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PROTECTION OF SUBSCRIBERS AND WIRED RADIO-RELAY INSTALLATIONS F--ETC(U)
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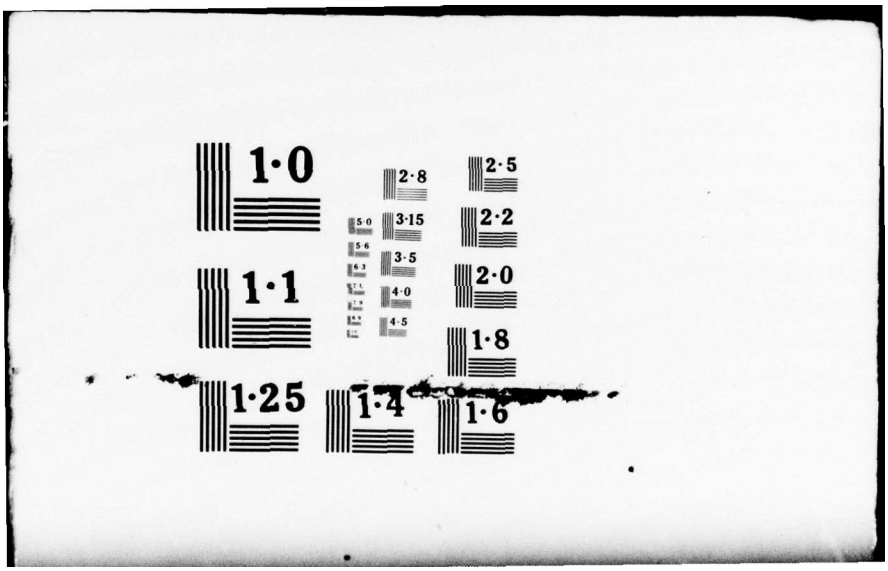
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FOREIGN TECHNOLOGY DIVISION

PROTECTION OF SUBSCRIBERS AND WIRED RADIO-RELAY INSTALLATIONS FROM DANGEROUS VOLTAGES AND CURRENTS OCCURRING ON RADIO-RELAY NETWORK LINES

Approved for public release;
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EDITED TRANSLATION

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PROTECTION OF SUBSCRIBERS AND WIRED RADIO-RELAY INSTALLATIONS FROM DANGEROUS VOLTAGES AND CURRENTS OCCURRING ON RADIO-RELAY NETWORK LINES

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ë in Russian, transliterate as yë or ë. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	A	α	*α*	Nu	N	ν	
Beta	B	β		Xi	Ξ	ξ	
Gamma	Γ	γ		Omicron	O	o	
Delta	Δ	δ		Pi	Π	π	
Epsilon	E	ε	*ϵ*	Rho	P	ρ	*ϱ*
Zeta	Z	ζ		Sigma	Σ	σ	*ς*
Eta	H	η		Tau	T	τ	
Theta	Θ	θ	*ϑ*	Upsilon	T	υ	
Iota	I	ι		Phi	Φ	φ	*ϕ*
Kappa	K	κ	*ϰ*	Chi	X	χ	
Lambda	Λ	λ		Psi	Ψ	ψ	
Mu	M	μ		Omega	Ω	ω	

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English
sin	sin
cos	cos
tg	tan
ctg	cot
sec	sec
cosec	csc
sh	sinh
ch	cosh
th	tanh
cth	coth
sch	sech
csch	csch
arc sin	$\sin^{-1}$
arc cos	$\cos^{-1}$
arc tg	$\tan^{-1}$
arc ctg	$\cot^{-1}$
arc sec	$\sec^{-1}$
arc cosec	$\csc^{-1}$
arc sh	$\sinh^{-1}$
arc ch	$\cosh^{-1}$
arc th	$\tanh^{-1}$
arc cth	$\coth^{-1}$
arc sch	sech^{-1}
arc csch	csch^{-1}
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

USSR State Standard

PROTECTION OF SUBSCRIBERS AND WIRED RADIO-RELAY INSTALLATIONS FROM DANGEROUS VOLTAGES AND CURRENTS OCCURRING ON RADIO-RELAY NETWORK LINES

GOST 14857-69

Official Edition

Moscow - 1969

UDK 621.396.976.5 : 621.316.9 Group E50

By resolution of the Committee on Standards, Measures, and Measuring Instruments of the Council of Ministers USSR of 25/7/69 No. 843 the period of introduction is established from 1/1/70.

Nonobservance of the Standard is subject to prosecution

This standard is disseminated to station, line, and subscriber facilities of urban and rural radio-relay networks (RN) and specifies systems and measures to protect them from dangerous voltages and currents occurring in RN lines during lightning discharges or upon contact between RN wires and high-voltage transmission lines (HL).

1. PROTECTION OF RADIO-RELAY EQUIPMENT CONNECTED TO FEEDER LINES OF MORE THAN 360 V

1.1. PROTECTING EQUIPMENT CONNECTED TO MAIN FEEDER LINES

1.1.1. The output from a high-voltage coil of a step-up feeder transformer at a booster station or substation must be protected from dangerous voltages during lightning discharges by means of

PR-1 fuses and IR-0.3, IR-0.5, and IR-7 spark-gap dischargers connected according to the layout shown in fig. 1.

