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ABSTRACT

Additional support to a stimulus-response (S-R) association by the use of an extraneous stimulus is called "prompting." Prompting has an effect on learner achievement particularly if the prompting agent is identical on successive S-R trials. This experiment sought to analyze the differences in learner achievement when different prompting stimuli were used on all the trials of the instructional sequence. The experiment was conducted in an industrial arts class that consisted of students, Grade 6 through Grade 9. The students were divided into five test groups and were directed to learn ten basic electronic symbols over six successive trials. Prompting agents appeared in all the trials, however for two of the groups the agents remained unchanged. Contrary to expectation, the study did not detect significant differences in learner performance regardless of the prompting pattern. (MC)

THE EFFECT OF VISUAL PROMPTING ON LEARNING

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THE EFFECT OF VISUAL PROMPTING ON LEARNING

PURPOSE

This study was conducted in order to learn whether or not a pattern of visual prompting which used different prompting stimuli on all trials of an instructional sequence would produce a different degree of learner ahcievement from one in which the identical prompting stimulus was used on all trials.

RATIONALE

In establishing an association between a given stimulus and response, it is imperative that as early in the instruction as possible, the two occur together.

Whenever a new stimululus is presented to a learner, there is a high probability the stimulus will be obscured from the learner by other stimuli competing for the learner's attention. To aid the learner in his isolation of the stimulus to which he is to respond, assistance is often provided by simultaneously employing a second stimulus which has some degree of power to attract and direct the attention of the learner to the stimulus to which he is to respond.

For the purpose of this study, this technique of providing additional support to a S-R association through the use of an extraneous stimulus was called "prompting". The extraneous stimulus employed in the technique was called the "prompting agent", and the additional support provided the learner by the presence of the prompting agent was called the "prompt". Such a technique of prompting has been shown to play a significant role in enabling learners to make the responses which were desired.

The literature on prompting is replete with studies in which an identical prompting agent was used on all S-R trials during the instructional sequence. For example, if a learner is to select a picture of an apple from several pictures of fruit, the color red might be used as a prompting agent. If red appeared with the apple on all trials, the learner might learn that simply selecting the picture which is accompanied by the color red consistently results in the correct response.

However, should the prompting agent which accompanied the picture of the apple be changed from red to green to blue as trials progressed, the learner could not continually rely upon the presence of a prompting agent which produced success on former S-R trials for the isolation of the stimulus. Such a pattern of prompting would prevent the learner from merely reacting to the prompting agent and would force him to turn his attention to the stimulus itself.

Learner responses might on the onset of instruction be expected to be controlled by the prompting agent. As instruction continues, however, this control should shift from the prompting agent to the new stimulus until the new stimulus alone has full power to produce the intended response. Often times, however, it remains easier to depend upon the recurring prompting stimulus than to attend to the new stimulus. The new stimulus is thus ignored. When the learner is then presented the new stimulus alone, it is not uncommon that the desired response is not forthcoming. The learner is said to be "prompt dependent".

Literature does not reveal the dynamics of how learners develop such dependence upon the presence of prompting stimuli. It might be hypothesized, however, that the recurrance of the same prompting stimulus on successive S-R trials might be one such dynamic.

In order to rid the instructional sequence of the extraneous support which was used to assist the learner in making the desired responses, and to prevent him from becoming dependent on such support, various methods for the removal of prompting stimuli have been developed. It has generally been the case that a system for the employment of prompting agents is not functionally complete without an accompanying system for the removal of such from the instructional sequence.

Should it be possible to develop a pattern of visual prompting that will provide the necessary prompt support to an instructional sequence and at the same time not produce a level of dependence having a detrimental effect on the resulting learning, the need for elaborate systems of prompting agent removal would be negated.

Extending the work of researchers such as Trabasso (1963), Norman and Rieber (1968), Taber and Glaser (1962), and Hershberger (1964), this study was designed to investigate the effects of a pattern of visual prompting which employed different prompting agents on successive trials of the instructional sequence.

PROCEDURES

The study consisted of a control group and four treatment

groups, two of which received instruction which used a different prompting agent on successive trials of the instructional sequence, and two groups which received instruction in which the prompting agents remained the same for all trials in the instructional sequence. The control group received the same treatment, without any visual prompting.

In order that data might also indicate whether prompting agent removal techniques might be eliminated via the use of a prompting pattern in which the prompting agent is changed from trial to trial, treatments were designed which would provide a maximum and a minimum level of prompt assistance within each of the two prompting patterns being studied. To dichotomize each of the prompting patterns, half of the learners prompted by each pattern received instruction in which the prompting agent was removed suddenly by withdrawal; the other half gradually by fading.

It was expected that learners receiving varied prompt-instruction would score higher on post achievement tests than would learners for whom prompting agents were not varied. Likewise, learners for whom prompting agents were gradually faded were expected to score higher than learners for whom prompting agents were suddenly withdrawn.

The Instructional Product

An instructional product was designed, validated, and produced which depended heavily upon the use of extraneous prompting agents to teach junior high school industrial arts students

to identify ten electronic symbols. (See Appendix 1) Constructing the array from which this identification was made were 34 electronic symbols selected at random from Grob (1971) via a table of random numbers. (See Appendix 2) The same procedure was used to select the ten symbols to be identified from the array as well as the order each of the ten symbols appeared in the instructional treatment.

Learners were provided six identification trials for each of the ten symbols to be learned; each trial was accompanied by a different visual presentation. Hence, six different visuals were produced, each containing the array of symbols, and each symbol in the array accompanied by a different identification number. (See Appendix 3) The six visuals differed only in the arrangement and the orientation of the symbols on the visuals and the numbers accompanying each symbol. While only six different visuals were used in the product, each of the six was used with each of the ten symbols being identified. On the first trial for each symbol, identification was made from visual number one; visual number two for all second trials, and so forth.

An identification trial consisted of the learners' being presented with one of the six visuals, the name in a verbal form of the symbol to be identified, instructions in a verbal form to make the identification, and ten seconds to respond. A verbal description of the symbol was provided on the first trial only. Proper identification involved the learners' writing the identification number of the symbol named.

Since color has been shown to be an effective agent for providing prompts to S-R trials, (Trabasso, 1963; Underwood, Ham and Ekstrand, 1962; Norman et al., 1968; Green and Anderson, 1956) ten shades of colored pressure sensitive materials were selected which would represent as nearly as possible the spectrum of colors. These were used to provide the prompting agents for the study. Circular discs of the colored materials were cut and applied to the visuals in the proximity of the electronic symbol being prompted. (See Figure 1)

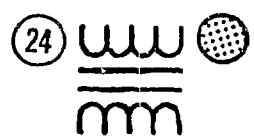

Figure One

After the colored disc was applied to the visual, the visual was photographed onto a color slide.

