of slotted armature cores, and the following rules must be followed in order to obtain satisfactory results:

Rule II.—The width of an armature coil slot must not exceed three times the length of the air-gap; if possible, it should be kept within twice the air-gap length.

Rule III.—The depth of a coil slot must not exceed six times its width; if possible, it should be kept within four times its width.

Rule IV.—The air-gap length must not be less than the value given in Table III opposite the diameter of polar bore and under the proper number of magnet poles.

Rule V.—The sum of the widths of all the armature teeth, measured at the narrowest part, must be practically equal to the diameter of the polar bore.

Before proceeding farther, it may be advantageous to illustrate the application of the formulas, tables and rules thus far given. Suppose it is desired to build a 220-volt, 5-h.p. motor, to run at 1000 r.p.m., the number of field magnet poles to be four. From Table I, the number of watts is 4400; from Table II, $K = 0.5225$. Substituting these figures in formula (1-*a*) we have

$A = 100 \times 4440 \div 1000 \times 0.5225$;

hence, $A = 842$ and a fraction. The nearest larger number in column 2 of Table III is 861.1 and the corresponding polar bore is 8 inches. From column 4, the maximum number of ampere-wires is 8540, and from Table I the current per wire is 10 amperes; the maximum allowable number of wires, therefore, is 854.

From Table IV, the size of wire necessary to carry 10 amperes at speeds less than those in Table III is No. 13.

TABLE IV.—Current-carrying Capacity of Round Armature Wires. B. & S. Gauge.

Wire size.	At Table III speeds.	At lower speeds.
8	40	34
9	32	27
10	25.6	21.7
11	20	17
12	16	13.6
13	12.8	10.9
14	10	8.5
15	8	6.8
16	6.5	5.5
17	5.1	4.3
18	4.1	3.5
19	3.3	2.8
20	2.6	2.2
21	2.1	1.78
22	1.7	1.45
23	1.35	1.15
24	1.1	0.93
25	0.9	0.76
26	0.7	0.59
27	0.56	0.47
28	0.46	0.39
29	0.36	0.31
30	0.29	0.25

From column 6 of Table III, the air-gap is 3-32 inch, and according to Rule II, the width of the armature coil slots must not exceed 9-32 inch. From the left-hand section of Table V, the nearest slot width for No. 13 wire is 0.21 inch, which takes one wire only. The slot depth, according to Rule III, must not exceed $6 \times 0.21 = 1.26$ inches; the nearest slot depth in the right-hand section of Table V for No. 13 wire is 1 9-32 inches, which will take 12 wires.

The number of wires required is 854, as just stated. Each slot will take 12 wires (1 wide x 12 deep), and the slots must all contain the same number of wires each; therefore it is not practicable to use exactly 854 wires. The nearest practical number is 852 wires, which will occupy 71 slots.

The polar bore being 8 inches and the air-gap 3-32 inch, the armature core will be 8 — 3-16 = 7 13-16 inches. The slots being 1 9-32 inches deep, the diameter of a circle drawn through the narrowest part of the teeth will be 7 13-16 — 2 9-16 = 5¼ ins. The circumference of this circle is 16.49 inches, and of this circumference the slots occupy $71 \times 0.21 = 14.91$ inches; this leaves only 16.49 — 14.91 = 1.58 inches for all the teeth, which is manifestly absurd, even without considering Rule V. It here becomes evident that the armature may have to be increased in diameter, which may increase the air-gap. The method of making this correction will be explained in the next article.

TABLE V.—Slot Dimensions for Standard Sizes of Round Armature Wires, Double Cotton Insulation.

