# DEVELOPMENT OF PROCEDURES FOR NON-ALERT TESTING OF OUTDOOR ATTACK WARNING SYSTEMS

Final Report

W. Sattler

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AC SPARK PLUG DIVISION
GENERAL MOTORS CORPORATION FLINT 2, MICHIGAN

# DEVELOPMENT OF PROCEDURES
# FOR NON-ALERT TESTING
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by

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General Motors Corporation

March 2, 1962 to October 22, 1962

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for

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This report has been reviewed by the Research Directorate, Office of Civil Defense, Department of Defense and is approved for publication.

## TABLE OF CONTENTS

## List of Illustrations

## List of Appendixes

## List of Tables

# INTRODUCTION

In recent years attack warning authorities have become increasingly aware of the detrimental effect caused by testing outdoor warning devices by actually sounding the public action signals. They have found that with every test more individuals learn to associate the sound of these signals whenever heard, with mere tests of the system. The Office of Civil Defense has, in an approach to solving the problem, ordered this development of alternate testing methods.

This study has as its objective the development of procedures for testing the readiness of attack warning devices and systems without producing warning signals which the public can confuse with an actual warning.

The procedures are developed principally for all types of outdoor sound producing devices, including sirens, horns, whistles, and electronic sound systems, which are used in cities and towns for disseminating attack warning. They are to test all portions of the systems—from the point at which activation occurs (the control point of the system), through the control and energizing circuits, to the sound transducer itself.

The procedures are required to be sufficiently inclusive so that full periodic testing may be accomplished as a part of an adequate maintenance program. This procedure provides the assurance that should a warning device actually sound as an attack warning there will not be justifiable cause for the public to assume it is a test (except possibly once a year during the nation-wide Operation Alert or its equivalent.)

In the approach to the problem the first task was fulfilled early in the study by inspecting existing systems in various parts of the country. During many of these visits the actual equipment at the activation point and at the alarm sites was inspected. The next important task was to become aware of the unusual, as well as typical, procedures presently in use for testing these warning systems. This was done by visiting the OCD Region Offices. The warning officer at each region provided general information on the procedures used throughout the region. For the details individual systems of interest were visited.

Any detail data needed regarding warning system equipment was obtained wherever possible by contacting designers or manufacturers of the devices. In a number of instances it was necessary to actually conduct tests on certain equipment to obtain desired performance characteristics of a non-standard nature.

This data was systematically assembled and analyzed and used to arrive at the possible solutions to the non-alert testing problem and the trade off values to be considered when selecting each.

It is intended in this report to describe various non-alert testing concepts, including how they can be used in conjunction with the many existing types of systems; and to provide sufficient data to support the recommendations made in this study.

## SUMMARY

This study was conducted during the project period from March 2, 1962 to October 22, 1962 under a Department of Defense, Office of Civil Defense contract number OCD-OS-62-50.

Twelve landline controlled and seven radio controlled warning systems currently in operation were studied in detail. Six of the eight OCD region offices were visited to obtain general information on warning systems in this country and to become aware of any unique systems or testing procedures presently used. Analysis of this cross-section of data provided an understanding of the general objectives and problems associated with outdoor attack warning systems commonly used in the United States.

This study has resulted in establishing two concepts for non-alert testing all outdoor warning systems that are being used at the present time. The concepts are "Silent Testing", which is a test of the system up to the sound producers, and "Minimum Sound Testing" where all parts of the system are energized — from the activation point up to and including the sound producers, as a test sound of minimum dimensions is produced.

The major features of the two concepts include the following items.

The Silent Testing concept

- No sound when testing system
- Frequency of tests unlimited

The Minimum Sound concept

- The total system is tested
- All equipment is "exercised" during test
- Daily tests are feasible
- Equipment modifications are minor

Closed loop system testing where the results are automatically fed back to the activation point is not recommended unless the malfunctions can actually be attended to as quickly as they are reported. A capability such as this is redundant, and unless it is very carefully engineered, it will degrade the reliability of the attack warning system itself.

It is obvious that the interval can be much shorter between non-alert tests than between those tests where the actual warning signals are

produced. Using minimum sound procedures the test sound will, for most individuals, be subliminal or for silent testing procedures will be non-existent. The accuracy of measure of system readiness obtained by system tests can be increased not only by devising more thorough tests, but also by expanding the rate at which the tests are repeated. Regardless of which type of non-alert testing considered, the tests should be conducted as frequently as possible.

The reader is referred to Section V where an integrated approach to non-alert testing is discussed.

# I. FIELD STUDY OF EXISTING OUTDOOR WARNING SYSTEMS

## A. General

The information contained in this section was primarily obtained by studying 18 warning systems in detail and meeting with warning officers at the eight OCD Region Offices. There are over 5,000 cities in the United States with populations over 2,500. The majority of these operate Civil Defense warning systems composed of two or more remotely controlled sound producing devices. The field study, necessarily limited in scope by the length of this contract, has been found sufficiently extensive for the purposes of this study. Specific equipment details were provided by equipment manufacturers. Technical details and operating characteristics of landlines and associated switching equipment were provided by various companies in the Bell Telephone System.

A list of the various categories of outdoor sound producers approved for attack warning use and the associated controlling equipment is presented in Figure 1. The chart also includes a listing of the control circuits commonly used to link the alarm sites to the control point. Systems are generally made up of more than one type of sound producer. This factor must be considered when designing a test signal which is to trigger dissimilar devices simultaneously. Either landlines or radio signals are used to remotely control any number of alarm devices from one or more control points. In at least one instance, a radio system is used to back up a landline system in the event that the signal via the wire path cannot be received at the remote points.

It is intended in the following sections to describe the major characteristics of the various sound producing devices with emphasis on how they differ and how they are triggered into operation by remote control.

## B. Outdoor Sound Producing Devices

1. Siren - single motor: The conventional electrically driven siren is by far the most commonly used device for outdoor attack warning. The siren itself has very few component parts, none of which are critical from a functional standpoint. For this reason these sirens operate reliably over long periods of time and require a minimum of maintenance effort.

The conventional siren produces sound as radial vanes on the inside of the motor driven rotor cause air to be drawn in by centrifugal force. The flowing air is then chopped when ports spaced around the periphery of the rotor match corresponding holes in the stator to produce the varying pitch as the motor changes speed.

| I. OCD Approved Sound Producing Devices | II. Control Circuit | III. Warning Signal Control or Generating Device |
|---|---|---|
| A. Sirens<br>1. Electric Motor Driven<br>a. Multiple Motor<br>b. Single Motor<br>2. Gasoline Engine Driven<br>3. Steam or Air Driven<br>B. Whistles, Horns, or Bells<br>C. Loudspeakers | A. Individual<br>B. Multiple — remote<br>1. Landline<br>a. Private<br>b. Telephone Company<br>2. Radio<br>a. Tone — Code | A. Controllers<br>1. Manually Operated Switch<br>2. Automatic Timer<br>a. Commercial<br>b. Custom<br>3. Telephone Dial<br>a. Landline — Bell and Lights<br>b. Radio — Selective Code<br>4. Push Button Array<br>a. Radio -- Selective Code<br>B. Signal Generators<br>1. Microphone<br>2. Tone Generator<br>3. Recordings |

Figure 1 - Classification of Outdoor Attack Warning Systems

This type siren is useful for this application in ratings from 2 to 40 horsepower. The corresponding sound output ratings at 100 feet are 100 and 130 decibels (minimum) respectively for the two extremes.

2. Siren - multiple motor: The word "conventional" was used in describing the sirens just mentioned in order to set that group apart from a siren developed and manufactured by the Federal Sign and Signal Company of Chicago. Because this siren, Federal Model 1000 "Thunderbolt," uses separate motors[1] to drive a blower and chopper assembly, the air flow and the sound amplitude do not vary with the pitch of the sound as in the conventional design. In addition to this basic difference, the makers of this unit have found it necessary to install a circuit in the control panel which in effect converts the standard 8 seconds on, 4 seconds off warble signal sent from the control point to 4 seconds on, 8 seconds off. This timing sequence, as illustrated in Figure 2, is needed to make the warble signal easily distinguishable from the steady pitch signal.

These differences do result in the use of a more complex triggering and controlling circuit (refer to Figure 11) that must be considered carefully when designing a compatible test signal.

3. Siren - gasoline engine: The gasoline engine driven sirens are in common use in spite of the obvious problems which might be encountered in using a complex prime mover such as this in standby outdoor service. This Type of siren can produce 135 decibels of sound at 100 feet, and it can start and operate without commercial electrical power up to the limits of its fuel supply. Features of interest from the standpoint of testing these sirens are: 1) They can be started by a momentary closure of the signal circuit; 2) the starter motor is automatically de-energized when the engine starts; 3) the cranking time is limited in the event that the engine does not start readily; 4) once started the engine continues to run, after the signal circuit is opened, for a short period of time; and 5) the Chrysler and Biersach & Niedermeyer sirens of this type use an integral blower and chopper and therefore produce siren sound as soon as the engine reaches idling speed. However, in the Federal Model 2000, the blower and chopper are again separate units as they are with Model 1000. The blower is driven by the gasoline engine and the chopper is driven by an electric motor, which receives its power from the storage battery. During the cranking interval the chopper motor is prevented from running. If the signal circuit is still closed when the engine succeeds in

[1] A third motor is used to rotate the siren

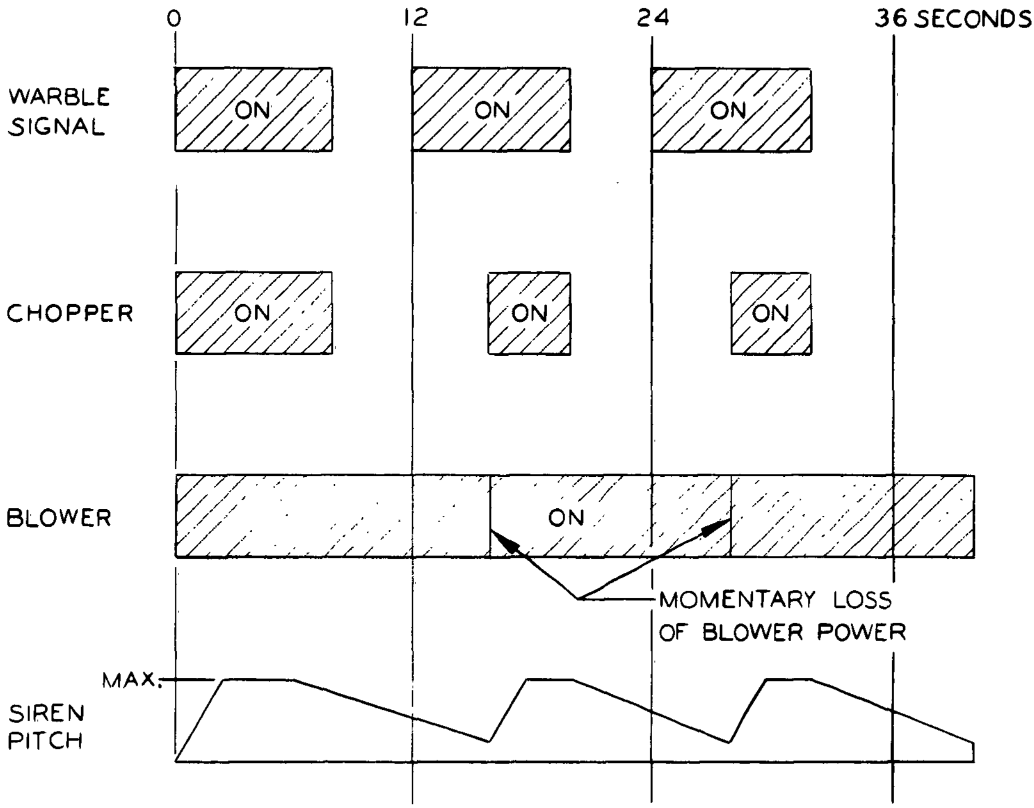


Figure 2 - Relation between input and output signals for Federal Model 1000 (Thunderbolt) siren.

starting, the chopper motor is automatically energized and siren sound is produced.

4. Horn - steam or air: Horns are frequently used in small systems or as fill-in for fringe areas in the larger systems. They are rated at sound output levels of from 100 to 120 decibels minimum at 100 feet. Horns have a characteristic possessed by no other warning device, and this is their ability to be started and stopped instantly. In the case of a horn operated by compressed air, a turn-on delay might be noticed if the distance between the control valve and horn is appreciable.

5. Loudspeakers: Loudspeakers used for electronic warning service are weatherproof units rated up to 75 watts and are nearly always grouped in clusters for omni-directional coverage. In addition to the loudspeaker cluster, an alarm site consists of either a transistorized, weatherproof power amplifier or a vacuum tube type power amplifier that must be suitably housed a limited distance from the speakers. Some types of power amplifiers can be operated from storage batteries; the lengths of transmission periods are limited only by the capacity of the batteries. The batteries are recharged by a battery charger connected to commercial power. During standby periods some amplifiers, depending on type and manufacturer, are completely de-energized while others idle at reduced power to extend component life. In either case, the amplifiers must be switched from standby to operate by remote control from the activation point. One method of doing this employs a sensitive relay at the input terminal of the amplifier which applies power to the unit when, for instance, the operator at the control point merely blows into the microphone before speaking. A time delay circuit prevents the amplifier from turning off during the short pauses between words.