1.1.2. Booster stations must have grounding with not more than 5 Ω resistance, which must be connected to an IR-0.3 discharger, as well as to the housing of line transformers and the grounding wire for the towers of overhead-tower main lines (fig. 1). Grounding wire must be re-grounded every two kilometers.

Grounding equipment for each tower is permitted. In this case, suspension of the ground wire is not required for the towers.

1.1.3. Resistances of intermediate grounds (for re-grounding of ground wires or ground equipment at each tower) must not exceed quantities given in table 1.

Table 1

Specific resistance of earth, Ω/m	up to 100 connections	100-300 conn.	300-500 conn.	over 500 conn.
Resistance of discharger grounding in Ω, not exceeding	20	30	35	45

1.1.4. In the absence of a main-line cable lead-in to the output switch rack (OSR) and transformer substation rack (TSR) cabinets, i. e., with an overhead lead-in, the IR-0.5 discharger may be replaced with the IR-7 discharger.

1.1.5. The current rating of PR-1 fuses installed in OSR and TSR cabinets must be 50-80% greater than the operating current of the sound frequency on the main feeder.

1.1.6. An automatic protection device (such as the AZF) must be installed and connected at the booster station to monitor the condition of feeder lines (interruption, short circuit, grounding).

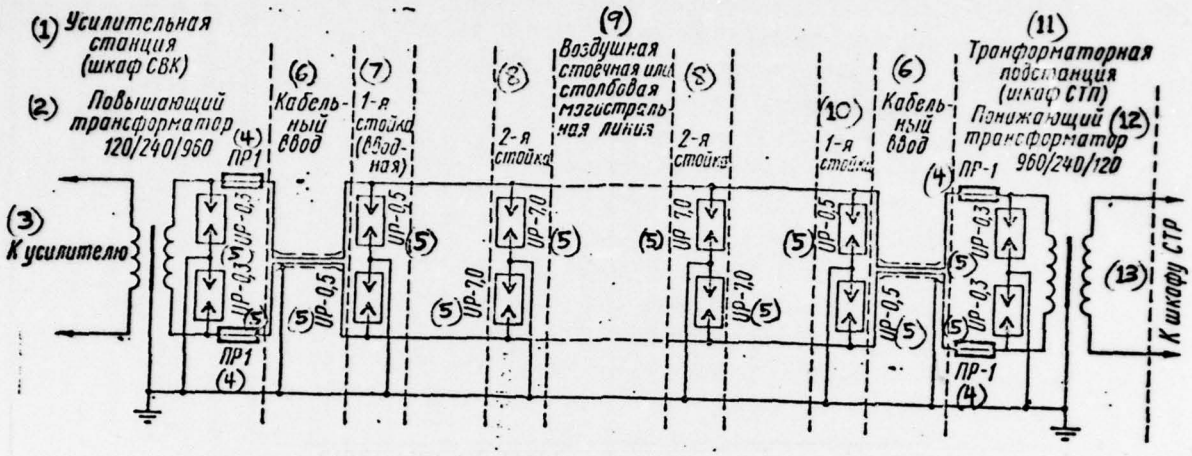


Fig. 1

1 Booster station (output-switch rack cabinet)

2 Step-up transformer 120/240/960

3 To booster

4 PR-1 fuse

5 IR-0.3 (0.5, 7.0) spark-gap discharger

6 Cable lead-in

7 1st (lead-in) tower

8 2nd tower

9 Overhead tower or pole main line

10 1st tower

11 Transformer substation (transformer-substation rack cabinet)

12 Step-down transformer 960/240/120

13 To STR [?] cabinet

1.2. PROTECTING EQUIPMENT OF RN FEEDER CIRCUITS WHICH ARE HUNG ON SUPPORTS FOR 3-10 kV TRANSMISSION LINES (HL)

1.2.1. RN feeder circuits may be hung on supports for a three-phase transmission line if the transmission-line operating voltage does not exceed 10 kV. The transmission line must be connected to a three-phase transformer whose neutral point must be insulated or grounded to active or inductive resistance; the value of the latter is established in properly authorized normative technical documentation.

It is permissible to suspend one RN feeder circuit with voltage not less than 960 V, in which case the operating voltage of the feeder circuit must be increased with line feeder transformers.

1.2.2. Feeder circuit wires must be placed below transmission lines. The vertical distance between the lower transmission line and the upper RN feeder line on and between supports must not be less than 1.2 m.

1.2.3. Equipment for an RN feeder circuit suspended on 3-10 kV HL supports must be protected from dangerous voltages occurring in the RN feeder circuit during contact with HL wires and during lightning discharges; use SN-1.0 - 80, VP-6-type fuses and 3-UR, IR-7, IR-10, IR-0.5, and IR-0.3 dischargers connected according to fig. 2. The layout must include RLND-35 - 600 high-voltage disconnectors mounted on the first radio-relay line support from the shared suspension section.