Prompting agents appeared in all treatments except the control treatment in each of the first four identification trials. For the two groups for whom prompting agents were varied, the color serving as the prompting agent was randomly selected for each prompted S-R trial. The color selected was used as the agent for a single S-R trial. On the next trial, the random selection was repeated. (See Appendix 4)

For the two groups for whom prompting agents remained unchanged, colors serving as prompting agents were randomly selected as each instructional sequence began and remained associated with that stimulus for the duration of the instructional sequence, or until eliminated by some technique of prompt-

ing agent removal. (See Appendix 4)

When the prompting agent was to be withdrawn, it appeared in each of the four prompted trials, then was dropped from the instructional sequence completely.

Studies by Spence (1937) and Grice and Saltz (1949) indicated that stimulus strength varies as the stimulus is manipulated on the size dimension. Since these studies were concerned with behaviors in animals, a pilot study was conducted in which the study by Spence (1937) was replicated using human learners responding to circular stimuli of 1/8, 3/16, 1/4, 3/8, and 1/2 inches in diameter. The results of this replication agreed with the original study.

On the basis of the results of this replication, fading was accomplished by reducing the size of the circular disc used for the prompting agent from 1/4" diameter for full strength prompts, to 3/16" diameter for intermediate strength prompts, to 1/8" diameter for prompts of the lesser strength. (See Table 1)

TABLE 1

Fading of the Prompting Agent

Strength	Size	Example
Full	1/4"	
Moderate	3/16"	
Lesser	1/8"	

The complete visual presentation given learners in the varied/faded treatment group for the identification of the symbol used to represent fuses is as follows: (See Appendix 5)

Pre and post achievement tests were constructed and

validated. Each of these tests consisted of a printed visual identical to those used in the treatments with the exception of the arrangement, orientation, and the numbers which accompanied the symbols. Verbal test instructions were provided by audio tape, and learners wrote the number of the symbol being identified on their response sheets.

Population and Sample

The population of learners to whom this study was directed was composed of learners enrolled in the early stages of industrial arts curricula. This population consisted of males in the 11 to 14 age group and represented grades six through nine.

A sample of learners was randomly selected from those students enrolled in Level I industrial arts at Smith-Cotton High School at Sedalia, Missouri. Learners from the sample were then randomly assigned to one of the five treatment groups and each group was in turn randomly assigned to one of the five treatments using a table of random numbers.

Analysis of Data

Data obtained from the administration of the pre and post-tests were analyzed by means of an Analysis of Covariance, a Newman-Keuls test, and a Page's L-test.

RESULTS

The results of Analysis of Covariance revealed that a significant difference did exist between the adjusted post-test performance of learners in the five groups. These results are in Table 2.

TABLE 2

Analysis of Covariance:
Posttest Scores Covaried by Pretest Scores

Source	SS	df	MS	F
Prompt Pat.	76.530	4	19.132	6.852*
Error Term	376.999	135	2.792	
Adj. Total	453.529	139		

*Probability of F > 3.47 = 0.01 for df of 4 and 125

A significant difference having been obtained from Analysis of Covariance, the data was then subjected to further analysis by the Newman-Keuls test to identify those differences. Results of the Newman-Keuls test revealed no significant differences between posttest performance of the four prompted groups regardless of the prompting pattern or the removal technique employed although all prompted groups differed significantly from the control group as was predicted. (See Table 3)

TABLE 3

Summary of Newman-Keuls Test

Rank Order	5	2	1	4	3

Though differences in achievement of learners in the four prompted groups was not great enough to be significant when analyzed by Analysis of Covariance and New-man-Keuls tests, this achievement was, of course, not identical. In order to determine if this difference agreed with earlier predictions, the data was subjected to analysis by the Page's L test. The results of this analysis indicated that the data in the study generally agreed with earlier perdictions.

CONCLUSIONS

Failure of this study to detect significant differences in learner [illegible] ce regardless of the prompting pattern or prom [illegible] ov [illegible] chnique employed was attributed to the following conclusions.

Prompt Dependence:

Dependence resulting from prompting instruction is upon the assistance provided by the prompting agent and not upon the prompting agent itself.

The fact that the prompting agent used in the varied pattern never prompted a given response two or more times in succession indicates that dependence upon the presence of a given prompting agent is not likely to occur. However, failure of learners to perform significantly higher under this condition leads to the inference that learner performance is equally dependent upon some dimension of the prompt common to all treatment conditions.

The conclusion is that learner dependence was upon the assistance provided the instructional sequence by the prompting agent, or, in other words, the prompt, and by varying the prompting agent that dependence was not affected.

Removal of the Prompt:

If prompting agents are used in a varied pattern in instructional sequences, elaborate techniques for the removal of prompting agents are not necessary.

The non-significant differences yielded by this study indicate that a pattern of varied prompting is at least as productive as a pattern in which prompting agents remain unvaried over all trials. In addition, since varied prompted

learners for whom prompting agents were suddenly withdrawn performed as well as learners for whom prompting agents were gradually faded, the use of a varied pattern of prompting could negate the need for elaborate techniques for the removal of prompting agents from instructional sequences.

The Power of the Prompt:

Extraneous visual prompting can be a powerful means for increasing the probability of a given response being brought under the control of a given stimulus.

Studies by Green et al., (1956) and Smith (1962) indicate that color is a powerful prompting agent, especially for the enhancement of discrimination. Such findings are further supported by the results of this study. For example, of the 28 learners in this study who received no prompting, 21 exhibited difficulty in discriminating between air core coil symbols and air core transformer symbols. (See Figure 2)

Air Core Coil

Air Core Transformer

Figure 2

No such pattern was found in any of the four prompted groups.

Recommendations

The results of this study raise several unanswered questions regarding visual prompting and the use of such as a component of instructional design.

1. Literature tends to deal with prompts much as entities unto themselves; little or no evidence seems to exist which reveals serious study having been directed toward the

components which are involved in the dynamics of teh prompt. The findings from this study suggest the need for further investigations aimed at closer examinations of the prompt, its components, and the function of each component.

2. The concept of prompting for instructional purposes is contingent upon the use of physical agents to provide some degree of assistance to a learning task. While there is no evidence to support the prediction that a more operational method of providing prompt assistance will be discovered, it is obvious that further studies should be conducted to determine the effects of introducing, manipulating, and removing visual prompting agents in instructional materials.