The remote alarm sites are generally connected back to the control console at the activation point by landlines but suitable radio equipment can also be used for this purpose. Most remote amplifier types can be tone tested (using a test oscillator built into each amplifier) during periodic maintenance visits. Some landline connected systems can monitor certain operating conditions at remote amplifiers such as battery condition and, of course, landline continuity.

The two public action signals are initiated at the control console by electronic tone generating circuits, disc recordings, or tape recordings. Most consoles include facilities for sending a test tone to all loudspeakers in the system by momentarily depressing a push button switch.

C. Control Circuits

In small towns where the attack warning system consists of a single outdoor sound producer, a simple switch is used to manually time the sound output of the siren or horn to generate the public action signals. However, in larger towns and cities, the situation becomes somewhat involved because many more sound producers must be used to cover the area. Also the controlling signals must be sent appreciable distances to link each alarm device to a central control point or to subcontrol points.

Landlines are commonly used in all sizes of systems from the smallest to the largest. The features included in landline circuits vary almost as widely as the size of the systems in which they are used. A landline circuit can consist of a simple direct line pair. Other features available are 1) circuits at the telephone office which constantly monitor the line pairs for abnormal conditions, such as opens, shorts, or foreign battery; and 2) use of a special telephone type dial at the control point(s) to select either of the two public action signals and the necessary timing circuits for the "Take Cover" signal. Full control of which signal is to be sent, when it is started, and when it is to stop is possessed by the control point operator.

Control of sirens and horns by use of the special telephone type dial is a part of the features of the Bell and Lights Warning System developed for use in the Bell System. This same telephone dial also activates a number of indoor warning devices consisting of wall mounted boxes presenting a row of digits numbered one through four, one of which is illuminated to indicate the nature of the alert. A bell produces a commanding ring to attract attention to the fact that an alarm is being received. The code presently being used in Bell and Lights Systems operated in the state of Michigan, for example, is listed in Table I.

TABLE I

BELL AND LIGHTS WARNING SYSTEM SIGNALS

| Signal Number | Name | Meaning |
|---|---|---|
| 1 | Preliminary | 5 to 8 minute advance warning when time permits. |
| 2 | Attack Alert 1/ | Listen to radio. |
| 3 | Take Cover 1/ | Take cover at once. |
| 4 | a. Weather Alert<br>b. End Attack Warning<br>c. Test | Listen to radio or TV. |

1/ Also given on sirens

Radio equipment is sometimes used to link the alarm sites to the control point, especially in areas when the distances between points are appreciable. Certain counties in the western states offer good examples of the type of area coverage for which radio is useful. Some form of coding is used in these radio systems to avoid false alarms caused by noise, to permit use of the same radio frequency for the remote control of other devices, or for selectively calling individuals. The coding in some cases consists of a single audio tone sent to the receivers (operating continuously) where, if it is the correct tone, it is amplified to operate a relay that controls the siren or horn directly. Other systems use a sequence of two tones to select either of the two civil defense signals. Another system uses a telephone type dial to interrupt a constant audio tone as a series of digits (from two to six) are dialed in a certain sequence. This signal must then pass through a bandpass filter at the receiving end and be amplified to operate an electromechanical decoding device. This device closes separate circuits depending on which alert signal is to be sounded. Both of the last two coding techniques described require an automatic timing device at each alarm site to stop the siren or horn after either of the standard three minute alert signals have been completed, and to provide the 8 seconds on, 4 seconds off timing needed for the "Take Cover" warble signal. In these systems where automatic timing devices follow decoding circuits, the alert signals cannot be cancelled (unless special precautions are taken) once they are set in motion by noise signals or by inadvertantly dialing or pushing the "wrong number."

D. Present Testing Procedures

Outdoor attack warning systems of all types are tested by periodically sounding the standard "Alert" and "Take Cover" warning signals. The tests are pre-announced but are held at a time of day that once chosen is not varied in a given system. Although it is not the general rule, certain systems are tested on a weekday which varies from month to month. The time of day for the test varies from about 9:00 a.m. to late evening in some systems. The interval between tests varies considerably—as often as weekly and as seldom as annually.

The "Alert" signal test is quite thorough—it is not a simulated operation of a part of the system but is an actual sounding of an attack warning which occurs at customary time of day, week, or month. An inseparable part of this type of test program is the maintenance visits to the alarm sites. The interval between maintenance visits to a given site varies depending generally on the type of sound producer involved. Gasoline engine driven sirens are maintained weekly in systems where these units are found to perform reliably. From a mechanical standpoint, the convention, electrically driven siren needs to be greased at six month intervals for reliable operation. Due to the possibility of ice and snow damage, wildlife damage, or vandalism, these sites are generally visited monthly.

A typical example of this type testing program used along with an effective maintenance program is found in the Detroit warning system. The Bell and Lights System is used to control 19 Chrysler gasoline engine driven sirens, 8 Federal Thunderbolt electric sirens, and 123 indoor Bell and Light units. The indoor system is tested Monday through Friday at 11:55 a.m., and the sirens are tested on the first Saturday of each month at 1:00 p.m. During the siren tests a fireman stands by at each site to report on any possible malfunction.

Certain systems are tested in a manner that departs considerably from the typical procedure described in the preceding example. It is estimated that about ten per cent of the systems in the United States are tested using specialized techniques. In Washington, D.C., for example, 227 sirens of all types are controlled by Bell and Lights equipment which is separate from the Bell and Lights dialing equipment used to control the 182 indoor devices in the area. The 33 gasoline engine driven sirens are also provided with backup radio control equipment and standby, emergency, 110 V 60 cycle generators at each site. Thus, in event of a landline malfunction the sirens can be activated via a two-tone radio system. The landline and/or radio operated relay at each siren site is followed by a time delay relay circuit. The circuit permits a test signal to be sent through the system without activating the sound producer provided the signal remains on the landline or radio frequency for less than four seconds. An electrically operated counter connected in the time delay circuit registers whenever a test or actual alert signal is received from the control point.

The testing routine in Washington consists of the silent test of the control circuit each Wednesday at 9:00 a.m. and the full test of the "Alert" and "Take Cover" signals on the second Saturday of January, April, July, and October at 11:55 a.m. Because of an exceptionally thorough maintenance program here, very few malfunctions occur during the quarterly tests.

Another example of a specialized testing routine is found in the St. Louis, Missouri warning system. In this system the 127 electrically operated sirens are tested on the first Monday of each month at 11:00 a.m. by dialing 2 - 2 (wait six seconds) - Stop on the special dial used to activate the sirens and indoor devices in this Bell and Lights Warning System. The ringing voltage is on the siren landlines for six seconds and therefore permits the electric sirens to reach full sound output and then gradually slow to a stop. A designated resident in the vicinity of each siren fills out a post card provided by the local civil defense officials describing the operation of the siren in their area. The sirens are not tested in any other way except perhaps annually during Operation Alert.

The specialized testing routine used in New York City provides another example for study. New York City conducts a monthly test of the 734 electric sirens (2 HP to 40 HP) where the "Alert" and "Take Cover" signals are sounded. In addition to this test the sirens are "growled" by applying the control signal on the landlines for approximately one second at noon Monday through Friday. This test is inaudible for all practical purposes at street level and no attempt is made to monitor these tests. The reason for growling the sirens is to exercise the equipment, to break up any icing conditions, and to discourage birds from building nests in and around the sirens in the spring. The growl tests attribute to the very low percentage of malfunctions, 1.5 per cent average, from all causes including landline interruptions. This is especially exceptional considering that nearly all the sound producers in the system have been in service over ten years.

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## II. NON-ALERT TESTING CONCEPTS

### A. General Considerations

In the preceding section the present testing procedures used in some of the systems throughout the United States were described. It was pointed out that, except for a few specialized techniques in cities numbering no more than ten per cent of the total, the procedure of sounding the Alert and Take Cover public action signals at a time anticipated by the residents of an area, is now universally used. Using this test plan along with a diligent maintenance program many system officials report that all sound producers function perfectly test after test. In recent years attack warning authorities have become increasingly aware of the detrimental effects of this type of testing. Every time the sirens, horns or loudspeakers produce the public action signals or signals very similar to them for test purposes, those hearing the signals become more thoroughly conditioned to associate those sounds, regardless of the time of day or month they occur, with a mere test of the system.

The need for discontinuing this test plan has been documented. A recent study[2] of responses to unanticipated air raid warnings which were sounded in three large United States cities, one occurrence as recently as 1959, has resulted in finding that only about one-third of those that heard the sirens realized that an air raid alert was being sounded and took the appropriate action. In one of the cities, Washington, D.C., ten per cent of those interviewed stated flatly that they ignore all warning messages that have not previously been announced.

In the following sections two distinctly different concepts for testing warning systems will be described in detail. They are "Silent Testing," which is a test of the system up to the sound producers, and "Minimum Sound Testing" where all parts of the system are energized—including the sound producers as a slight test sound is emitted.

### B. Silent Testing

The concept of silent testing as applied to remotely controlled attack warning systems is not new. It consists of activating the system from the

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[2] Mack, R. W., & Baker, G. W., The Occasion Instant. The Structure of Social Responses to Unanticipated Air Raid Warnings. Disaster Study No. 15, Washington: National Academy of Sciences-National Research Council, 1961

ASTIA Report AD 269591

control point in the same manner as when initiating an actual alert, but due to the action of some intervening device which opens the circuit at a point prior to the terminals of the sound producer, the alarm remains silent.

The advantages of the silent testing concept are primarily the following:

- No sound when testing system—

  Since no sound whatsoever is produced by the alarm device, it is highly unlikely that anyone would assume an actual alarm is a test, provided that the alarm is never sounded in any way even for practice alerts.

- Frequency of tests unlimited—

  The test can be repeated as frequently as desired and thereby establish a very high degree of assurance that at least the system from the control point through the landline or radio link up to the intervening device is ready for use.

The disadvantages of silent testing are:

- Total system not tested—

  With everything in the system being tested except the warning device and its starting and controlling mechanisms, much more dependence must be placed on the maintenance program. Visits to equipment sites must be frequent and thorough. (Note however, that it is possible to test multiple-motor sirens, engine driven sirens, and loudspeaker systems without producing warning sounds.)

- Reliability of system affected by test equipment—

  The reliability of the warning system is reduced to a degree dependent upon the reliability of the intervening device used at each alarm location. The reliability factor of the device itself could be made less important if its mechanism is fail safe so that if it fails in any way, only the silent testing capability is lost and the ability of the sound producer to sound an actual alert is not affected.

- Test monitoring is complex task—

  To completely monitor the performance of that part of the warning system which is being tested using this concept, a mechanical and/or human data recorder must determine that if a test signal were sent it was received as a test and no sound was produced by the alarm. In addition they must record any response of the alarm device which occurred when actually no signal was sent.

- Not suitable for electronic warning systems—

  Silent testing does not appear to be suitable for electronic loudspeaker warning systems. Because of their ability to project a multitude of sounds as well as warning signals, loudspeaker systems can be tested much more efficiently using a distinctive test sound as discussed in Section II.C. Minimum Sound Testing.

A continuously operating chart recorder could be used to record any test signals or false alarms that were received. The time of occurrence, duration, and amplitude of the signals could be read from the chart during the maintenance visits. After the system is refined to the degree where no false signals are received and all test signals are properly received, the chart recorders can be replaced with simple electrically operated, resettable counters. These devices are readily available. A suitable example is one made by Durant Manufacturing of Milwaukee, Wisconsin, Model 4-Y-9434-B. This unit is pictured in Figure 3. It should be installed in a weather protected enclosure.

One method in which the intervening device and counter can be connected to instrument the silent testing concept is illustrated in Figure 4. The chart recorder could be connected across points A-A indefinitely or as long as necessary to fully evaluate silent testing as applied to a particular system or part of system.

The particular intervening device suggested in the circuit in Figure 4 is a time delay relay. This device functions to prevent any momentary signals up to four seconds duration from starting the sound producer. A silent test signal therefore must be shorter than four seconds, preferably about one second, to insure against false sounding of the alarm. The time delay relay or any intervening device must not disturb the normal functions of the alarm starting and controlling circuits required to actually sound either of the public warning signals. Table II describes the three coded signals which must be considered.