1.2.4. The SN-1.0 and VP-6 fuses, as well as 3-UR dischargers, must be mounted in special protective devices.

The protective device and step-up or step-down feeder transformer are mounted on the third relay-network support from the

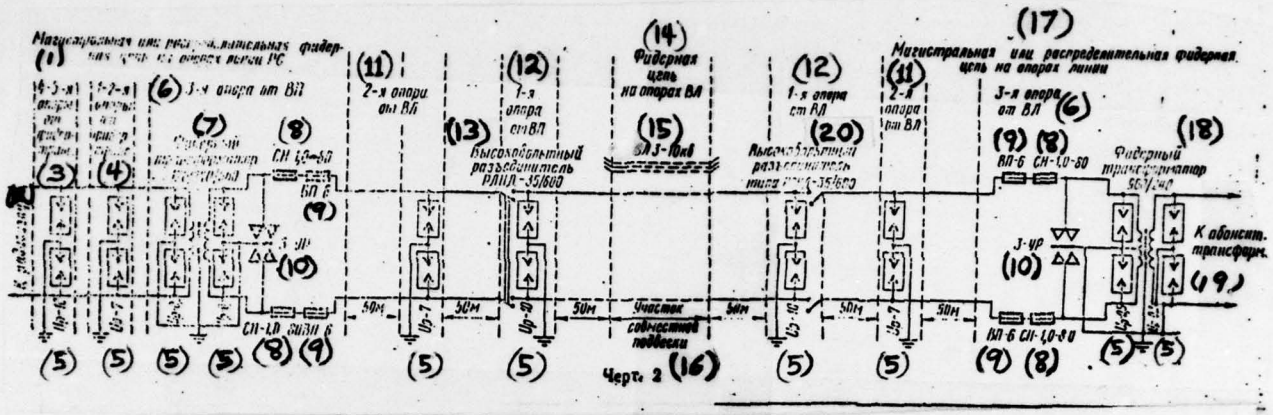


Fig. 2

1 Main or distributing feeder circuit on RN line supports

2 To radio-relay center

3 4th and 5th supports from feeder transformer

4 1st and 2nd supports from feeder transformer

5 IR-10 (7, 0.5, 0.3) spark-gap dischargers

6 3rd support from high-voltage transmission line (HL)

7 Feeder transformer 120/240/960

8 SN-1.0-80 fuse

9 VP-6 fuse

10 3-UR discharger

11 2nd support from HL

12 1st support from HL

13 RLND-35/600 high-voltage disconnector

14 Feeder circuit on HL supports

15 HL (3-10 kV)

16 Shared-suspension section

17 Main or distributing feeder circuit on line supports

18 Feeder transformer 960/240

19 To subscriber transformer

20 RLND-35/600-type high-voltage disconnnector

shared suspension section (fig. 2). Fig. 3 shows the layout on the support for the protective device and feeder transformer.

