melting may be written in the form:

$$I = c\sqrt{[kd^3+(2\lambda d^4/L^2)]}, \text{ where}$$
$$c = \sqrt{\{[103,360(t_s-t_o)]/[P_o(1+a_o t_s)]\}}$$

t_s= melting-point of the fuse in degrees C.; t= room temperature in degrees C.; P_o= specific resistance of the fuse in ohms/m/mm^2; a_o= temperature co-efficient of resistance per 1° C. at 0° C.; k= a ventilation constant; d = diameter of fuse wire in cm; λ = co-efficient of thermal conductivity in gramme calories per sec. through 1 cm^2 and 1 cm of the fuse metal with a temperature difference of 1° C. at 0° C.; and L = the 'ideal' length of fuse in cm. When L = ∞ the above formula reduces to Preece's formula. The 'ideal' length is that for which the ends of the wire are at atmospheric temperature, assuming the actual curve of temperature variation along the wire to be extrapolated. The author does not agree with Meyer that the rise in k with decrease in the diameter of the wire is due to change in the ratio of the thermal capacities of the wire and the terminals; it is due, he considers, to changes in the emission of heat from the wire to its surroundings, regardless of the terminals. A chart is presented showing values of k for copper wires of various diameters, corresponding values of the limiting current I, and a curve showing values of the ratio d/k; the latter curve is linear for the greater part of its length. The author next presents data ragrading the ideal length as a function of the actual length for various materials and sizes of wire. The curve is shown to be independent of the heat capacity of the terminals, and it is affected very little by such changes in ventilation as are represented by (1) a wire hung vertically in air, and (2) a wire packed with kieselguhr in a horizontal tube. An average curve can be taken for the ideal length in terms of the actual length for all practical cases. The limiting current for any diameter and length of fuse wire can now be calculated by means of the formula given above, in conjunction with the curves for k and L. The author shows that values thus calculated agree closely with experimental results. A simple graphical construction is given which eliminates the use of the formula. The question of time required for melting is investigated. The empirical formulae of C. Feldmann and of Schwartz and James are shown not to conform with the author's results. (Abstr. 1428/1926)

高功率熔断器

17 Grant, L. C.:'High Power Fusible Cut-Outs.' J. Inst. Elec. Engrs., 64, 920-941 (Discussion 941-959) (1926).

The author discusses the requirements of high power fusible cut-outs, and analyses the factors influencing the rupturing capacity of the latter. The ratio of the

... full-load current to the minimum fusing current depends largely upon the cross-section of the fusible element, and has an important bearing upon the rupturing capacity; it is desirable that this ratio should be kept low. The application of the magnetic blwo-out is of doubtful value--the simpler forms of magnetic blwo-out are the more satisfactory. Many existing types of enclosures for cut-outs are defective in form and/or strength; and many commercial forms of cartridge cut-outs fail to satisfy requirements. Reliable forms of enclosure and fillings have been tested and are described in this paper. An elaborate series of tests has been carried out on many different types of cut-outs up to short-circuit values of 70,000 kVA; the test procedure and results are stated in the original. Tests were also conducted on small current, high pressure cut-outs for the protection of potential transformers and for rural and other small services. For this purpose a special form of cut-out has been developed embodying a limiting resistance; this is available for all voltages up to 132,000V., and has been fully tested with satisfactory results. It is concluded that satisfactory cut-outs of the following types are now available for the duties mentioned: (1) Iron-clad oil-immersed cut-outs, low pressure type and double-tube cartridge cut-outs for interrupting powers up to 70,000-100,000 kVA. at pressures up to 600V.; (2) single and double tube modern cartridge cut-outs for interrupting up to 60,000 kVA. at high, medium and low pressures; (3) iron-clad oil-immersed cut-outs of the high pressure type for interrupting several hundred thousand kVA. at high pressures. Plain fusible cut-outs in air were found to be extremely dangerous for highpower work. (Abstr. 1715/1926.)