An example of a time delay relay suitable for use in the circuit in Figure 4 is one manufactured by the Elastic Stop Nut Corporation of America in Elizabeth, New Jersey, Model NED-11. This particular unit provides the

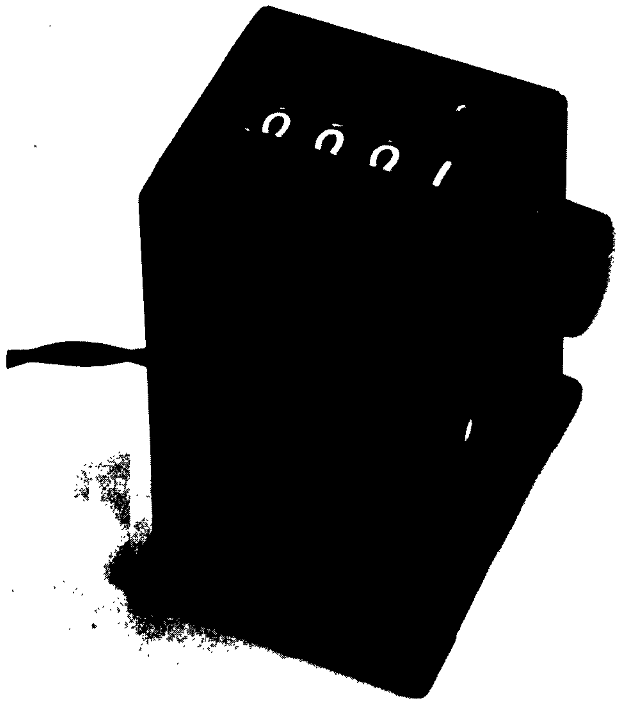


Figure 3 - Representation of electrically operated, resettable counter suitable for monitoring non-alert tests. Pictured here in actual size.

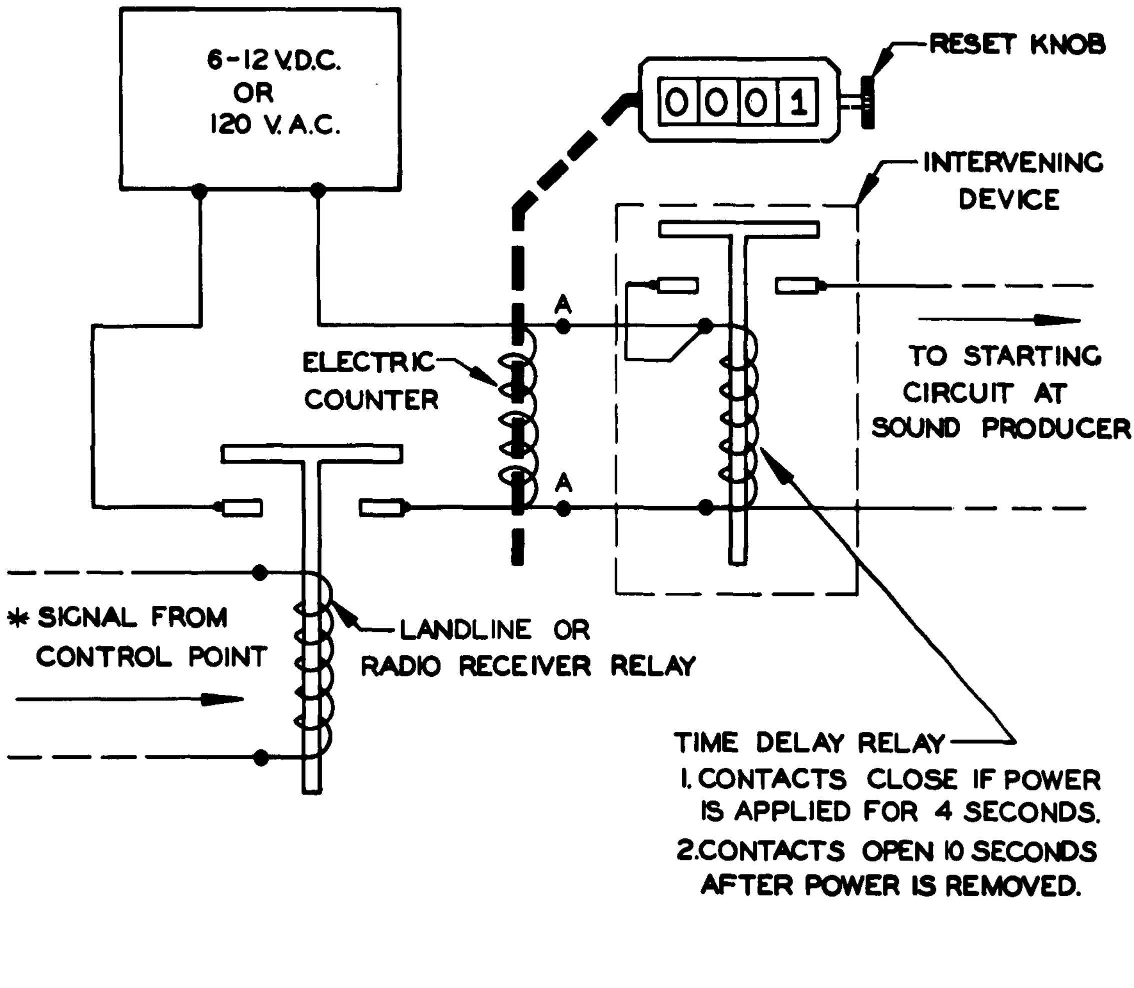



Figure 4 - Example of the type of circuit needed at all alarm sites in order to "silent test" outdoor warning systems

"make" time delay needed to permit counting the short test pulses and the "break" time delay needed to hold the circuit during the four second off periods in the warble signal. The two time delay functions could be provided by two separate time delay relays connected as shown in Figure 5 (the points A-A in this figure refer to the circuit points A-A in Figure 4). The most important factor in the selection of any of these devices is their reliability, since they must function properly when the siren or horn is to sound an actual alert.

TABLE II

CIVIL DEFENSE WARNING SIGNALS

| Signal | Description | Timing |
|---|---|---|
| Alert | Steady Sound | 3 to 5 minutes |
| Take Cover | Warble Sound | 8 sec. on, 4 sec. off - 3 min. |
| Silent Test | No Sound | One short pulse 1/ |

1/ Approximately 1 second duration

Another possibility for an intervening device is a time clock located at each alarm site in the system which would be set to disable all sound producers for a ten minute period each day. During this period the full three minute Alert signal can be transmitted from the control point with the knowledge that no sound whatsoever will be produced. It is essential that in the event the clock power is interrupted even momentarily that the sound producer is again disabled and a battery operated bell at the site sounds so that the failure is reported promptly. An authorized person must then reset the clock to the correct time. The clock at the control point must, of course, be correct and similarly fail safe. Care must be taken to avoid having the same ten minute test period used in one city also being used in other cities. This will be avoided if random times not on the hour or half-hour are chosen for testing.

The time clock method has the advantage, over the time delay method, of having the system ready for instant use without even the four second delay and of not requiring the intervening device to perform any action when an actual alert is to be sounded. The hazard that a time clock might be inaccurate for reasons other than a power interruption can be reduced by using a test signal much shorter than three minutes. Then, if a particular alarm is not disabled during the system test period, only a short siren growl or horn blast, both easily distinguished from an actual alert signal, would be produced.

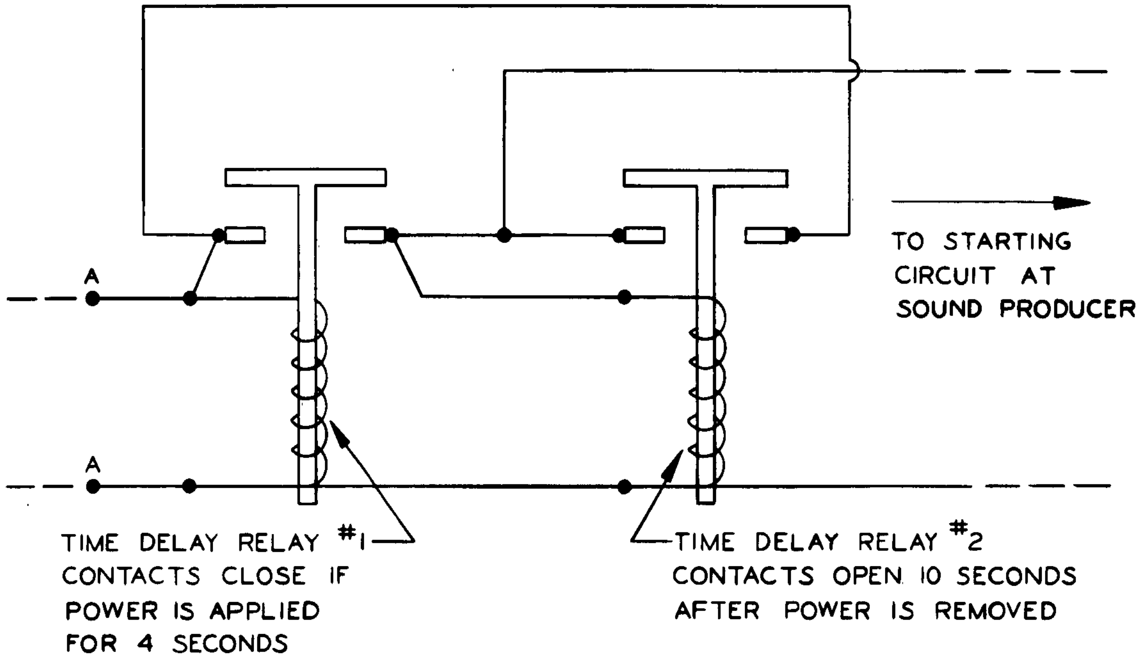



Figure 5 - Sketch showing how two separate time delay relays can be used in place of one double head unit

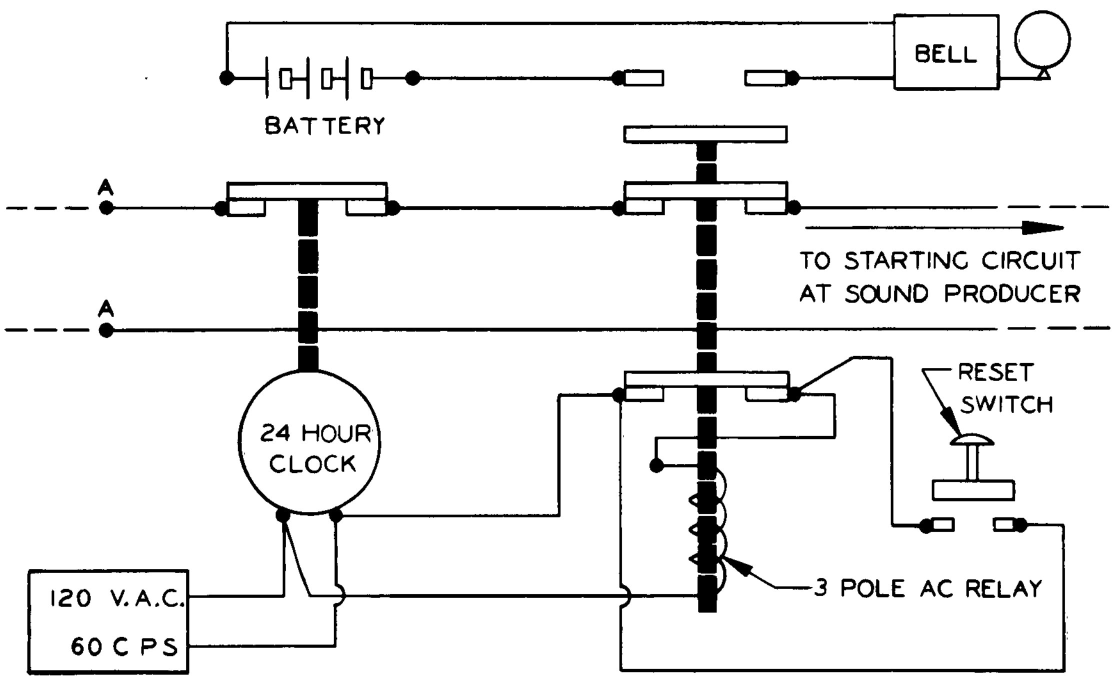



Figure 6 - Circuit showing the use of a time switch and AC relay as the intervening device

A circuit that could be used for silent testing with a time clock as the intervening device, is shown in Figure 6. The reset switch is needed to silence the bell and restore the circuit after the clock power has returned and the clock has been set to the correct time. An example of a suitable time clock is one manufactured by Zenith Electric Company of Chicago, Illinois, Catalog #P5-24.

The A.C. relay could be any one of many suitable for continuous duty such as one made by the Allen -Bradley Company of Milwaukee, Wisconsin, Bulletin 700, Type B-210.

C. Minimum Sound Testing

Completely silent testing as described in Section II.B is the ultimate method for eliminating, as quickly as possible, the confusion between the sound of a test and that of an actual alert signal. On the other hand, successful silent testing is largely dependent upon a very thorough maintenance program and a highly reliable intervening device. The concept of actually energizing the alarm device and permitting the generation of a limited amount of sound is immediately recognized as a compromise test procedure. Using this testing concept which results in the production of limited sound means that those in the immediate vicinity of the alarm device who hear the test might conceivably confuse it with an actual alert signal which ended abruptly due to some malfunction. This possibility will be found to be remote if the tests are actuated in the manner suggested herein. The important factors in this determination are primarily the amplitude, duration, and general similarity of the test signal to the sound of an actual alert signal.