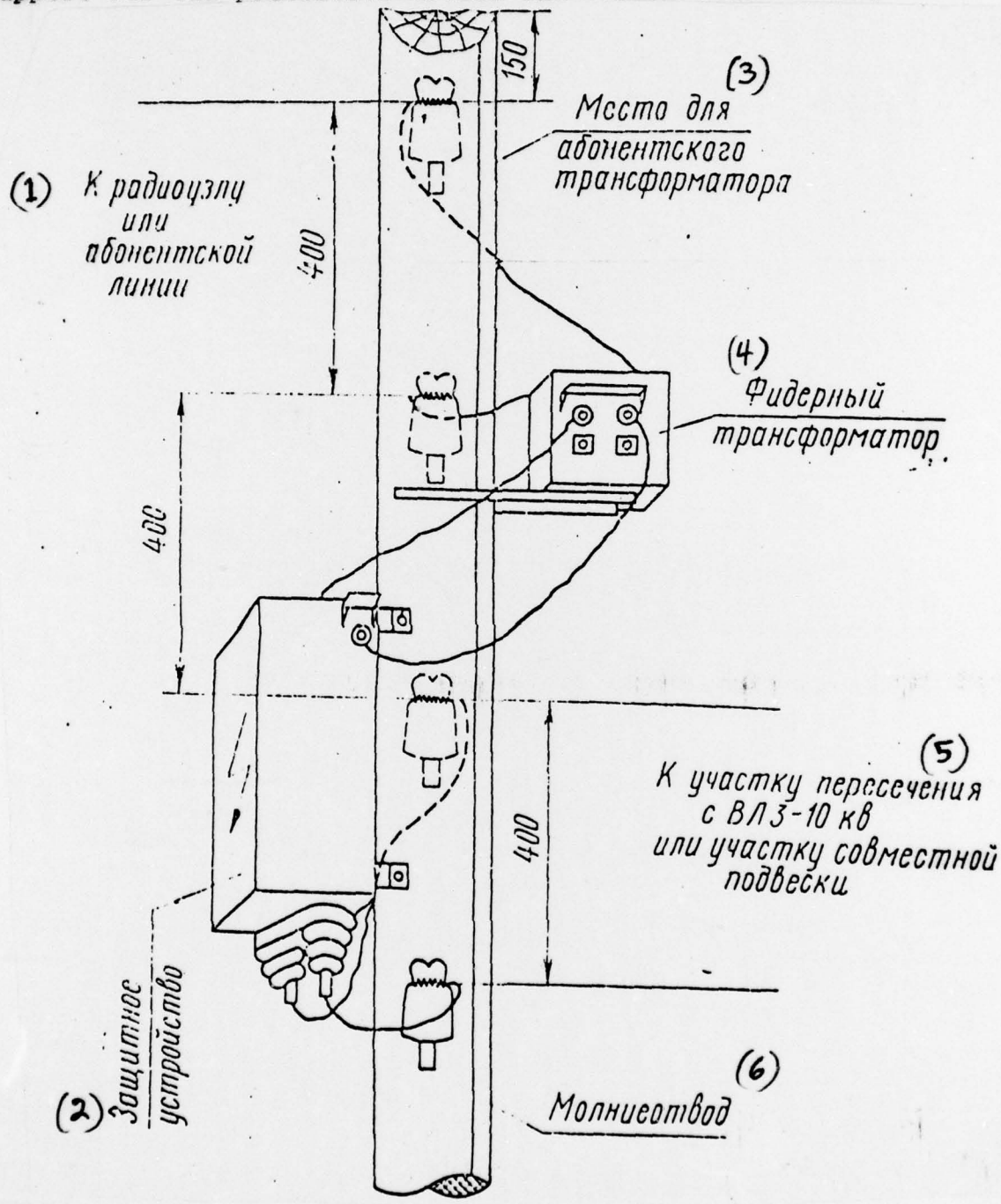


Fig. 3

(1) To radio-relay circuit or subscriber line; (2) Protective device; (3) Location for subscriber transformer; (4) Feeder transformer, (5) To intersection with 3-10 kV HL or to shared suspension section; (6) Lightning conductor

1.2.5. An automatic protector must be installed at the station or substation to shut off the feeder circuit power if the circuit is damaged.

1.2.6. Grounding resistance for IR-0.3 dischargers at the support with the protective device must not exceed 5 Ω regardless of the specific resistance of the earth, while grounding resistance for IR-7 and IR-10 dischargers must not exceed the values in table 1, depending on the specific resistance of the earth.

The lead on the third support for the RN line, as well as the IR-7 and IR-10 discharger leads, must be completely covered by wooden conduits.

2. PROTECTING EQUIPMENT WITH CONNECTED RN FEEDER LINES OF UP TO 360 V

2.1. PROTECTING EQUIPMENT WITH CONNECTED 120 V FEEDER LINES

2.1.1. Equipment of booster and transformer substations which supply distributing feeder lines having 120 V nominal voltage must be protected from dangerous voltages and currents by SN-1.0 fuses and R-350, IR-0.3, and IR-7 dischargers connected according to fig. 4, regardless of whether the circuits are suspended on their own supports or on common supports together with 380/220 V HL or with rural telephone circuits.

2.1.2. With an operating current above 1 A, SN-1.0 fuses must be replaced by fuses with nominal current 50-80% above the feeder-circuit operating current.

2.1.3. IR-7 dischargers are not required if a subscriber transformer (with spark-gap dischargers on the primary winding) is connected in their place.