短时負载和短路时导体的发热

18 Gutt, G., and Grünberg, L.M.: 'Heating of Conductors with Loads of Short Duration and with Short-Circuits' ('Erwärmung von Leitern bei kurzen Belastungszeiten und bei Kurzschlüssen'). Bull. Ass. Suisse Elect., 18, 205-225 (1927).

An exhaustive mathematical investigation with numerous numerical examples to show how great the temperature rise of conductors may be with short time loading or under short-circuit conditions. The treatment takes into account the fact that in the short periods considered there is practically no dissipation of heat, as also the variable specific heat of the conductors dependent on temperature and the decrease in the short-circuit current from the maximum to the permanent value. A number of curves are given for different types of material connecting the temperature rise with the current density and time of loading. (Abstr. 1437/1927.)

熔化问题

19 Klement, W. (SSW Berlin): 'Fusing Problems' ('Sicherungs-fragen'). VDE-Fachberichte, 58 (1927).

To provide a reliable basis for the rating and standardization of h.v. fuses the author gives a rather complete survey of the problems that arise in design and application of the sundry over-current protective devices.

交流电弧的熄灭

20 Slepian, J.: 'Extinction of an A.C. Arc.' J. Amer. Inst. Elect. Engrs., 57, 706-710 (1928).

The transition from high conductivity to high resistivity which an a.c. arc undergoes on extinction is studied. Theory and approximate calculations are given for the rate of recovery of dielectric strength of the arc space for short arcs, with results of experiments on short arcs and arsc in holes and slots in insulating material and insulating plates. The influence of chemical activity in arc gases is discussed. (Extract from the synopsis of the paper.)

低压一般容量 熔断器电流定额的精密研究

21 Morgan, P.D. : 'A Critical Study of the Current Rating of Low-Pressure Ordinary-Duty Fusible Cut-Outs.' J. Inst. Elect. Engrs., 66, 926-939 (1928). (E.R.A. Ref. G/T33).

The paper deals only with the special type of fuses mentioned in the title. Tests are described, and proposals are made for the standardization and determination of the critical current.

The author reports on special phenomena due to the oxidation of the surface of the wire when the current slowly rises. Then the heating of the wire is suddenly retarded because of the increased heat-emission of the oxidized surface. The discussion following the lecture was interesting and spirited.

装有截面积为6mm²的电缆和额定为25安的熔断器的电网短路所引起的熔断器和自动开关开断过程的研究

22 Paulus, C.: 'Investigation of the Breaking Processes in Fuses and Automatic Switches caused by Short Circuits in Electrical Networks with Cable Cross-Section up to 6 mm.^{2} and Fuses Rated up to 25 A.' (By order of the sub-committee for automatic switches of the Verband Deutscher Elektrotechniker).('Untersuchungder Abschaltvorgänge in Schmelzsicherungen und Installations-Selbstschaltern bei Kurzschlussen in elektrischen Verteilungsanlagen mit Querschnitten bis zu 6 mm.^{2} bzw. Sicherungen bis 25A.' Elektrotech. Z. (ETZ), 50, 1829-1878 (1929).

A great number of short-circuit tests made in domestic networks supplied oscillograms, from which the difference in the behaviour of fuses and automatic switches could be compared.

新型高压安全熔断器

23 Boutin, M.: 'A New H.V. Safety Fuse.' Elect. World, N. Y., 94, 240 (1929).

This new type of fuse was developed for short-circuit protection of feeders in 3 to 6 kV networks. in a oil-filled container with two bushings and expulsion chamber is provided. Within the chamber the silver fuse-element is connected to a piston made of insulating material. When the fuse blows, the piston is shot out of the expulsion chamber by the pressure, thus breaking currents up to 12,000A. Formulae are given for calculating the dimensions of the silver wire.

66千伏熔断器試验

24 Jones, B.M., and Coxe, E.H. Jnr.: '66kV. Fuse Tests.' Elect. World, N.Y., 93, 785-786 (1929).

Describes tests carried out by the Duquesne Light Co. on potential transformer fuses installed on a 66 kV. system for use in connectio with directional relays. The fuse was of the Schweitzer and Conrad liquid type, and consisted of an 88 kV., 100A. glass-tube case containing a loA. fuse link mounted vertically upon pin insulators set at 45°. Eleven tests were made with short-circuit currents varying from 1,200 to 3,720 A. at a voltage to neutrla of 39 kV.