1. General description of procedures required: The minimum sound concept consists of actuating the warning system from the control point(s) in the same manner as for the "Alert" signal, for instance, but due to a canceling action at the sending end, the sound producers stop well before they have reached their peak output or as in the case of horns or loudspeakers the duration of sound is very short. Using a test pulse of approximately one second it can be shown that the test sound is subliminal for the vast majority of those in the coverage area of a given sound producer.

A possibility for further investigation is the use of a transducer operated preferably by the sound of the alarm device. This transducer closes a switch directly and operates a counting device similar to the type shown in Figure 3. The device can be made insensitive to other loud sounds such as jet planes by wiring it to operate from the same power utilized by the starting circuit of the sound producer. In this way the recorder would false count only if the loud sound occurred coincident with the one second test signal.

The type of recording device used here is passive and provides no immediate notification of a malfunction. However, this is where the minimum sound concept has one distinct advantage. The test sound is sufficiently loud (assuming that the observer is in the immediate vicinity of the alarm site) and distinguishable from any other sound so that if the customary sound is not emitted during the normal test period or if "that" sound occurs at a time different from the usual time, the event is noticed and reported to the local civil defense authorities without delay. The counter readings at the alarm sites would be obtained during the regular maintenance visits and all readings would be compared with the known number of tests sent.

The advantages of the minimum sound concept are primarily the following:

° The total system is tested—

The entire system is tested in a manner which in nearly all cases is identical to that used for activating an actual alert. No intervening device in the circuit means that the system is ready for actual use at any time without any delay whatsoever.

° Equipment modifications are minor—

The modifications required to instrument minimum sound testing are minor. All control systems and all sound producers except one type of gasoline engine driven siren not in common use lend themselves to this testing concept with little or no equipment changes other than the addition of a counting device at each alarm site.

° Daily tests are feasible—

If the interval between tests can be very short, as it would be if tests were conducted daily, a malfunction in any part of the system could be reported by the designated observer within the day that it occurred. By comparison, silent testing allows a particular alarm device or group of devices to be inoperative until the counters are read during the maintenance visits. (The interval between these visits to electric siren sites vary, depending mostly on the environmental conditions in an area, from one month to as long as six months.)

- All equipment is "exercised" during test—

  One of the important advantages of this testing concept is that each test results in the "exercising" of all the moving and rotating parts and the "energizing" of all electrical components in a system. The test sound serves the very practical purpose of discouraging birds or other animals from building nests in the rotating parts of any siren or in the sound oriface of any siren, horn, or loudspeaker as they do when the equipment is dormant for weeks or months at a time. Many areas of the country report a seasonal problem, to varying degrees, with the sound producer becoming attenuated or disabled due to a buildup of ice and snow. This problem would be alleviated by the daily exercising afforded by the tests. The gasoline engine driven siren is a device which cannot be expected to start and run properly if it is not exercised for 30 minutes to an hour weekly or every other week depending on location and season of the year. Additional daily exercising where the device is run about one minute is expected to be highly beneficial for this type of equipment and may be instrumental in improving the degree of readiness, now somewhat lacking, of this type of sound producer.

The disadvantages of minimum sound testing are:

- Some sound when testing system—

  This concept results in the production of a distinctive test sound which is limited in duration and, for sirens, in amplitude also. When use of this test procedure is to be started in an existing system, advance information should be given to the public as to the characteristics of the test sounds that those near the alarm sites might hear.

- Dependence on humans for failure reporting—

  The failure reporting task is dependent upon private citizens acting as observers and conscientiously performing their assignment not only at the beginning of the new testing program but years after it is instituted as well. However, as counter readings are routinely compared using this concept, the effectiveness of the failure reporting procedure is being monitored at the same time that system reliability data is being accumulated.

If, as the program continues, the diligence of the observers is questionable a daily test could be omitted purposely to permit an evaluation of particular observers. Arriving at a diligent observer group may require months of testing wherein individuals and alternates originally selected are replaced.

2. Adaptability to landline control circuits: Adapting existing warning systems to provide for the generation, transmission, and reception of the one second pulse required for minimum sound testing will be relatively simple in most cases.

The usual landline control circuit consisting of leased line pairs connecting the control point to a bank of relays at a telephone office, and of additional line pairs conducting ringing voltage to a telephone type relay at each alarm site can be used to generate the one second signal pulse with the aid of a stopwatch. Systems using a simple spring loaded toggle switch or a momentary push button switch for generating the warning signals can easily produce the one second pulse. Other systems using automatic timers designed for air raid signal control have a push button switch which closes the alarm circuit as long as it is pressed. This, again with the aid of a stopwatch, would be convenient for generating the one second pulse. Any custom designed timer without a push button switch for manual operation could be modified by connecting one in parallel with the cam operated switches used for generating the "Alert" and "Take Cover" signals.

Many cities use the Bell and Lights warning system for indoor warning and some of these also control their outdoor warning devices using the same equipment. Where this is the case, the system can be used without modification to generate a one second pulse of ringing voltage for the relay at each site by dialing 2 - 2 - Stop in normal dialing sequence. This technique is identical to that employed in the Washington, D.C. system, also the results are identical except that, in the usual Bell and Lights system, the indoor devices will emit a momentary ring and momentary flicker of the numeral 2 when the one second pulse of ringing voltage is sent to the outdoor alarms. (The indoor devices do not also operate when 2 - 2 - Stop is dialed on the Washington, D.C. landline equipment is obvious because, as noted earlier, the siren control equipment is a completely separate and independent system from the indoor device control equipment.)

A test was conducted on a conventional Bell & Lights system to assure that the equipment would respond properly to this dialing technique. The specific information desired was 1) the time response characteristics of the Bell & Lights indoor device; 2) the average length of the ringing voltage pulse resulting when different individuals dial the test signal; and 3) the minimum pulse length obtainable when the dial is forced. The test was conducted and instrumented as outlined in the schematic of Figure 7 and the results of the test are listed in Table III. The fact that the indoor device responded as noted in this test may require that tests of the indoor and outdoor devices be conducted at the same time to preserve the effectiveness of the indoor warning.

TABLE III

RESULTS OF TEST OF BELL & LIGHTS SYSTEM

TO DETERMINE CAPABILITY OF GENERATING A ONE SECOND PULSE

| Dialing Rate | Digits Dialed | Person Dialing | Measured Pulse (seconds) | | Indoor Device Response Bell | Light |
|---|---|---|---|---|---|---|
| Normal | 2-2-Stop | x | 1.12 | 1.1 second average | Ring 1/ | Flicker 1/ |
| Normal | 2-2-Stop | y | 1.15 | | Ring 1/ | Flicker 1/ |
| Normal | 2-2-Stop | z | 1.02 | | Ring 2/ | Flicker 2/ |
| Forced | 2-2-Stop | x | 0.68 | 0.65 second average | None | None |
| Forced | 2-2-Stop | z | 0.62 | | None | None |

1/ Approximate duration: 1/3 second
2/ Approximate duration: 1/4 second

When 2 - 2 - Stop is dialed in this fashion all elements of the system vital to the production of the "Alert" signal are energized and exercised. A single group of relays used for generating the eight seconds on, four seconds off timing essential for the producing the warble in the "Take Cover" signal is not energized in this test procedure. This equipment too could be tested by dialing on alternate days 3 - 3 (wait three seconds) - Stop. The pause is required to compensate for a time delay that occurs in the timing relays before the ringing voltage first appears at the output. A stopwatch should be used to control the three second period with sufficient accuracy.

3. Adaptability to electronic warning systems: Loudspeaker control systems, using either a tone generator or recordings to develop the low level siren sound signal for transmission via landlines to amplifier-loudspeaker combinations at the alarm sites, are readily adaptable to the minimum sound testing concept. Where the remote amplifiers are not operated continuously, they can be turned on by preceding the test pulse with a one second turn-on pulse. The two pulses should be separated by about three seconds. Systems using a tone generator would require that the circuit be capable of being placed in a test mode where, with the circuit producing a steady midband frequency

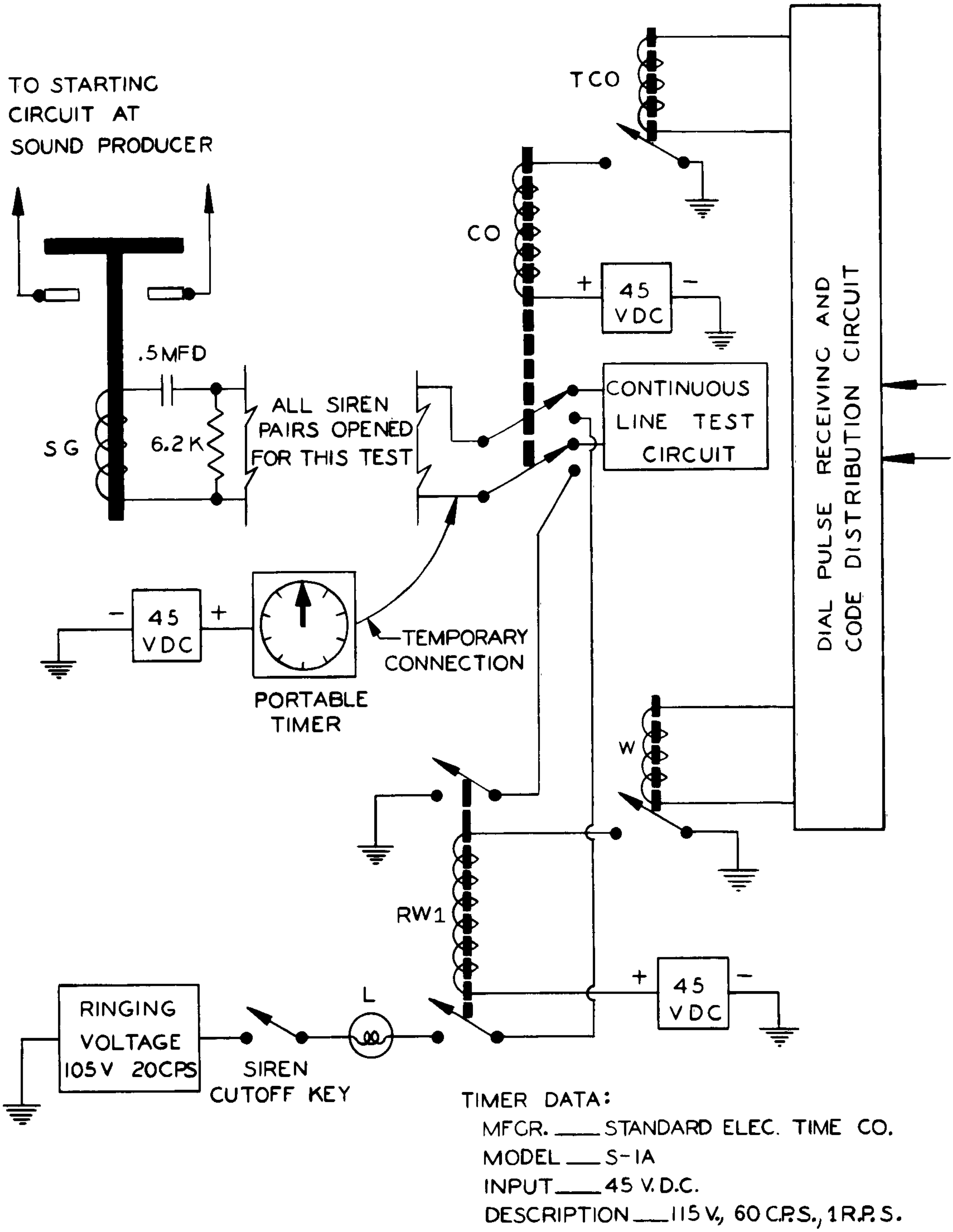



Figure 7 - Sketch of circuit used to obtain timing data for using bell and lights dialing equipment with the minimum sound testing concept

as for the "Alert" signal, the signal appears at the output connector only when a push button is depressed. The button should be held in as long as found necessary by experiment, to produce a one second burst from each loudspeaker.

Systems using a disc or tape recording of the siren signals would utilize an additional disc or tape which would have one second long pulses of a midband frequency such as 600 or 1000 cycles per second spaced at liberal intervals to avoid the possibility of sending more than one pulse during a given test. The test recording itself must of course be clearly designated as such to avoid confusing it with the recordings of the public action signals.

4. Adaptability to radio controlled systems: Certain radio control systems which utilize push button selected tone or perhaps two tones in the proper sequence to activate the "Alert," "Take Cover" or "Cancel" functions on an automatic timer may be capable of energizing the sound producers for periods as short as one second. Other radio control systems using a telephone dial may be capable of cancelling an "Alert" signal but the appreciable time required for the operator to dial the "Stop" code of three or four digits and for the decoding circuits to function might cause the sound producers to be activated for as long as five seconds. Some radio control systems which use a telephone type dial at the control point and an automatic timer at each alarm site are incapable of stopping an "Alert" or "Take Cover" signal once one is started. Therefore, those who do use radio control systems will have to determine if their particular equipment is capable of starting an "Alert" signal and then stopping it soon enough so that the alarm devices are energized for only one second.