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APPENDIX

APPENDIX 1

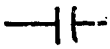
Electronic Symbols Taught by Instructional Product

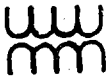

Iron Core Transformer


Resistor

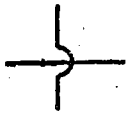

Ground


Air Core Coil

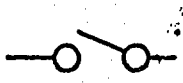

Capacitor


Air Core Transformer


Battery

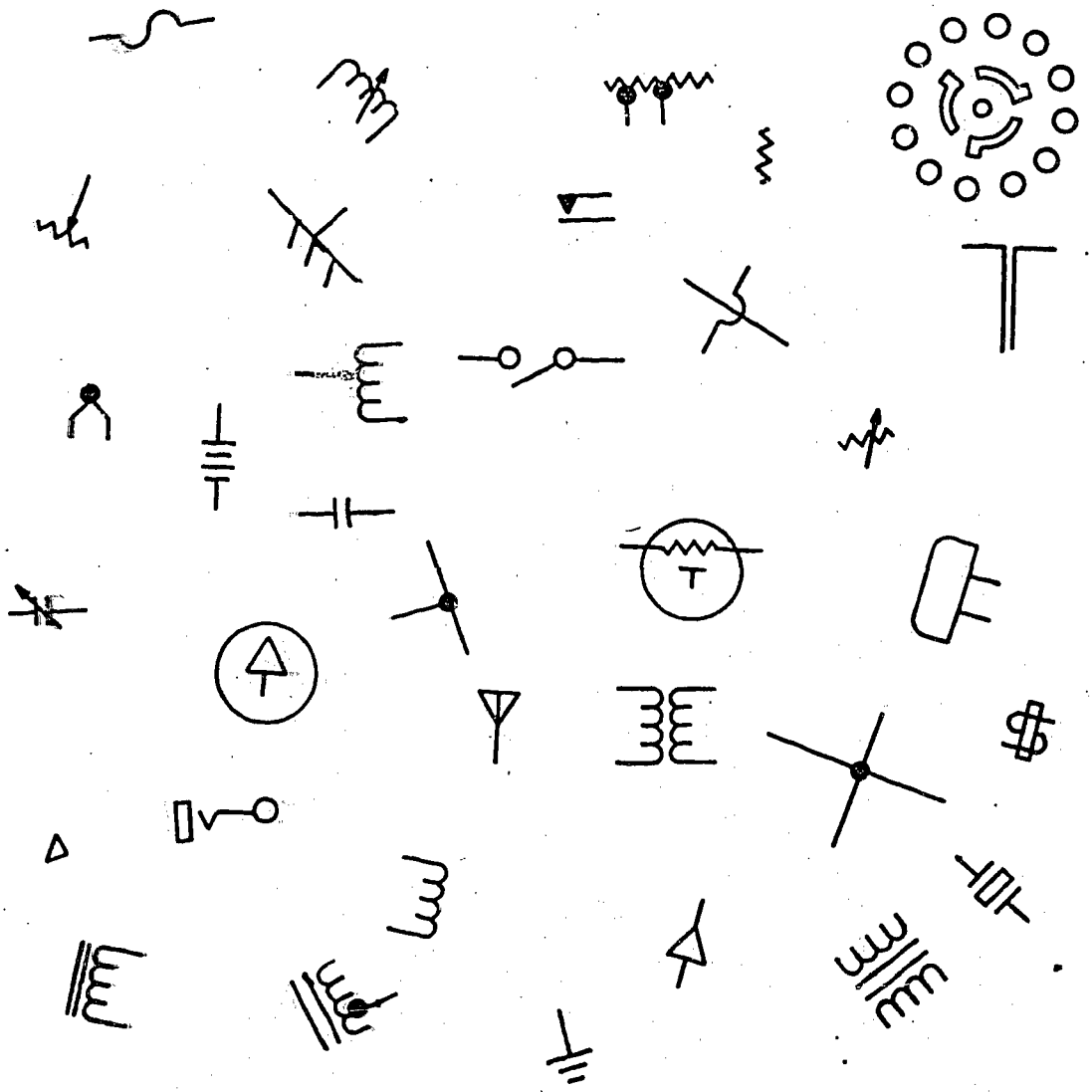

Crossed Wires - No Connection


Fuse


Switch

APPENDIX 2

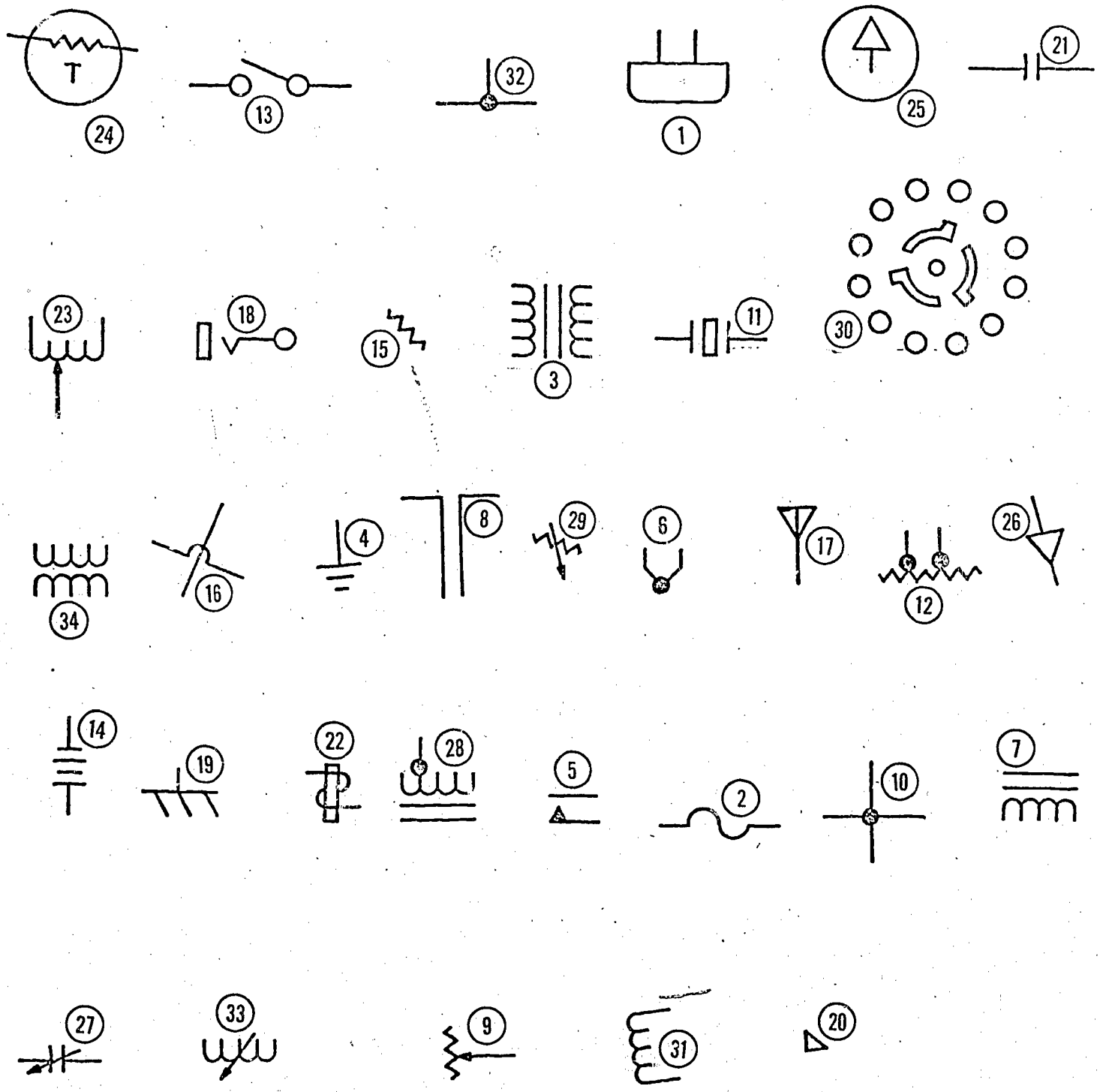
Electronic Symbols Constituting Array



APPENDIX 3

Visuals Used in the Instructional Product

Visual Number One



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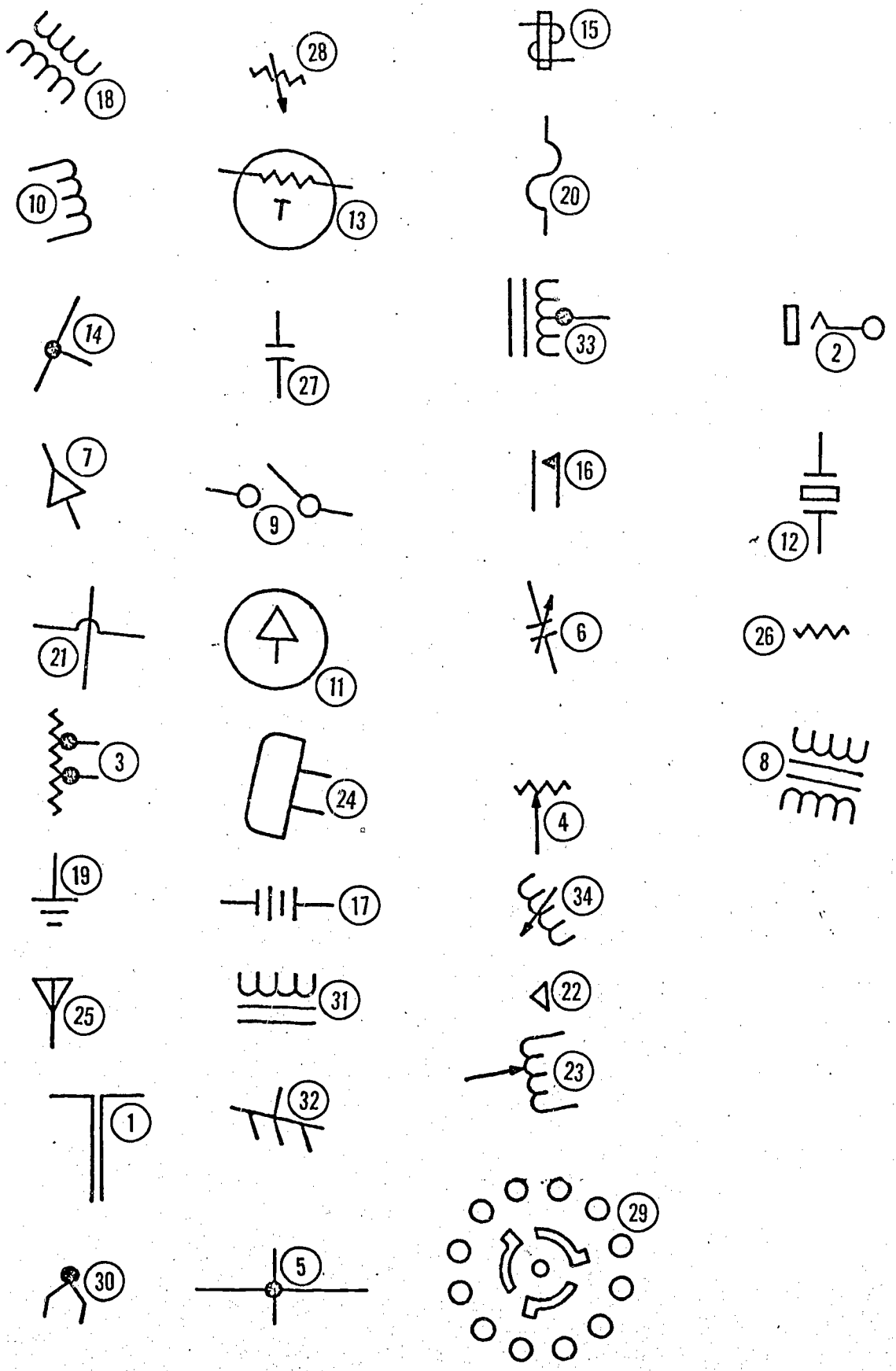