In all cases the fuses cleared the short circuits satisfactorily in from 4 to 9 cycles, thus successfully interrupting 145,000 kVA. The article is illustrated with diagrams and photographs. (Abstr. 1812/1929.)

高压小电流熔断器及开关

25 Wilkins, R.: 'High Voltage Low Current Fuses and Switches.' Trans. Amer. Inst. Elect. Engrs., 49, 96-98 91930).

For interrupting small currents at relatively high voltages, fuses and air-br ak switches are most commonly employed. This paper treats of their use for the protection of transmission lines supplying small blocks of power such as rural lines. The requirements for this service are outlined, and a discussion is given on the ability of the devices to meet these requirements. (Abstr. 2151/1929.)

射击式熔断器解决高压问题

26 Medlin, J. P. (Montana Power Co.): 'Shot Gun Fuse Solves High Tension Problem.' Elect. World, N. Y., 93, 383 (1929).

The fuse described consists of a thermostatic cartridge placed at the lower terminal and a tube, which bridges across the fuse terminals and in which the circuit is broken. The cartridge, which is 12 gauge, contains a suitable thermostatic wire surrounded by a little gunpowder. The correct loading and rating of the device is now highly reliable. It is stated that the fuse has been adopted for general use by the Montana Power Co. for 6.6-5 kV; fuses for 102 kV are being developed.

装有熔断器的消弧角及均压环

27 Stewart, P.: 'Fused Arcing Horns and Grading Rings.' Trans. Amer. Inst. Elect. Engrs., 48, 891-895 (1929).

This paper considers the use of fuses on insulator strings of h.v. overhead conductors to interrupt the arc at time of flashover before the line relays operate to disconnect the circuit. Consideration is first given to the original development of this idea, in which a fuse was connected between the line conductor and an arcing ring, attached to the second insulator unit. When an excessive voltage occurs on the conductor to ground, there is a flash between a two-pronged horn on the top insulator unit and the ring. The circuit is completed through the fuse which immediately opens, breaking the arc. Further consideration is given to a later development of the principle, in which two expulsion type fuses replace the two-pronged horn at the top of the insulator string and the arcing ring is placed at the conductor end of the string. Data are presented from tests and from experience on about 100 miles of the 66,000 V. circuit of the Union Gas and Electric Co., Cincinnati, Ohio. (Abstr. 1822/1929.)

采用66仟伏线路的农村变电站

28 Perry, L. H.: 'Rural Sub-Station Tapped to 66 kV Line.' Elect. World, N.Y., 93, 1246-1247 (1929).

This article describes equipment developed on unconventional lines for supply of scattered rural loads direct from h.v. lines. e.g. 15-50 kVA sub-stations fed by 66 kV lines. A 73 kV high voltage combined isolator and fuse is described, the fuse being spring-released with a resistor in series.

"塔多"熔断器設計、运行及其优点

29 Junck, E.: 'Design, Operation and Advantages of the Tardo Fuse' ('Konstruktion, Wirkung und Vorteile der Tardo-Sicherung'). Elektrotech. Z. (ETZ), 50, 1357-1359 (1929).

The Tardo fuse is a fuse of the screw-plug type in which four parallel paths are available for the current, namely: 1 - connection made with solder of low melting point between two metal strips so held as to spring apart when the solder melts; 2 a resistance wire remote from the soldered joint but also connecting the two strips. Paths 1 and 2 are in series with a piece of normal fuse wire d. Path 3 is another fuse wire e

connected directly between the terminal plates of the fuse. Path 4 is an indicating wire connected practically between the two terminals. The main portion of the current flows through the soldered joint and the fuse d, and in the event of a heavy overload the wires d and e (also the indicating wire) melt at once.

When the overload is slight, however, the current flowing in these wires is insufficient to melt them, but the heat generated in the resistance wire, gradually conducted via the metal strips, is at last sufficient