Wire sizes.	Slot width. No. of wires side by side: 1	2	3	4	5
8	.27	..	..	..	..
9	.25	..	..	..	..
10	.24	.35	..	..	..
11	.23	.33	..	..	..
12	.22	.31	..	..	..
13	.21	.29	.37	..	..
14	.20	.28	.35	..	..
15	..	.26	.33	..	..
16	..	.25	.31	.37	..
17	..	.24	.29	.34	..
18	..	.23	.28	.33	..
19	..	.22	.26	.31	..
20	..	.21	.25	.29	.33
21	..	.20	.24	.28	.31
22	..	..	.23	.26	.30

Wire sizes.	Slot depth. Total number of wires, depthwise of slot: 4	6	8	10	12	14	16	18	20	Wire sizes.
8	¾	1 1/32	1 5/16							8
9	11/16	15/16	1 3/16							9
10	5/8	7/8	1 1/16							10
11	19/32	25/32	1							11
12	9/16	¾	15/16	1 3/32	1 9/32					12
13	½	11/16	27/32	1	1 5/32					13
14	..	5/8	25/32	15/16	1 1/16	1 7/32	1 3/8	1 ½		14
15	..	9/16	11/16	27/32	1	1 1/8	1 ¼	1 3/8	1 ½	15
16	..	..	21/32	25/32	29/32	1 1/32	1 3/16	1 5/16	1 7/16	16
17	..	..	5/8	23/32	27/32	15/16	1 1/16	1 3/16	1 ¼	17
18	..	..	9/16	11/16	25/32	7/8	31/32	1 1/16	1 3/16	18
19	..	..	..	5/8	23/32	13/16	29/32	1	1 1/16	19
20	..	..	..	19/32	21/32	¾	27/32	15/16	1	20
21	..	..	..	9/16	5/8	23/32	25/32	7/8	15/16	21
22	..	..	..	17/32	19/32	21/32	¾	13/16	7/8	22

AN INCONSISTENCY IN THE NATIONAL ELECTRICAL CODE.

BY C. R. JAMES.

The National Underwriters' Electrical Code has much to say about the construction of lamp sockets and goes into many details. It seems strange that the committees which have formulated this code should have given so much attention to the socket itself and utterly ignored a defect which is common to the great majority of Edison sockets. This defect is that the brass shell of the Edison lamp base usually is not by any means entirely protected by the lamp socket, with the result that a part of the lamp base which is especially liable to be brought in contact with persons and grounds is exposed without any protection whatever. The accompanying photograph of an Edison socket with lamp illustrates this point. This lamp and socket are not by any means exceptional, as both are of standard markes now on the market, hundreds of thousands of which are now in use. The live lamp base is exposed for a distance of about 3-16 of an inch. The majority of electrical engineers seem never to have noticed this detail, but they would have done so quickly had they received shocks in attempting to turn on a drop light in a damp basement with the exposed part of the lamp base on the non-grounded side of the circuit. The exposure of live metal is sufficient on the socket shown, so that it is not only possible, but quite probable, that any one taking firm hold of the socket would make contact with it. Of course, the voltage on an ordinary lamp socket is not dangerous to the average person, but it is far

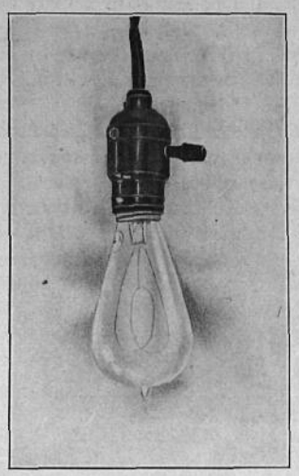

FIG. 1.—EDISON SOCKET AND LAMP.

from being pleasant to receive a shock even from such a low voltage, and further than this, there is danger that fires may be caused by the live lamp base coming in contact with some grounded conductor. In view of the great precautions that are taken to prevent defective lamp sockets from causing fires, it looks decidedly absurd to "strain at a gnat" in the socket itself and "swallow a camel" in the lamp base which is screwed into the socket. One would think that the Edison lamp base had been in use enough years so that little defects of this kind would have been weeded out. All that is necessary is either a lengthening of the socket shell and lining or a shortening of the lamp base.

SELECTIVE RINGING SYSTEMS.

The Kellogg Harmonic System.

BY A. DALLAM O'BRIEN.

The question as to the advisability of the use of party lines in telephone central offices may at the present stage in telephone development be considered as being fairly settled. Subscribers whose use of the telephone is small demand service at a low cost and it is to this class of customers that the party line particularly applies. The objections that may be offered to this class of service on the part of the subscriber are all insignificant compared to the annoyance due to signal ringing and the consequent necessity of being on the alert whenever the telephone rings; in addition to this there is a most decided temptation to listen to conversations which may originate from another station on the line. After a