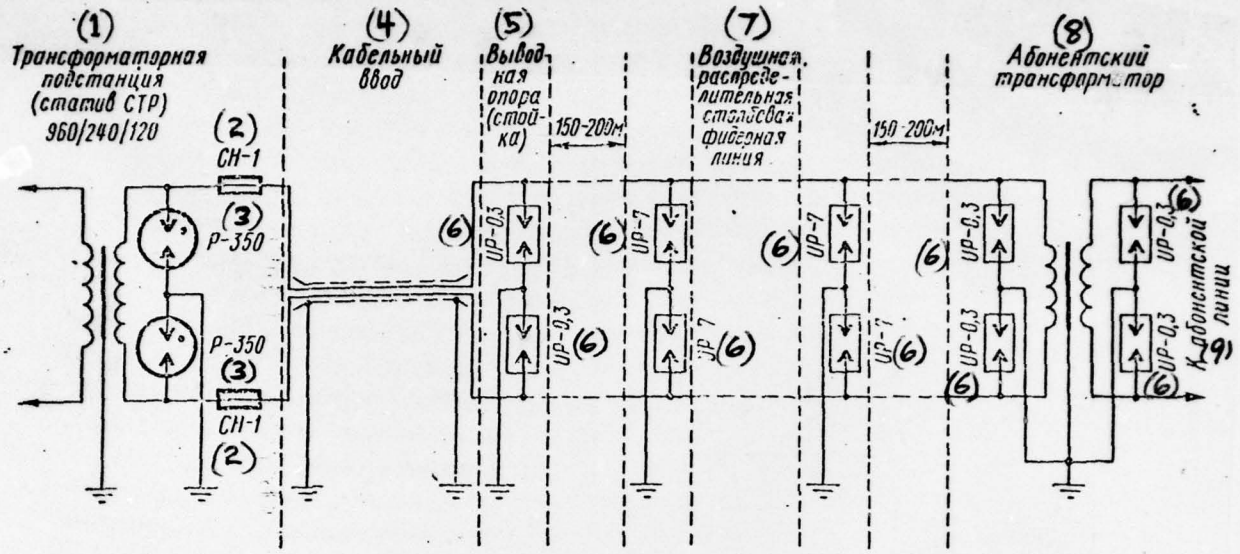


Fig. 4

1 Transformer substation (STR [?] rack) 960/240/120

2 SN-1 fuse

3 R-350 discharger

4 Cable lead-in

5 Outlet support (tower)

6 IR-0.3 (-7) spark-gap dischargers

7 Overhead pole distributing feeder line

8 Subscriber transformer

9 To subscriber line

2.1.4. In the absence of a cable lead-in, the IR-0.3 discharger may be replaced with the IR-7.

2.1.5. The ground resistances of the IR-0.3 and IR-7 dischargers must not exceed those given in table 1. In order to ground the dischargers and the transformer housing, it is possible to utilize a ground of collectively used television antennas.

2.1.6. IR-7 dischargers must be mounted directly by an insulator or in closed structures, while IR-0.3 dischargers must be only in closed structures.

2.2 PROTECTING EQUIPMENT WITH CONNECTED 240 AND 340 V RN FEEDER LINES

2.2.1. With 240 or 340 V feeder-line operating voltage, equipment must be protected according to para. 2.1 by replacing the R-350 discharger in fig. 4 with IR-0.3 discharger.

3. PROTECTION OF SUBSCRIBERS AND EQUIPMENT ON 15 AND 30 V SUBSCRIBER LINES

3.1. PROTECTING SUBSCRIBERS AND EQUIPMENT ON SUBSCRIBER POLE LINES

3.1.1. To protect subscribers and equipment on pole lines belonging to a radio relay center, in urban and rural areas subscriber-circuit wires must have IR-7 dischargers connected at every other support, IR-0.3 dischargers must be connected to subscriber transformer coils, and an SN-1.0 fuse must be connected to the transformer secondary winding as shown in fig. 5.

In addition, IR-7 dischargers should be connected wherever possible on supports which have branches to subscribers.

3.1.2. If a subscriber line does not have branches to sub-

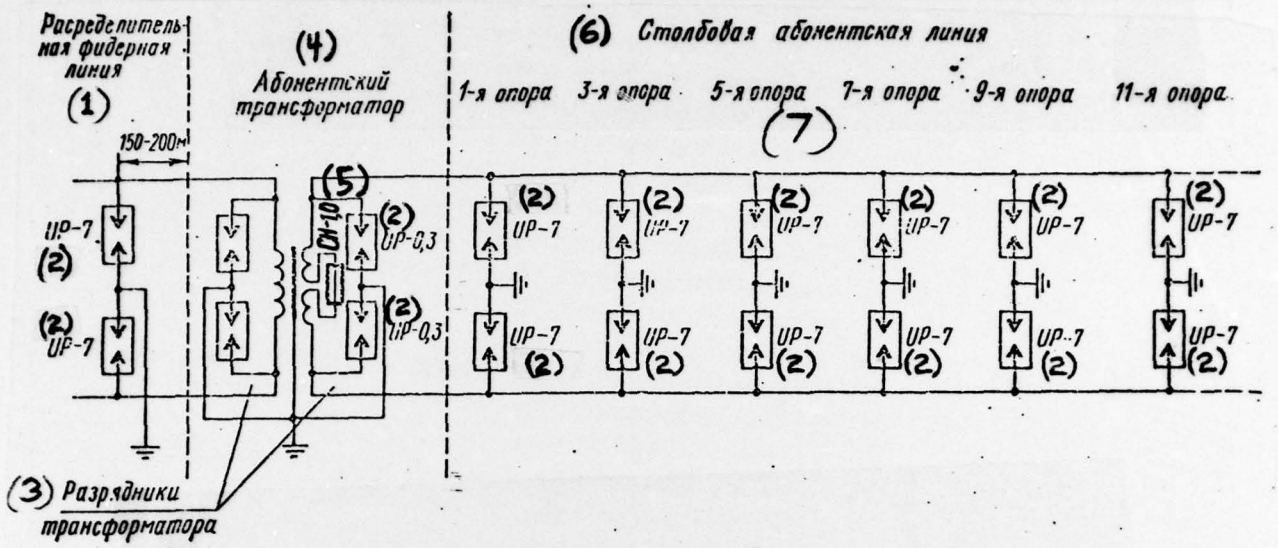


Fig. 5

1 Distributing feeder line

2 IR-7 (-0.3) spark-gap dischargers

3 Transformer dischargers

4 Subscriber transformer

5 SN-1.0 fuse

6 Pole subscriber line

7 Supports (1st, 3rd, 5th, 7th, 9th, 11th)

scribers on one of the sections, it is required to connect IR-7 dischargers only to the section's second and next-to-last supports.