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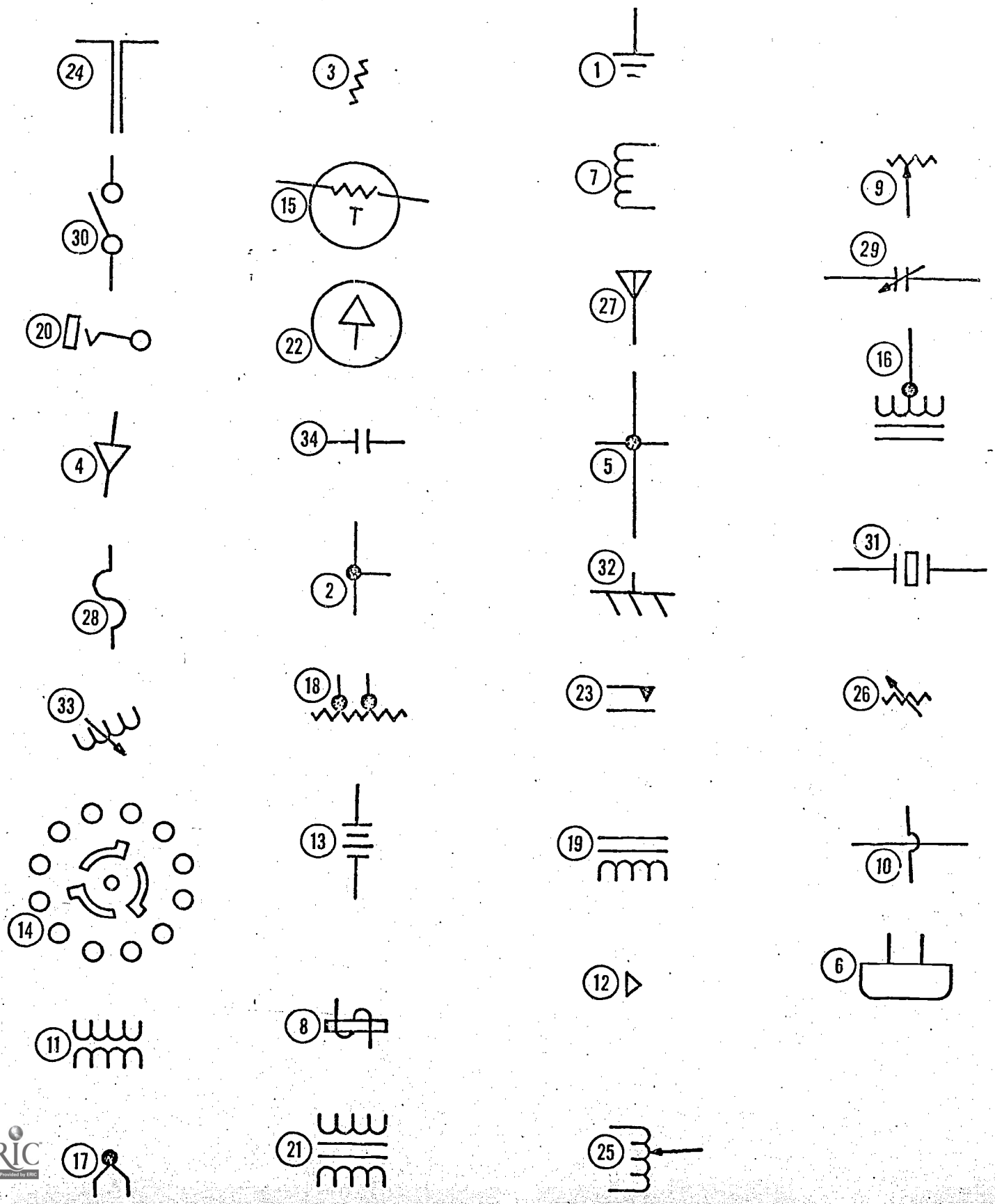