5. Application to various types of outdoor sound producers: The various outdoor sound producing devices approved for use in civil defense warning systems differ to such an extent that they were considered separately to determine how each will respond to a one second long control pulse. The particular type of device used in most systems is the conventional 5 HP, 7.5 HP, and 10 HP electrically driven non-directional siren. It was desirable to determine in detail the response of one of these commonly used devices to a minimum sound test signal of one second as well as for time values both shorter and longer than this to determine the consequences of inaccurate timing. A test of a 5 HP siren[3] of this type was conducted and instrumented as shown in the schematic of Figure 8. It is desirable to minimize the number of people that hear the "growl" produced by this type siren when it is tested. Figure 9 illustrates how the percentage of coverage changes as the length of the test signal is varied for the particular siren tested. It can be seen that the test pulse duration should be held in the range of 1.0 to 1.4 seconds to restrict the penetration of the "growl"

[3] Federal Sign & Signal Co. Type 50C, 440V 60 CPS, 3 Phase

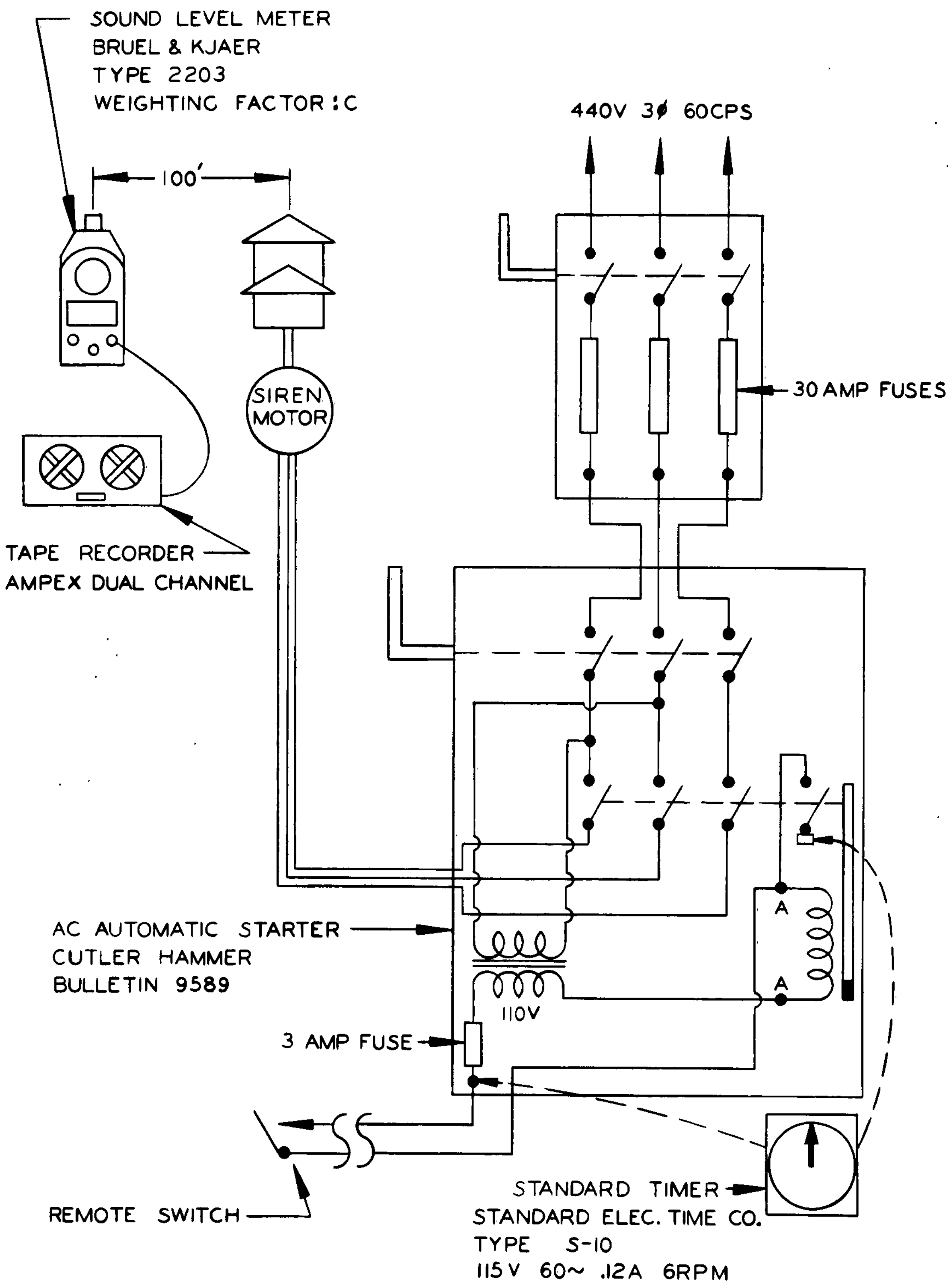



Figure 8 - Schematic showing how test equipment was utilized for growl sound measurements

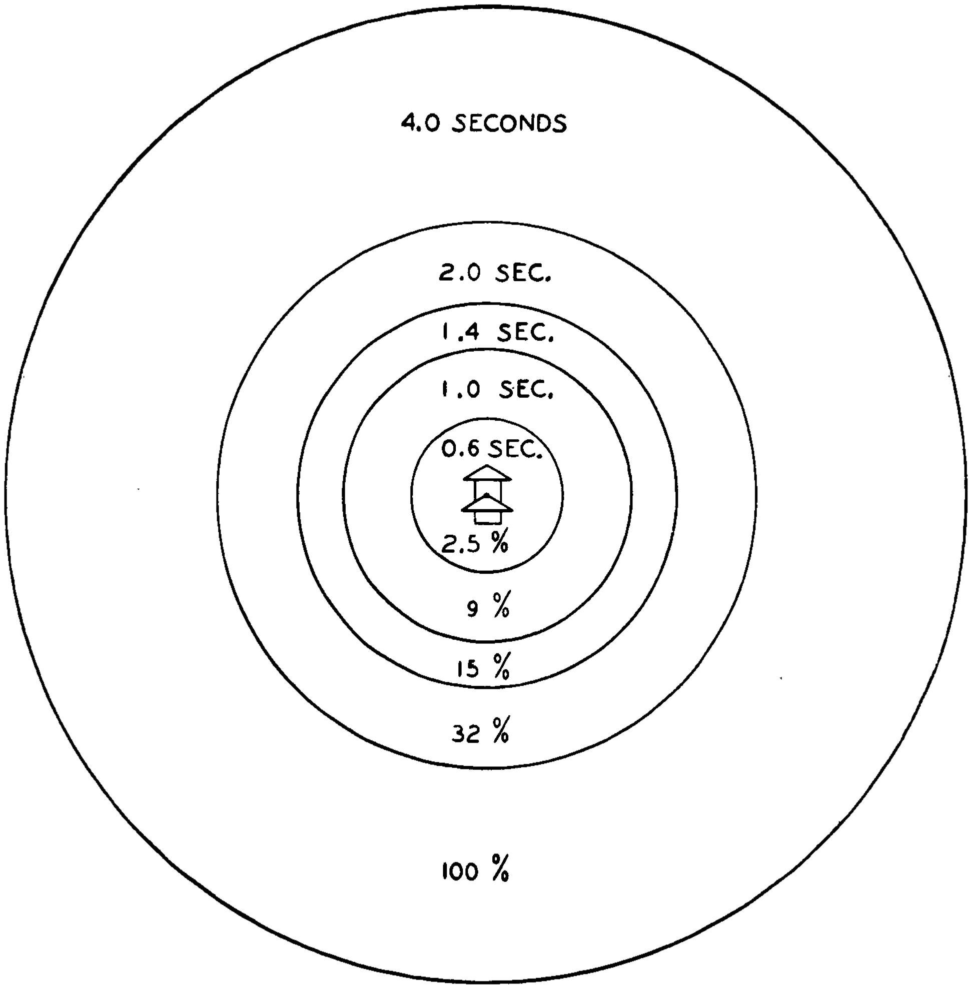



Figure 9 - Percent of area covered by a conventional electric siren when power is applied for short durations

sound to approximately 10 and 15 per cent respectively of full coverage. Figure 10 presents the actual amplitude and frequency vs. time data that was recorded in this test.

The resetable counting device should be connected between points A-A shown in Figure 8 for this type siren. Using this connection, if the main siren power is not on at the time of the test, the counter will not operate thereby indicating that the siren was inoperative.

The only electrically operated siren which differs appreciably from the conventional type is the Federal "Thunderbolt" Model 1000. The growl sound characteristics with a one second signal applied should not differ greatly from that of a conventional siren. The length of time that the amplitude remains high after the end of the one second pulse will be longer than for a conventional siren but at the same time the frequency is continuously falling.

The average response of the human ear falls off markedly for frequencies below 100 cps. In any event a truly distinctive test growl is produced which is not likely to be confused with a public action signal. The counting device should be connected to the Thunderbolt control circuit as shown in Figure 11.

The gasoline engine driven sirens can be separated into two categories for the purpose of this analysis. The Chrysler and the Biersach & Niedermeyer sirens are similar in that a momentary closure of the landline or radio relay activates holding relays which permit the starter motor to crank the engine until it idles or until the cranking time limit of 40 seconds and 15 seconds respectively is exceeded depending upon which occurs first. In addition neither of these engines will accelerate unless the landline relay is still closed when the 10 to 15 second engine warm-up period has elapsed. The concept of testing where the landline relay is only closed for one second merely causes these engines to crank, idle for a short period (less than one minute), and then automatically shut off. During the idling period, a steady low frequency sound is produced at a level that is 20 to 30 decibels below the rated output. A 6 or 12 volt D.C. resettable counter can be connected across the output of the generator on the engine and thereby indicate whether or not idling speed is attained during each test. The counter will not operate if the engine merely cranks but does not idle.

The gasoline engine driven siren manufactured by the Federal Sign and Signal Company differs from those in the preceding description in that it can produce siren sound only if, after the engine driving the blower starts, the telephone relay remains closed to operate the battery powered chopper motor. When the landline relay closes for merely one second in a test, a counter

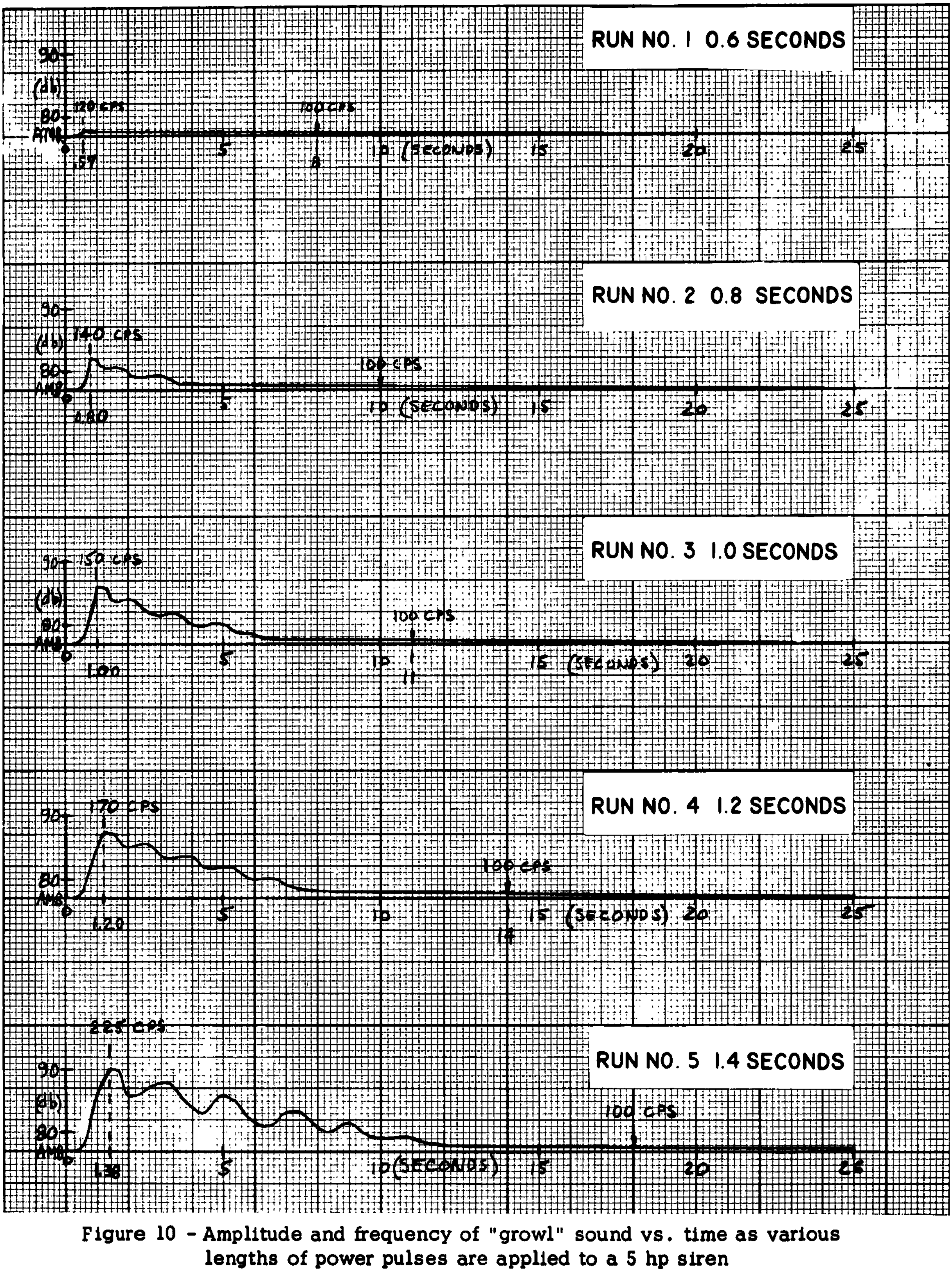



Figure 10 - Amplitude and frequency of "growl" sound vs. time as various lengths of power pulses are applied to a 5 hp siren