3.1.3. The resistance of the grounds of IR-0.3 and IR-7 dischargers must be, depending on the specific resistance of the earth, no less than quantities in table 1.

3.1.4. IR-0.3 and IR-7 discharger grounding taps must consist of 4mm diameter steel wire (or two 3mm diameter wires) in accordance with GOST 1668-46 and must be concealed by wooden conduits along the entire length of the support.

3.1.5. On subscriber circuits suspended from supports for transmission lines with 380/220 V operating voltage, and on relay-center lines with their own supports which are shielded from direct lightning along their entire length by other facilities or by trees, connection of IR-7 dischargers is not required.

3.1.6. Connection of IR-0.3 and IR-7 dischargers is not required on subscriber lines not longer than 100 m.

3.2. PROTECTING SUBSCRIBERS AND EQUIPMENT ON SUBSCRIBER TOWER LINES

3.2.1. On subscriber tower lines in rural areas, IR-0.3 dischargers must be connected to subscriber transformer coils; SN-1.0 fuses are connected to the transformer secondary winding. IR-7 dischargers are connected at every other support as shown in fig. 6. If a subscriber line does not have branches to subscribers on one of the sections, connection of IR-7 dischargers is not mandatory on that section.

3.2.2. On subscriber tower lines longer than 100 meters in urban areas, IR-0.3 dischargers must be connected to subscriber

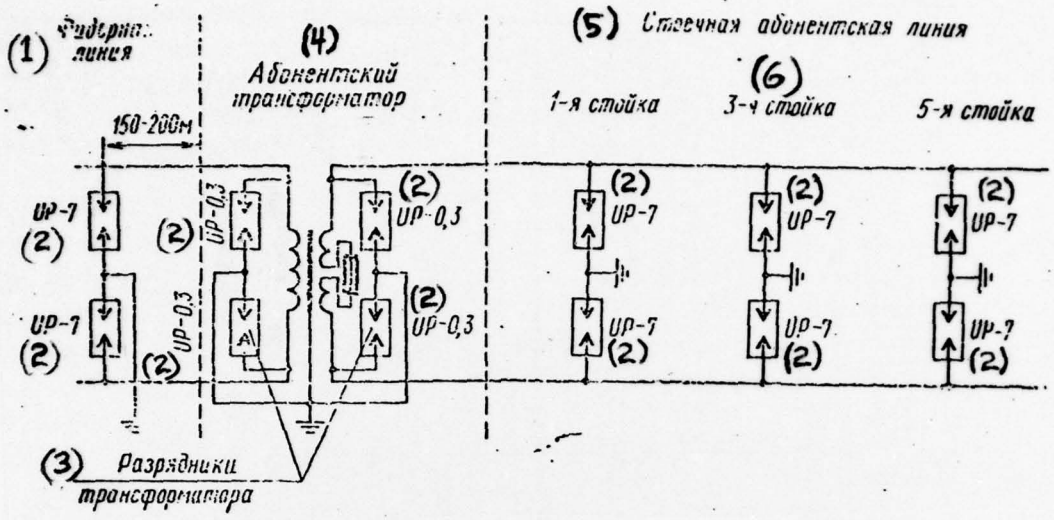


Fig. 6

1 Feeder line

2 IR-7 (0.3) spark-gap dischargers

3 Transformer dischargers

4 Subscriber transformer

5 Tower subscriber line

6 Towers (1st, 3rd, 5th)

transformer coils. However, on lines which pass over the roofs of multistory buildings and which are shielded by other facilities, it is permissible to install subscriber transformers without connecting IR-0.3 dischargers and SN-1.0 fuses.

3.2.3. Towers being installed on new or reconstructed buildings with grounding equipment must be grounded. If connection of spark-gap dischargers is envisaged, towers being installed on old buildings must be equipped for grounding. To ground such towers, it is possible to use metal roof grounding, if the grounding resistance of the roof does not exceed the values in table 1.

3.2.4. Grounding resistances of IR-0.3 and IR-7 dischargers for current taps must correspond to the values in table 1.

Taps on multistory buildings must be made of 20x5mm steel strips or 8-10mm dia. steel wire in accordance with GOST 535-58.