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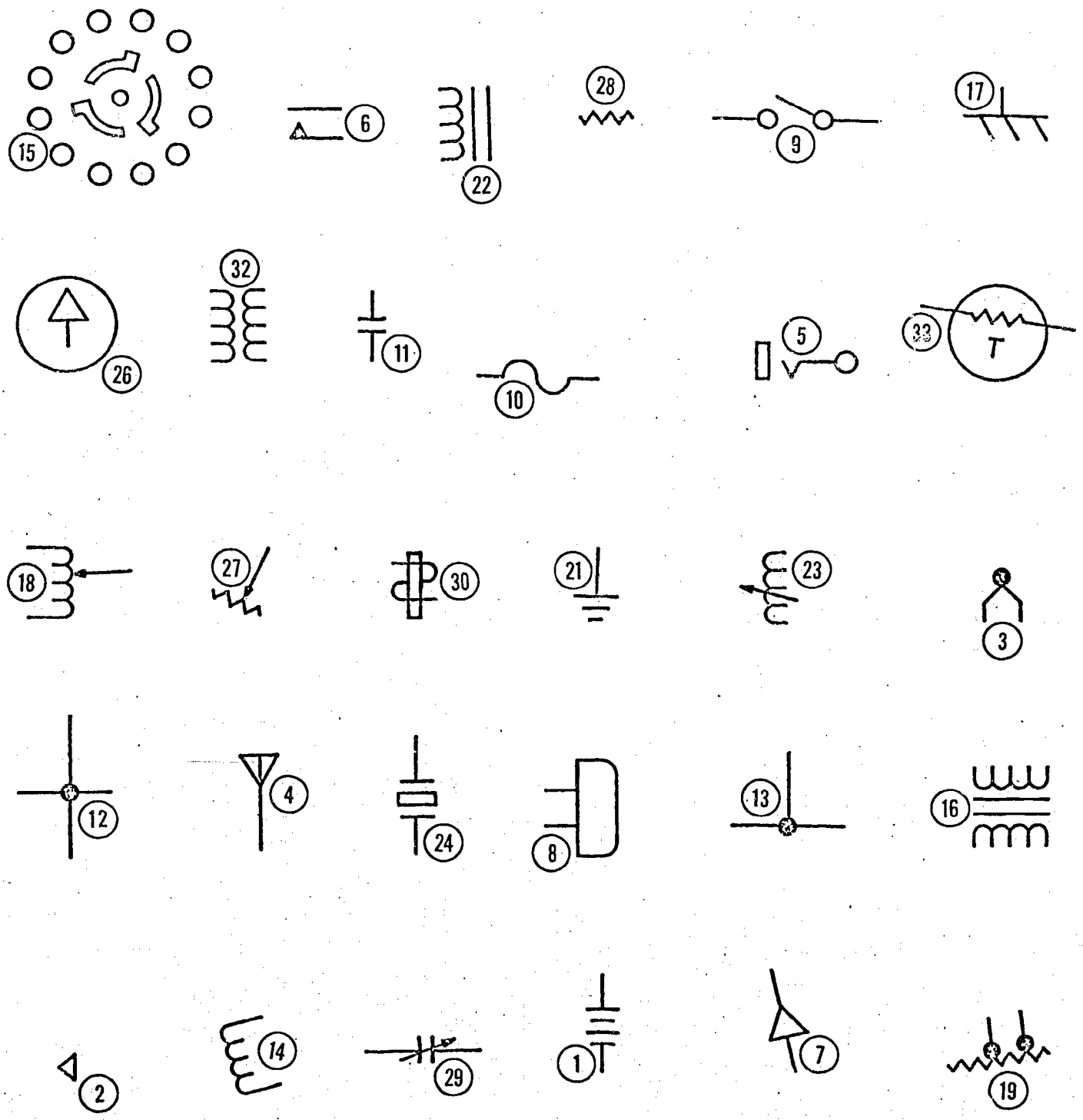
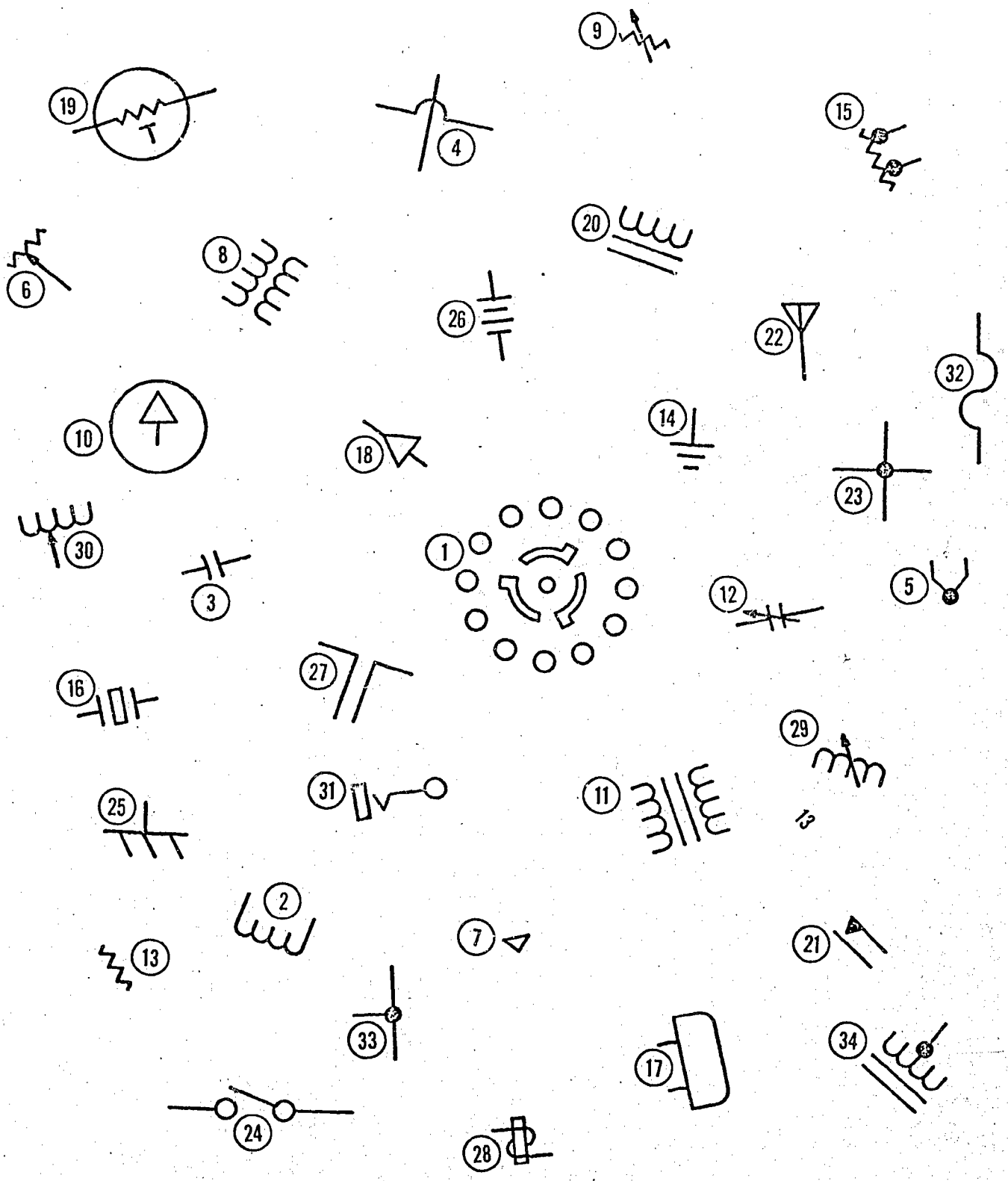
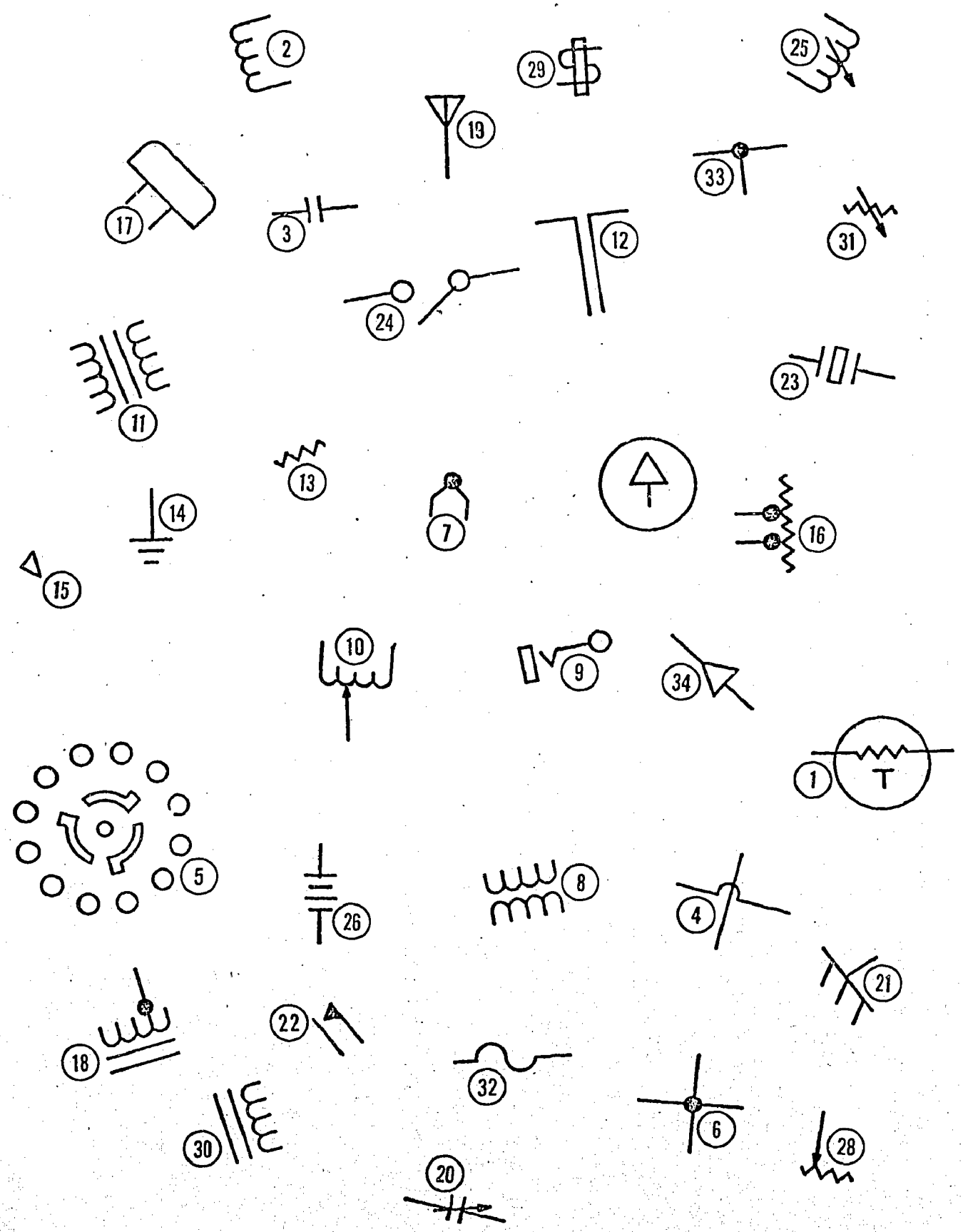