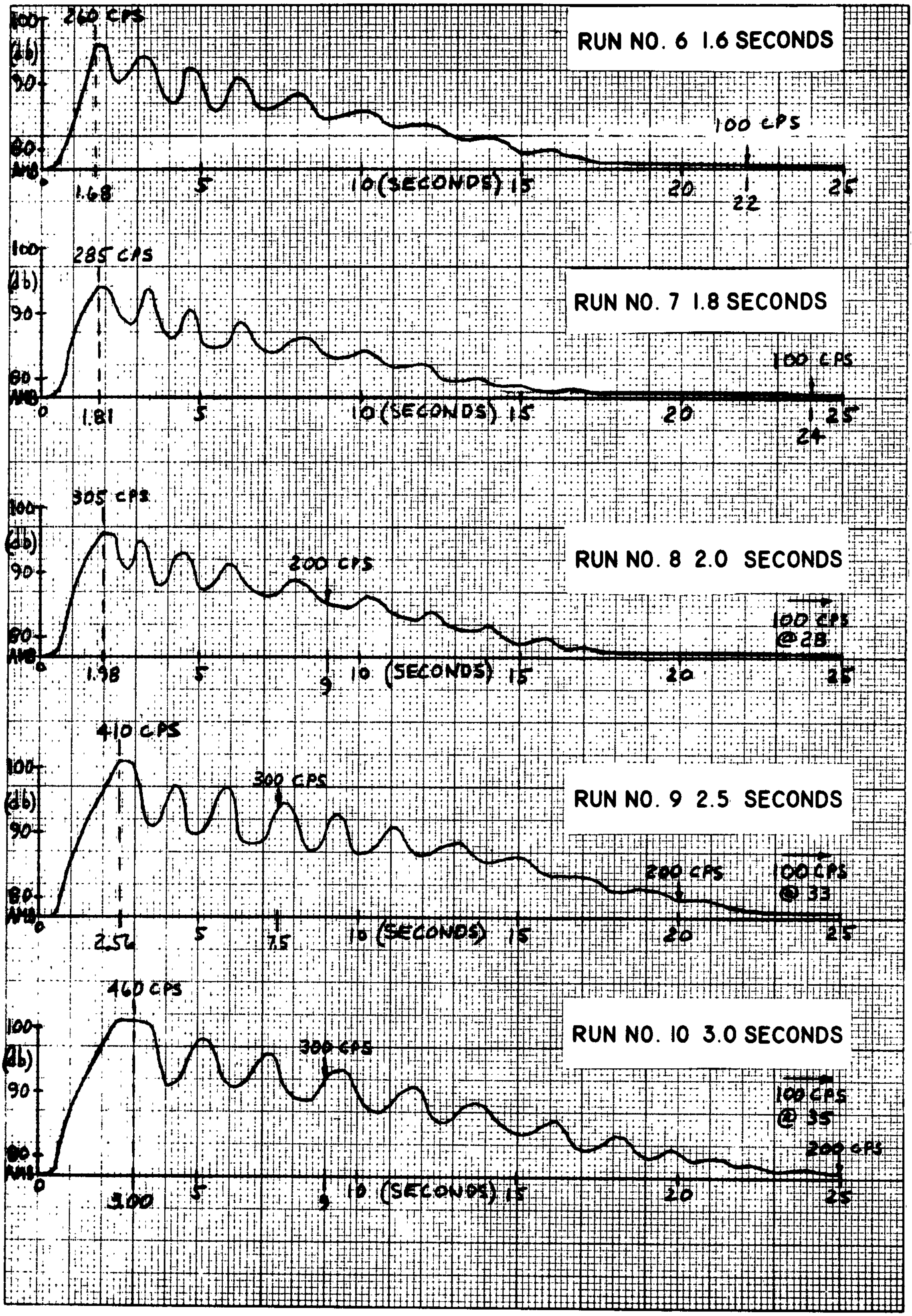



Figure 10 - Sheet 2

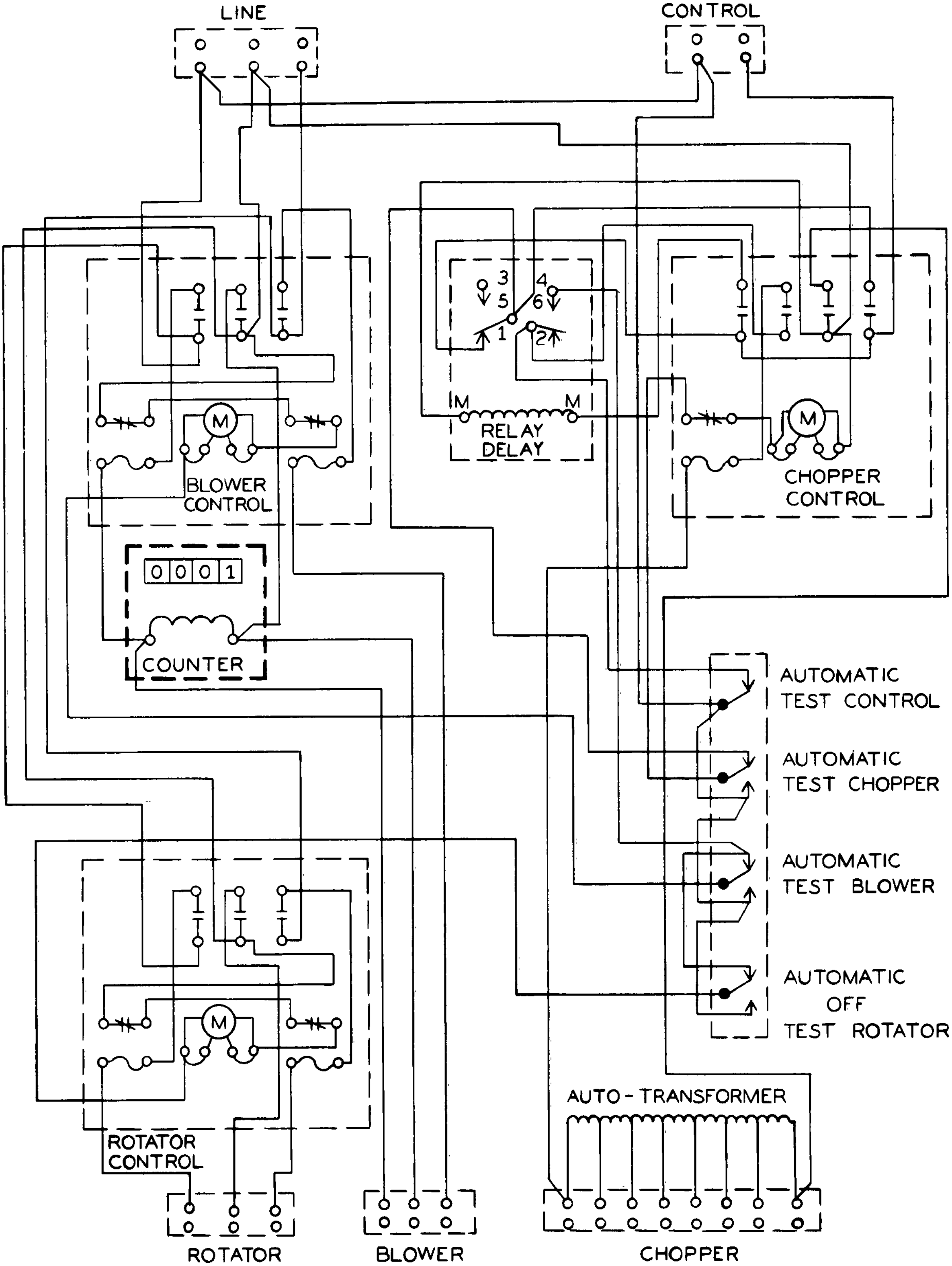



Figure 11 - Control panel circuit for Federal Model 1000 (Thunderbolt) siren. A counter is shown connected as required for non-alert tests.

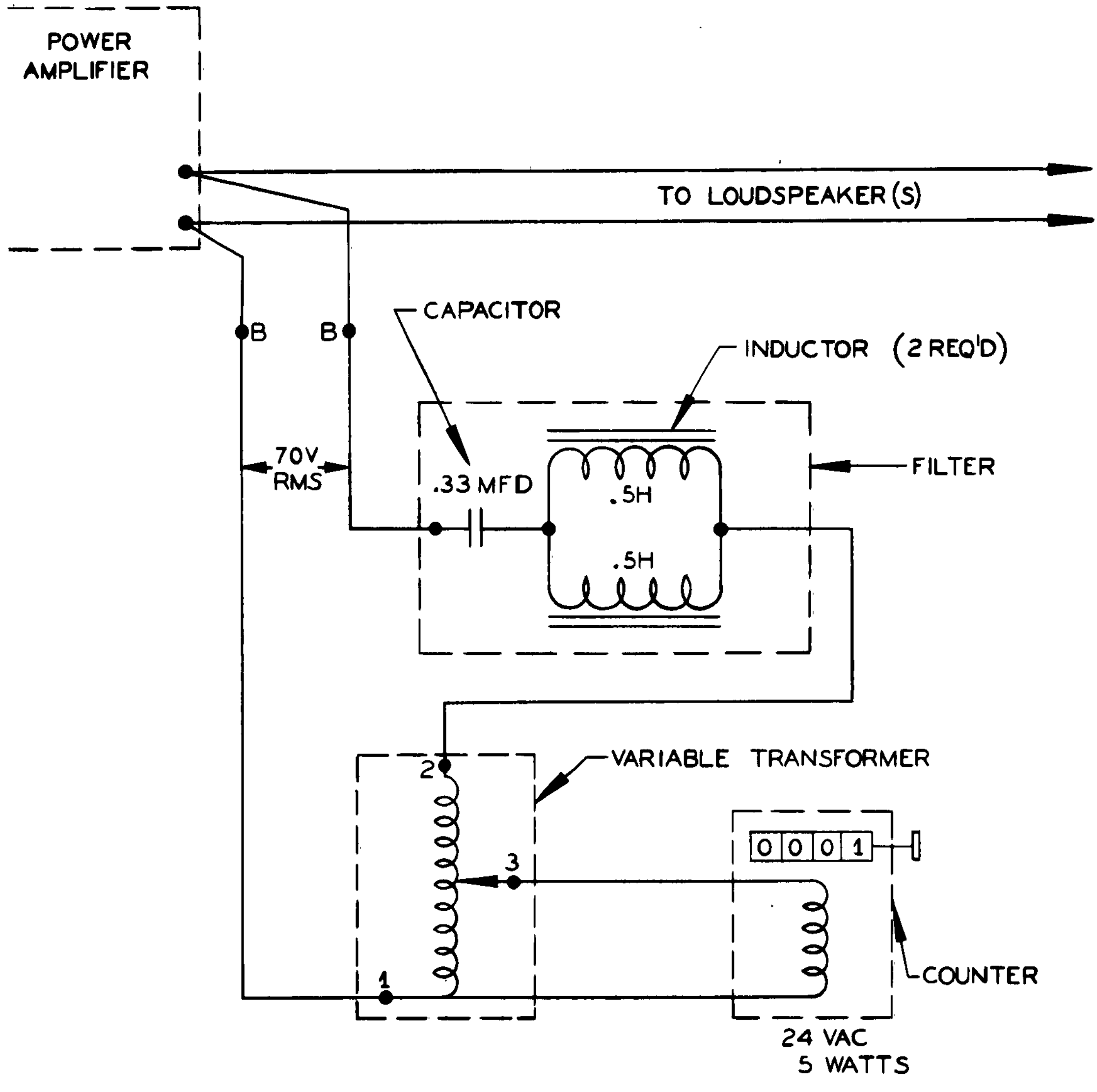
connected across the generator would record whether or not the engine succeeded in starting and accelerating at least to idling speed. No sound except that of the cranking and running engine would be produced. Without a test sound, the failure reporting procedure could not be used. Users of this type of siren will find that the engine sounds are loud enough to be reliably heard by a trained observer.