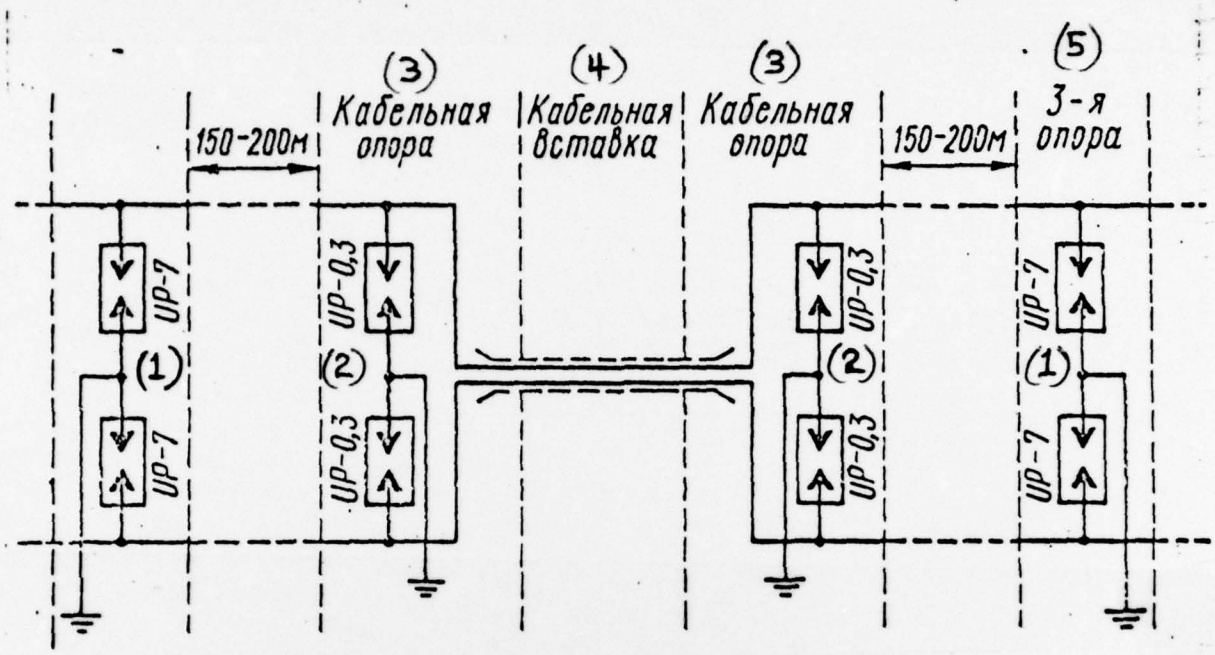
3.3. PROTECTION ON SUBSCRIBER CABLE LINES

3.3.1. On subscriber cable lines using MRM or PRPPM-type cable in rural or urban areas, where the cable has been laid in sectors not shielded by other facilities, an IR-0.3 discharger must be connected to the line winding of a subscriber transformer. Connection of an SN-1.0 fuse into the secondary winding is not required.

4. PROTECTION OF CABLE INSERTS AND LOADING COILS OF RADIO-RELAY NETWORK OVERHEAD LINES

4.1. Cable inserts and loading coils which can be connected across a circuit of overhead RN lines must be protected from dangerous voltages during lightning discharges; connect IR-0.3 and IR-7 dischargers according to fig. 7.

(A) Защита кабельных вставок



(B) Защита пупиновских катушек

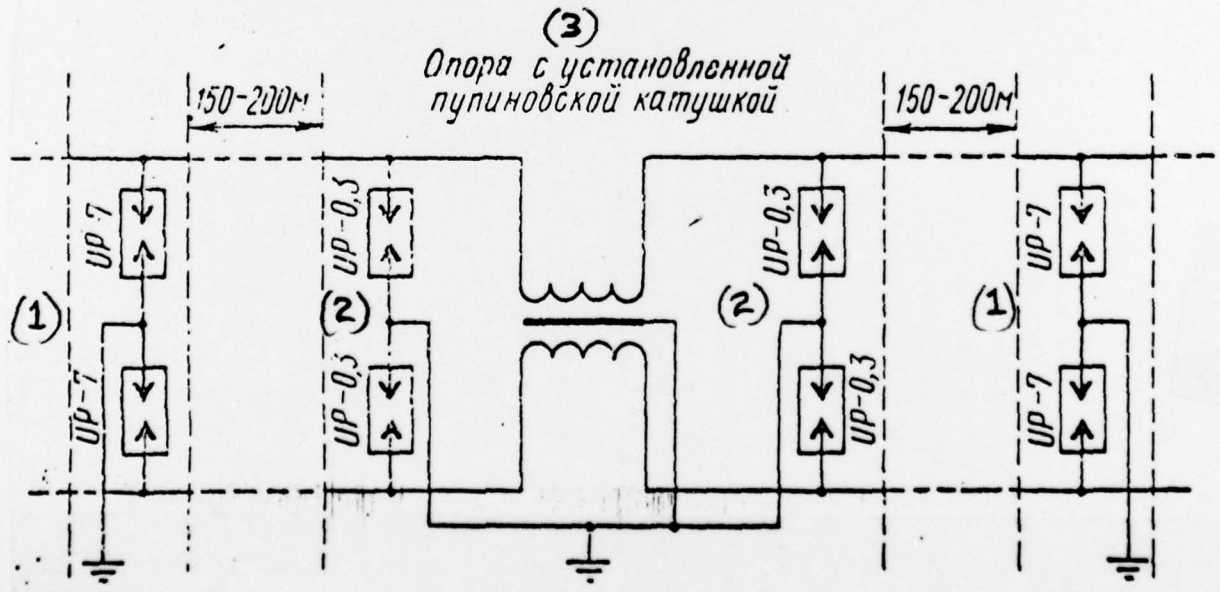


Fig. 7. See following page.

Fig. 7.