Visual Number Five

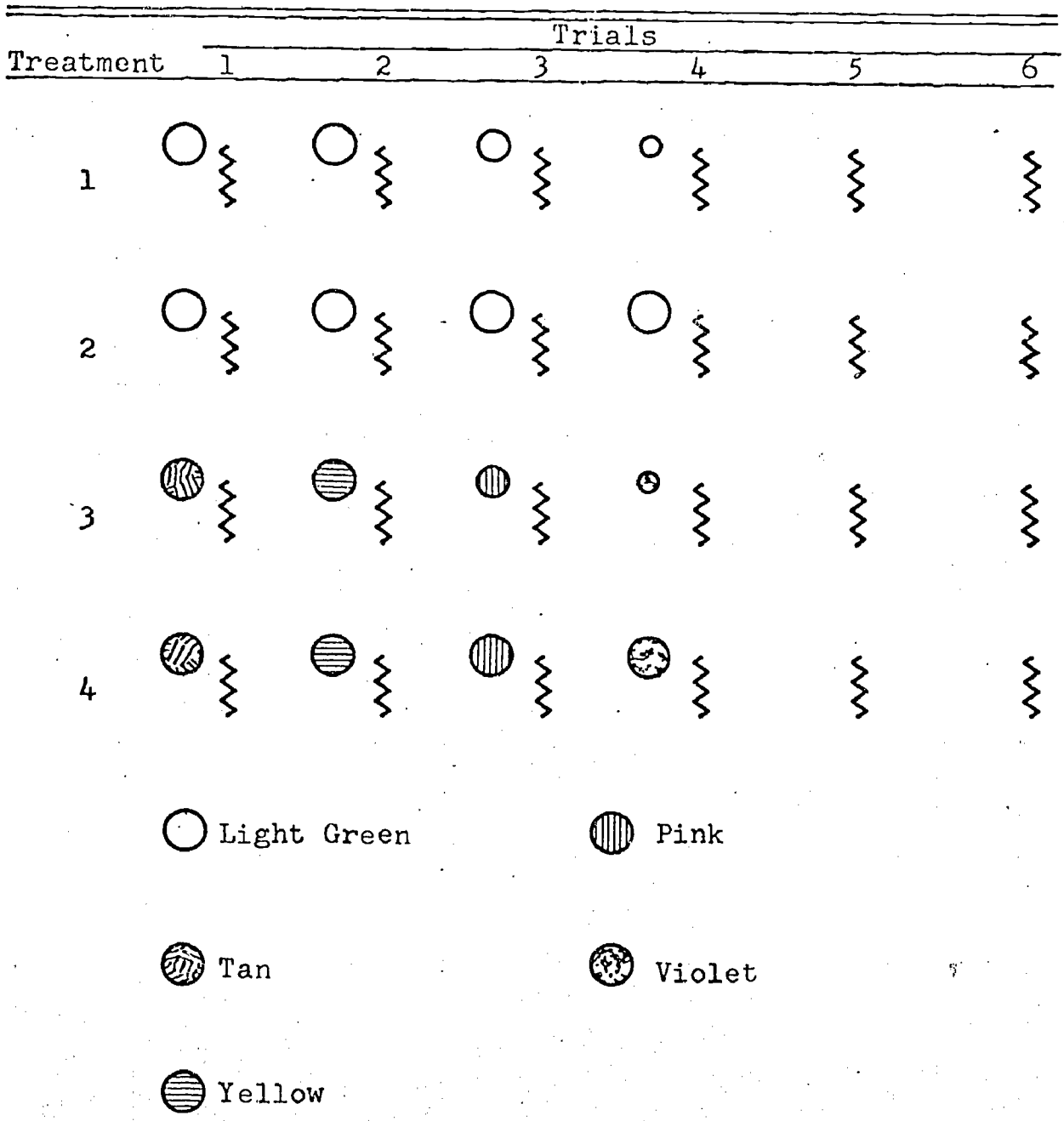


Visual Number Six



APPENDIX 4

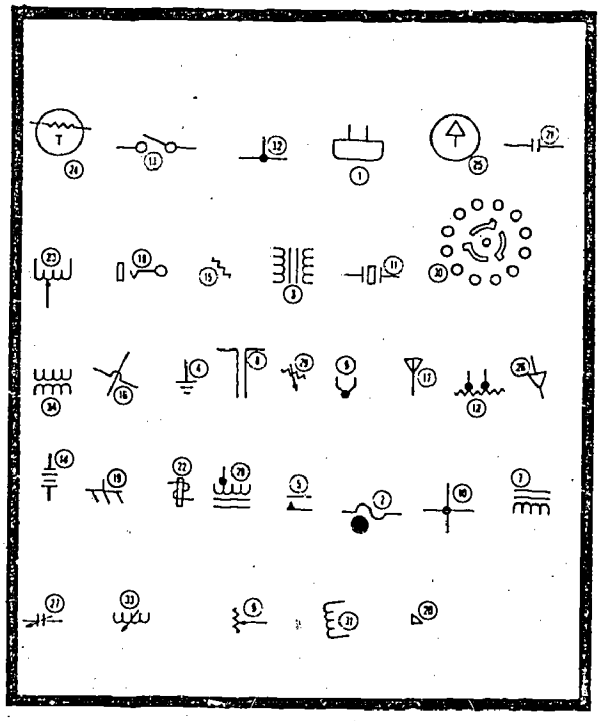
Prompting by Trial of One Electronic Symbol Over all Treatments