Sirens powered by steam or compressed air are triggered when the landline or radio controlled relay applies power to a solenoid valve in the main line to the sound producer. This type of siren would be expected when tested to emit a growl with essentially the same sound characteristics as described for the conventional electrically driven siren. A counter operated when both the solenoid valve and a pressure switch, located in the line between the valve and the siren, are closed would thereby indicate that the valve operated successfully and that adequate pressure was in the supply.

Horns powered by electricity or compressed air should be monitored with a counter connected in the same way respectively as for sirens powered by electricity or compressed air. The sound produced by a horn when tested differs from that of a siren primarily in that it is a full amplitude burst of sound lasting about one second whereas the conventional siren growl does not reach full amplitude but lasts for many seconds.

Loudspeakers used in outdoor warning applications are generally directly coupled to a driver transformer which serves the purpose of transforming the low impedance of the loudspeaker itself up to a higher impedance which is easier to couple to an amplifier that may be many feet away. An electrically operated counting device with appropriate voltage rating can be connected directly across the output line of each amplifier provided that the system is used only for broadcasting siren sound signals. If a loudspeaker system is also used for broadcasting voice or music, a counter so connected would count erratically during these messages. This counter, then, in order to have the ability to discriminate between a mid-band test tone and voice or music would have to be preceded by a simple filter tuned to pass only the test tone.

The circuit shown schematically in Figure 12 indicates the appropriate values of the test tone filter and other parts need to assure that the counter will not operate during voice or music transmissions. The variable transformer is used to adjust the voltage across the counter to 24 V (R.M.S.) when a full amplitude test tone is delivered to the loudspeakers. In most systems more than one loudspeaker is driven by a power amplifier. In these cases it would be redundant to connect counter circuits across more than one of the loudspeakers. The normal installation will therefore consist of one counter circuit per alarm site provided there is only one amplifier in use at the site.




PARTS LIST (OR EQUIVALENT)

CAPACITOR, .33 MFD. ± 5%, 500 VDC
SPRAGUE #145P 753

INDUCTOR, .5H. ± 1%, Q OF 80 MINIMUM (600 CPS)
UNITED TRANSFORMER CO. #MQB-5

VARIABLE TRANSFORMER, SUPERIOR ELECTRIC CO. #10B

COUNTER, 24V 600 CPS, 5WATTS, PANEL MOUNTED, RESETTABLE.
DURANT MFG. CO. #4-Y-11488

Figure 12 - Loudspeaker system - Test monitoring circuit

The filter specified in Figure 12 is designed to prevent signals other than a full amplitude one second tone in the range of approximately 400 to 800 cycles per second from operating the counter. Voice and music messages would produce short tone pulses of lower amplitude dispersed over the typical system bandwidth of 100 to 3000 cycles per second. This monitoring circuit will consume approximately five watts when the siren sound is being broadcasted. This loading should not be noticeable during a voice message even when an amplifier as small as 50 watts is used.

Amplifiers with output voltages lower than the standard 70.7 V RMS will require the use of a step up transformer inserted in the monitoring circuit at points B-B. A suitable matching transformer for this application is one manufactured by United Transformer Corporation of New York, N.Y., Catalog #LS-33. This unit has many primary and secondary windings which permit the selection of the proper turns ratio needed to deliver 70 V RMS to the monitor circuit. The proper transformer connections can be determined by test or by use of the following formula:

$$(70.7 \text{ volts} \div \text{output voltage of amplifier})^2 = \frac{\text{Secondary Impedance}}{\text{Primary Impedance}}$$

For example, consider an amplifier which delivers 26 volts to the loudspeaker at full output. Then $(70.7 \div 26)^2$ equals 7.2 and, referring to the connection diagram printed on the side of the LS-33 transformer use of the secondary winding of 333 ohms and the primary winding of 50 ohms yields a ratio of 6.7 which is sufficiently close to 7.2.

In this section, the possible techniques which could be used to conduct minimum sound testing in various existing systems and the adaptability of specific equipment to this concept have been discussed. In the sections to follow certain factors are analyzed which should be considered when establishing non-alert testing procedures.

## III. CLOSED LOOP SYSTEM TESTING

It is possible to "close the loop" in a test of a warning system so that when the one second pulse is sent from the control point, counting devices at the control point indicate within seconds the success or failure of all sound producers. Automatic feedback of test results in this manner would eliminate the need for a test sound since observers would not be used. It would still remain desirable to energize and exercise all equipment, however, and this cannot be done on any alarm device without producing some sound.

Basically, the technique to be followed would be to transmit back to the control point the same information obtained by the counting device at the alarm sites. If the same landlines or radio frequency that is used to transmit the test signal to the alarm sites can be used to send the results back, feedback will be accomplished more economically. No technical problems should be encountered in doing this in the landline controlled systems where path isolation is inherently provided, but the drawback is that the feedback data is received at the telephone office instead of at the control point. It is unlikely that the telephone company would be interested in assuming the responsibility for monitoring the test results and reporting any failures to the local civil defense officials. In some radio controlled systems where each alarm device can be triggered individually by transmitting its corresponding audio tones, the test sound itself could be monitored at the control point via two way radio. This feedback system could be expensive but should accomplish the desired function adequately. In other radio systems where the sound devices cannot be triggered individually, feedback via radio is impractical unless all alarm site transmitters operate on different carrier frequencies thereby permitting simultaneous transmission of the test results to separate receivers tuned to receive the transmissions.

Providing for automatic feedback of test results would be difficult to justify considering the increased original cost plus the recurring expense for maintaining the extra equipment. The amount of data arriving at the control point in a large system consisting of a hundred or more alarm sites would be sufficient to warrant using memory circuits or recording devices to permit analysis of the data to be accomplished at the conclusion of the test. This situation approaches that of a similar ailment common to some complex systems called "indigestion of information." The system designers have been so eager to provide sufficient data inputs to permit high accuracy decisions to be made that the computer becomes bogged down and no decision at all is forthcoming. It becomes absolutely needless to be informed within moments after a test, for instance, that X number of failures occurred unless there is a sufficiently large maintenance crew waiting to investigate each and make the repairs. In view of this, the use of closed loop techniques is not recommended,

## IV. INTERVAL BETWEEN NON-ALERT TESTS

The frequency of tests designed for use with either the silent or minimum sound concepts discussed herein should be determined only by the minimum repetition rate deemed necessary to establish a high degree of assurance that the entire system would be capable of sounding an attack warning at any desired instant. The testing rate must not be permitted to be limited by any public annoyance or equipment wear-out factor, for example. Steps must be taken to eliminate the causes of these problems if, in truth, they exist. It is inconceivable that any complex system involving multiple, remotely controlled devices for producing intense sound atop tall buildings or towers would be considered in readiness as the result of tests performed as seldom as once per month.

The time of day chosen for the test is completely immaterial for silent testing but the minimum sound concept may require an hour between 8:00 a.m. and 5:00 p.m. if, for instance, a siren is located in an area consisting only of business offices in one of which the siren's observer is employed. A test period coinciding with the observer's work starting or stopping time is undesirable as it may not receive his full attention. Due to individuals traveling from city to city it would be desirable to have the test sound heard at the same local time in each city. This is definitely not a requirement because with the test sound being of minimum amplitude and/or duration it would be distinguishable from ambient levels by only a small percentage of those persons within the coverage area of a particular warning system.

## V. A RECOMMENDED APPROACH TO NON-ALERT TESTING

A non-alert testing plan designed to gain general acceptance throughout the United States must have two principal characteristics. It must test the complete system without reducing the reliability of the alerting function, and it must be simple to initiate and administer once in operation.

The general specifications of a plan which best meets these requirements are summarized as follows.

Time of Test ............ 11:55 a.m. local time

Day of Test ............ daily except Sunday

Description of Test .... The control circuit is to be activated for approximately one second. Sirens driven by electric motors, compressed air, and steam would produce a "growl" sound during the test. The gasoline engine driven sirens would produce a constant low frequency, low amplitude sound for a period of time of 15 seconds for the Biersach & Niedermeyer siren and 45 seconds for the Chrysler siren. Horns and loudspeaker units would emit a burst of sound lasting one second.

Evaluation of Test Results .... Using this procedure, a distinctive test sound is heard by those near the sound producers at a particular time each day. Coverage of the test sound is estimated at 15 per cent of that for full sound output. Responsible individuals who live or work in the vicinity of each alarm site would be designated to notify the local Office of Civil Defense whenever the test sound is not heard at the usual time. An electrically operated counting device at each siren, horn, or loudspeaker location registers each successful test by advancing its reading by one digit. The reading on the automatic counter at each site is then compared during regular maintenance visits to the known number of test signals sent from the control point(s). In this way the effectiveness of the failure reporting procedure is monitored at the same time that system reliability data is being accumulated.

Public Information ....Prior to initiating this type of testing program, the public should be told what the test will sound like and when to expect it. This must be done so that an individual when first hearing the test does not have reason to believe that an alarm device failed as it started to warn of an actual enemy attack.

After this test program is in operation it will be necessary to periodically instruct and remind the public of the nature of the two public action signals and the recommended action which they signify. The information should be presented in graphic form in the local newspapers. Recordings of actual alert signals should not be broadcast to radio or television receivers in an effort to instruct the public. Doing this would again give individuals a reason to believe that the actual attack warning being sounded might be coming from their neighbors television set.

Equipment Modifications ....In the majority of situations, this non-alert test procedure can be instrumented by installing an electric counter of the proper voltage rating at each site. However, certain other modifications may be required in a limited number of cases. These modifications (originally discussed in Section II.C.) are briefly described and summarized in the following list.

| Equipment Description | Additional Modifications |
|---|---|
| Sound producers driven by steam or compressed air. | A pressure switch must be installed in the supply line at each site to prevent the counter from operating after the supply has failed for some reason. |
| Loudspeaker systems used for voice warning | A tone filter should be installed between the counter and the amplifier to assure that only the daily test tone and not voice messages operate the counter. |
| Radio control systems lacking a rapid "cancel" function | The automatic timer at each alarm site should be modified as determined by its designer to include a "cancel" function. Also, a simple code must be established to activate the "cancel" function. |

# APPENDIX A

## WARNING SYSTEM RECORDS

Date of Contact: April 4, 1962

Location: City Hall
1101 S. Saginaw
Flint, Michigan

Person Contacted: Mr. Thomas Kay
Deputy City Manager
CE-8-5641

SYSTEM DESCRIPTION:

Main Control Point: City police radio base station at City Hall.

Alternate Control Point: None

Outdoor Warning Devices: 1 135 db gasoline powered, rotating siren (Chrysler)
10 110 db electric motor, non-rotating siren (Federal)

Siren Control System: Separate leased telephone lines connect the control point to each siren. When a special dial at the radio station is activated, the proper ringing voltage is applied to the individual telephone company relays located at each siren. In the event the special dial device fails to generate the proper signals at the telephone company automatically, a direct line to the telephone company switch room can be used to verbally instruct the maintenance personnel to manually apply the ringing voltage to the siren relays.

Area Communication Circuit: Notification of an actual alert is transmitted from the State Police Headquarters at Lansing by VHF voice radio to all State Police Posts. The Flint State Police then transmit (via radio) the alert instructions to the Flint control point at police headquarters. The station operator then activates the special dial to initiate either of the two public warning signals on all sirens in the city.

In addition to activating the sirens, the same signal generated by the special dial also activates a bell and light warning at key points within the city. In the Flint system, eighteen such alarms are connected by means of separate leased lines to the control point. When activated the bell sounds and one of four lights on the bell housing lights to indicate type of alarm in progress. Typical locations for the bell and light devices are the switchboard at City Hall, the City Manager's home, and the Superintendent of Schools' office.

SYSTEM TESTING:

Outdoor Warning Devices: The entire system is fully activated once a month (First Saturday at 1:00 p.m.)

Communication Circuit: The bell and light devices and the lines connecting them to the control point are tested daily at noon. For this test the number four digit on the special dial is used. The signal generated activates the bells and lights but not the sirens. Once a week the bell and light test is initiated at noon by the State Police, thereby testing another link in the circuit.

Date of Contact: April 12, 1962

Location: Chicago Office of Civil Defense
140 S. Dearborn Avenue
Chicago, Illinois

Person Contacted: Chief Slattery
AN 3-4173

SYSTEM DESCRIPTION:

Main Control Point: 4911 W. Belmont

Alternate Control Point: Soldiers Field and 8028 S. Kedzie

Outdoor Warning Devices: 106 Sirens

Siren Control System: Separate leased telephone lines connect the control points to each siren. When a special dial at a control point is activated, the proper ringing voltage is applied to the individual telephone company relays located at each siren.