KEY:

A. Protection of cable inserts.

1. IR-7 dischargers
2. IR-0.3 dischargers
3. Cable support
4. Cable insert
5. 3rd support

B. Protection of loading coils

1. IR-7
2. IR-0.3
3. Support with installed loading coil.

4.2. Grounding resistances for IR-7 dischargers and for the loading coil housing must not exceed the values in table 1.

5. PROTECTION OF APPARATUS AT RECEIVING-ANTENNA INLETS

5.1. R-350 dischargers must be installed on an antenna screen of a radio-relay center as shown in fig. 8. Relay-center grounding is used to ground the R-350 discharger.

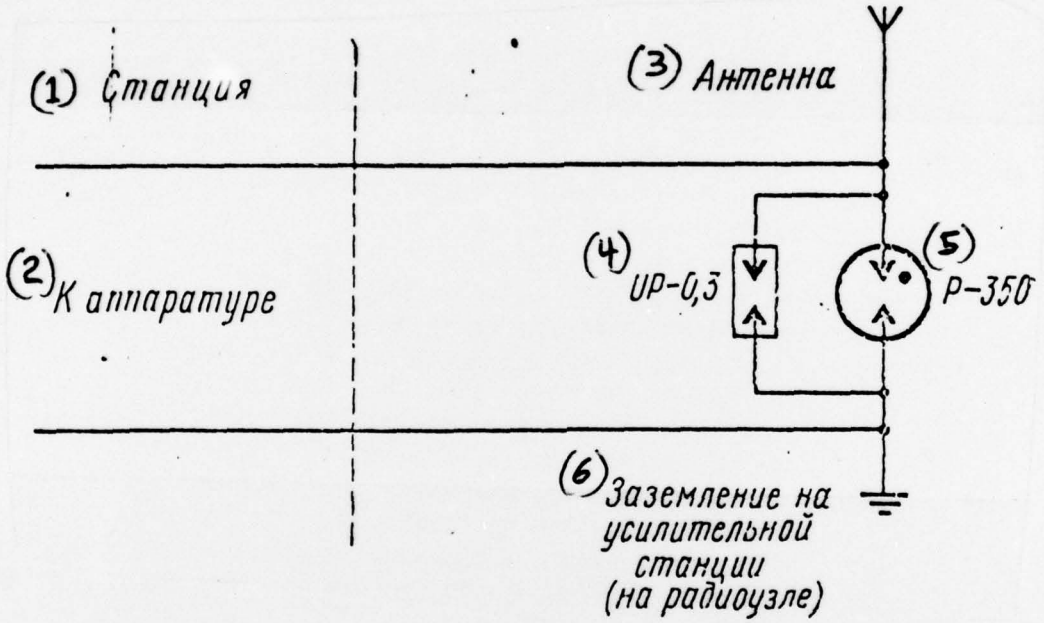


Fig. 8

(1) Station; (2) To apparatus; (3) Antenna; (4) IR-0.3; (5) R-350; (6) Grounding at booster station (at radio-relay center)

6. PROTECTION AT INTERSECTIONS OF RADIO-RELAY NETWORK LINES WITH TRANSMISSION LINES OR WITH CONTACT WIRES OF ELECTRIC-POWERED GROUND TRANSPORTATION SYSTEMS

6.1. PROTECTION AT INTERSECTIONS WITH TRANSMISSION LINES UP TO 1000 V

6.1.1. Intersection of radio-relay network wires with transmission lines not exceeding 380/220 V must be accomplished in conform-

ance with properly authorized normative technical documentation. In this case, protection of cable inserts is not implemented.

6.1.2. Intersection with streetcar and trolley-bus contact networks must conform to GOST 67-67.

6.2. PROTECTION FOR INTERSECTIONS WITH TRANSMISSION LINES OVER 1000 V OR WITH CONTACT NETWORKS OF ELECTRIC-POWERED RAILROADS

6.2.1. Intersections of overhead radio-relay lines with transmission lines over 1000 V must conform with properly authorized normative technical documentation. Furthermore, in intersection spans with transmission lines of 35 kV or lower which have pin insulators, radio-relay lines must use MRM or PRPPM-type underground cables.

6.2.2. Intersections of overhead RN lines with AC and DC contact networks of electric-powered railroads must conform with GOST 67-67.

6.2.3. On RN overhead-line supports which bound a span of intersection with transmission lines over 1000 V, lightning arresters must be installed with 50mm gaps located 2.5-3.0 m from the earth.

Supports with guys must have guy (egg) insulators, which are mounted 2.5-3 m above the earth to prevent grounding through a guy. Ground resistances of lightning arresters on supports which bound intersections must not exceed values in table 1.

6.2.4. Protective measures for hazards of high-voltage lines in areas of intersection with radio-relay network lines or areas of parallel flow must be determined in accordance with properly authorized normative technical documentation.

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Chairman of the Scientific and Technical Commission NIKIFORENKO A.M.

Commission Members - SHAKHURIN, V.N., REMIZOV, B.A., LYAMIN, B.N., INOZEMTSEV, N.N., POTEMKIN, L.V.

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