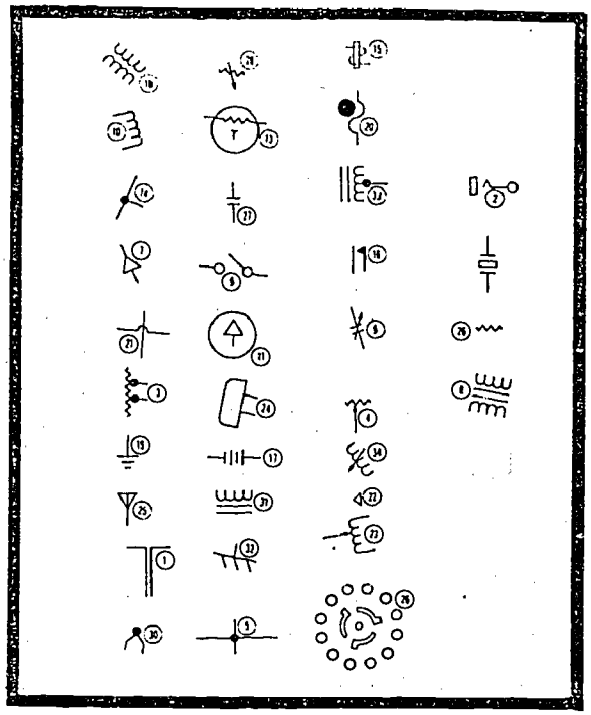
APPENDIX 5

Visual Presentation given learners in
Varied*/Faded Group

Visual Number One



Visual Number Two



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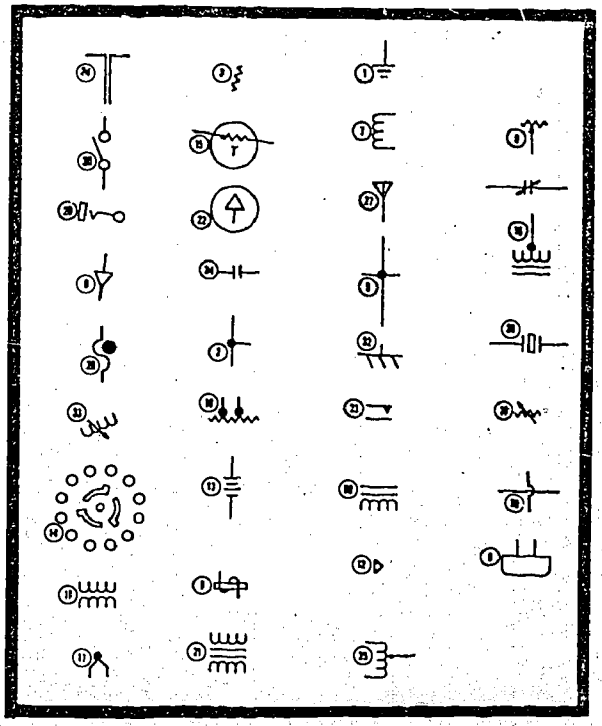

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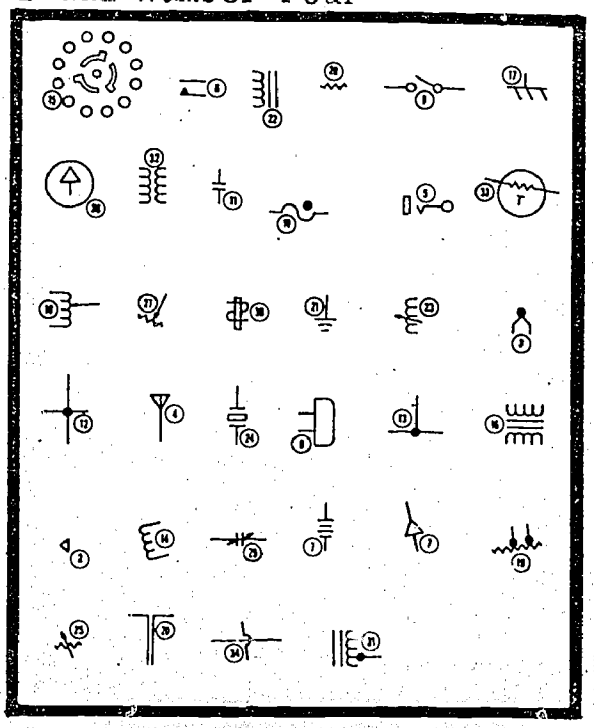

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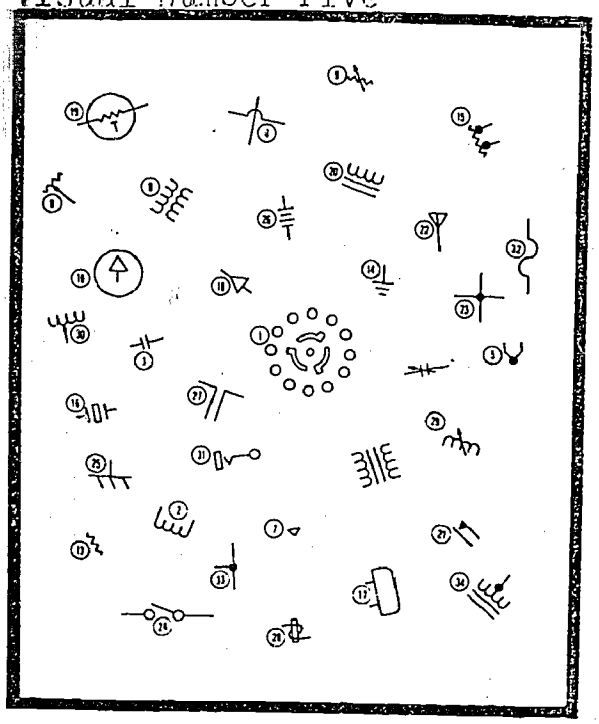

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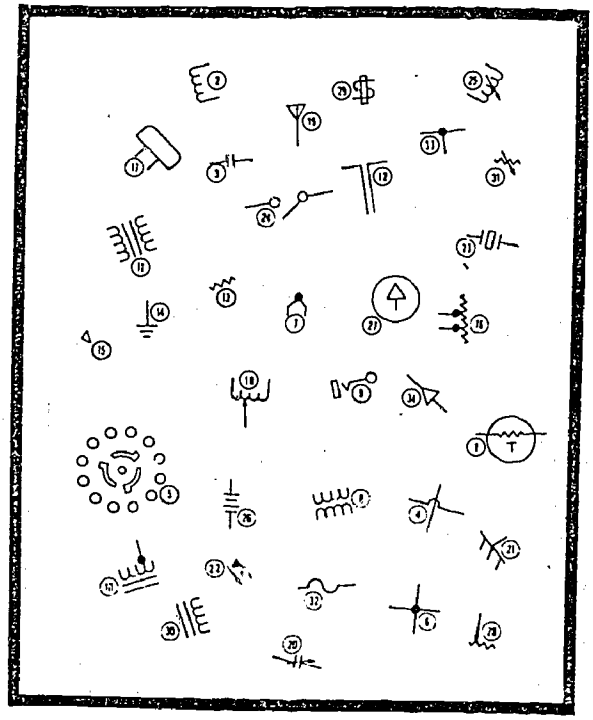

* Prompting agents appeared in the following colors:

visual number one: blue
visual number two: green
visual number three: dull green