Area Communication Circuit: Notification of an actual alert is transmitted from Colorado Springs, Colorado by NAWAS circuit to Chicago. A special dial activated at any of the control points activate simultaneously the 113 Bell and Lights stations and 106 sirens connected to the network. This same network controls 7 Bell and Lights stations and 6 sirens in adjacent suburbs.

SYSTEM TESTING:

Outdoor Warning Devices: The entire system is fully activated once a week. (Tuesday at 10:30 a.m.)

Communication Circuit: The communication circuit composed primarily of the Bell and Lights network is tested at least once a week along with the siren system.

Date of Contact: April 26, 1962

Location: Detroit Office of Civil Defense
900 Merrill Plaisance
Detroit, Michigan

Person Contacted: Mr. Peter C. McGillivray
Director of Civil Defense
UN 4-1800

SYSTEM DESCRIPTION:

Main Control Point: Detroit Police Headquarters Building
1300 Beaubien St.

Alternate Control Point: 1) Northwest Detroit Police Radio Station
999 Iris St.

2) Detroit Office of Civil Defense

Outdoor Warning Devices: 19 135 db gasoline powered, rotating siren (Chrysler) Coverage: 3 Mile Radius
8 126 db electric motor, rotating siren (Federal Thunderbolt) Coverage: 3/4 mile radius

Siren Control System: Separate leased telephone lines connect the three control points through several telephone offices to all sirens within the city limits and to all the Bell and Light signals in the metropolitan area. The telephone offices are connected to each other in a loop circuit with one open point which can be closed if the loop should open at any other point.

Area Communication Circuit: Notification of an actual alert is received at the Detroit Office of Civil Defense via the National Warning System (NAWAS) through the State Police Headquarters at Lansing. The station operator at the main control point is then authorized to activate the special dial to produce one of the four Bell & Light warning signals. This signal is sounded and displayed instantly on 123 Bell & Light devices installed at key points throughout the Detroit Metropolitan area.

The four signals are:

1. PRELIMINARY (8-5 minute advance warning when time permits)

*2. ATTACK ALERT (listen to radio)

*3. TAKE COVER (at once)

4. A. WEATHER ALERT (listen to radio or TV)
   B. END ATTACK WARNING
   C. TEST

*Also given on sirens

SYSTEM TESTING:

Outdoor Warning Devices: The entire system is fully activated once a month (1st Saturday at 1:00 p.m.). A fireman stands by each siren to report on its performance during the test.

Communication Circuit: The Bell and Light devices and the lines connecting them to the control points are tested Monday through Friday at noon. The signals are initiated from each of the three control points on a pre-arranged schedule during the week. Only the number one and four digits are used in this daily test.

Date of Contact: June 11, 1962

Location: Office of Civil Defense
Region 2 Headquarters
Washington D.C. Warning Area
Route 97, Olney, Maryland

Person Contacted: Mr. Paul White
Warning Officer, Region 2
WH 6-6200

SYSTEM DESCRIPTION:

Main Control Point: A secure location outside of the Washington area.

Alternate Control Point: OCD Region 2 Headquarters
Olney, Maryland

Outdoor Warning Devices:

27 135 db gasoline powered, rotating siren (Chrysler)

6 125 db gasoline powered, rotating siren (Biersach and Neidermeyer)

194 125 db electric motor, rotating siren (Federal Thunderbolt)

Plus 20 additional Thunderbolts soon to be added.

All sirens are equipped with counting devices to record number of operations of each siren between maintenance visits (weekly visits for gas, monthly for electric). Each siren is also equipped with a time delay relay which delays the activating signal 4 seconds to permit a "silent test" of the control system.

Siren Control System: The 227 sirens in the 40 mile diameter Washington area are connected by leased land lines through the various telephone offices to both control points. Special dials at the control points are used to activate any "Alert," "Take Cover" or test signals. A separate dial at each control point is used to activate the 182 Bell & Light warning devices at key points throughout the area.

In the event of a power failure in a particular area, the 33 gasoline engine siren sites are equipped with small gasoline driven 110 V 60 cycle generators which automatically cut in. If the landlines to these sites are damaged, VHF radio receivers on stand-by are used to receive and decode the two-tone signal transmitted from either control point and thereby activate the gas sirens.

SYSTEM TESTING:

Outdoor Warning Devices: Sound test - 2nd Saturday of January, April, July and October at 11:55 a.m.

Communication Circuit: Silent test - Each Wednesday at 9:00 a.m. via landline. Dial 2-2 and immediately "Stop" for silent test of "Alert," Dial 3-3 and after 3 seconds "Stop" for silent test of "Take Cover."

MISCELLANEOUS INFORMATION:

1. NAWAS Network (landline) with control center at Colorado Springs, Colorado is checked with all sections reporting by voice at 1930Z time (Greenwich) daily.

2. A separate time delay relay and counter is used at gas engine siren site for use with radio control.

3. The Thunderbolt sirens are purchased with the control circuit already modified for silent testing. The parts are: time delay relay, Industrial #SF-155; AC Relay, 110 V 60 cps SPST; and Counter, Production Instrument Co. #MDA-S4-115A.

4. The control panel for the gasoline engine driven sirens contains the following equipment for silent testing: Time Delay Relay (2), Eagle Signal Corp. #HD 32A621.

Date of Contact: June 19, 1962

Location: City Hall - Office of Civil Defense
35 Lyon N.W.
Grand Rapids, Michigan

Person Contacted: Mr. Edward Smith
Superintendent of Fire Communications
Phone 456-9175

SYSTEM DESCRIPTION:

Main Control Point: City Hall

Alternate Control Point: None

Outdoor Warning Devices: 3 135 db gasoline powered, rotating siren (Chrysler)

Siren Control System: The three sirens are connected to the control point through the fire alarm pull-box cables. An AC relay installed at each siren is energized by 48 V 60 cps supplied by a step down transformer at the control point. The control equipment consists of a power switch to energize the 48 V transformer and center-off, three position toggle switch which when in the "Up" position causes the siren to sound the "Alert" signal and when alternately placed in the spring loaded "Down" position for 8 seconds and "Off" for 4 seconds causes the "Take Cover" signal to be sounded.

Area Communication Circuit: Commercial telephone and city police and fire radio circuits.

The Bell and Lights warning system is not used in Grand Rapids.

SYSTEM TESTING:

Outdoor Warning Devices: Sound test - once per year. Siren engines are run with clutch disengaged for 15 to 20 minutes during maintenance visits which occur at two week intervals.

Communication Circuit: No special tests of siren controls are conducted. The cable circuits are in constant use for their primary purpose of transmitting fire alarm signals to the fire department.

Date of Contact: June 25, 1962

Location: Denver, Colorado
Building 50
Denver Federal Center

Person Contacted: Mr. Angelo Matassa, Warning Officer Region 6
Phone: BE 7-8831 Ext. 6772
Mr. William Traugh, Acting Civil Defense Director
City of Denver

SYSTEM DESCRIPTION:

Main Control Point: Fire Department Dispatch Room
8th and Josephine
Denver, Colorado

Alternate Control Point: None

Outdoor Warning Devices:

| | |
|---|---|
| 11 | 125 db, electric, rotating siren Federal Thunderbolt |
| 8 | 115 db, electric, Federal Model SD-10 |
| 7 | 110 db, electric, 7 HP, Federal Co. |
| 10 | 100 db, electric, 2 HP, Federal Co. |

Siren Control System: Leased telephone lines are used to connect the 36 sirens to the control point. A Federal "Air Raid Timer" Model AR is used to automatically produce the necessary timing for either the "Alert" or "Take Cover" signals when the proper push-button is momentarily depressed. An additional push-button labeled "Manual" is connected directly across the line to the telephone company and can be used to produce a "short pulse" on the siren lines for growl testing.

Area Communication Circuit: Although Denver is quite close to NORAD at Colorado Springs, it receives all warning information via the NAWAS network as would any other community.

SYSTEM TESTING:

Outdoor Warning Devices: No system tests are conducted except Operation Alert which usually occurs each year.

Communication Circuit: Approximately once a month the telephone company checks the continuity of each siren line by applying a ringing signal at the central office end as a fireman disables the siren on that particular line to prevent its sounding.

Date of Contact: June 26, 1962

Location: Seattle, Washington

Person Contacted: Mr. Donald Mueller
Director of Civil Defense

Phone JU 3-2095

SYSTEM DESCRIPTION:

Main Control Point: City Hall
City Police Radio Dispatch Room
Cedar River Park - Renton, Washington

Alternate Control Point: Kent, Washington

Outdoor Warning Devices:

| | |
|---|---|
| 14 | 135 db, gasoline engine rotating, Chrysler |
| 9 | 115 db, electric, 10 HP, Federal |
| 5 | 110 db, electric, 7.5 HP, Federal |
| 2 | 105 db, electric, 5 HP, Federal |
| 6 | 100 db, electric, 3 HP, Federal |
| 12 | 100 db, electric, 2 HP, unknown mfr. |

Siren Control System: The 48 sirens in this system are remotely controlled from either of the two control points by means of the Bell and Lights equipment of the Pacific Northwest Bell Telephone Company. In addition to the sirens, 64 Bell and Light warning devices located at key points throughout the Seattle area are also controlled by this same equipment.

Area Communication Circuit: All attack warning information is received via the NAWAS network.

SYSTEM TESTING:

Outdoor Warning Devices: The entire system is activated once a week (Wednesdays at noon). The "Alert" signal only is tested. The duration of the test is 90 seconds.

Communication Circuit: The Bell and Light devices and lines connecting them to the control points are tested Monday through Friday at 10:00 a.m.

Date of Contact: June 27, 1962

Location: Tuscon, Arizona

Person Contacted: Mr. Roy I. Post
Communications Officer - Region 7
Santa Rosa, California
Phone: LI 2-1680

SYSTEM DESCRIPTION:

Main Control Point: Sheriff's Dispatch Radio Room

Alternate Control Point: None

Outdoor Warning Devices: 6 125 db electric, rotating Federal Thunderbolt
14 115 db electric, 7.5 HP, vertical, Federal Co.

Siren Control System: Leased telephone lines are used to connect the 20 sirens to the control point. A Federal "Air Raid Timer" Model AR is used to automatically control the sirens.

Area Communication Circuit: The Tuscon State Police post is on the NAWAS network. The State Police relays any warnings to the Sheriff's dispatch radio operator by landline.

SYSTEM TESTING:

Outdoor Warning Devices: No system tests other than Operation Alert are performed. The sirens are individually "growled" during monthly maintenance visits.

Communication Circuit: Mr. Post did not know if the telephone company checked the leased lines for continuity on a routine basis.

Date of Contact: June 28, 1962

Location: Dallas, Texas

Person Contacted: Mr. Charles Dickinson
Warning Officer - Region 5
Phone: DU 2-5491

SYSTEM DESCRIPTION:

Main Control Point: Fire Department Headquarters

Alternate Control Point: None

Outdoor Warning Devices: 37 125 db Federal Thunderbolt electrically driven sirens.

Siren Control System: The city of Dallas has a unique system for controlling air raid sirens. The 37 sirens are all located atop hose towers on fire stations. A Federal "Air Raid Timer" is located near the dispatch desk at each siren equipped fire station. The order to activate the sirens is given verbally to each dispatcher simultaneously via the same two-way VHF radio equipment (Motorola) that is used for ordering fire companies out to fight fires. The old tape-punch equipment made by the Gamewell Company is used as back-up in case of radio failure. The signal 8-8-8 denotes "Alert" and 9-9-9 denotes "Take Cover" on the tape-punch system. The radio equipment can be used to alert any one or all stations by the use of selective tones preceding the message. False alarms are non-existent with the control for each siren located in the same building with the siren. On the other hand, siren activation is not automatic, and during a fire all must leave the fire house, thereby leaving the siren controls unattended. The human element at best introduces a time lag and possibly a chance for misunderstanding the alarm order.

SYSTEM TESTING:

Outdoor Warning Devices: About once a year in addition to Operation Alert the system is fully activated using the fire radio channel for communication.

Communication Circuit: The radio and tape-punch communication circuits that would also be used for notification of attack warnings are in constant use providing fire fighting information.

Date of Contact: July 5, 1962

Location: St. Louis, Missouri
Office of Civil Defense

Person Contacted: Col. W.D. Paschall (By Telephone)
Director of Civil Defense
Phone: MA 1-5560

SYSTEM DESCRIPTION:

Main Control Point: Fire and Police Telegraph Office

Alternate Control Point: None

Outdoor Warning Devices: 127 electrically operated sirens.

Siren Control System: Bell and Lights warning system with the required additional equipment for siren control.

Area Communication Circuit: NAWAS Network

SYSTEM TESTING:

Outdoor Warning Devices: The entire system is tested on the first Monday of each month at 11:00 a.m. preceded by newspaper publicity. The sirens produce a distinctive "growl" in this test* because the ringing signal is placed on the siren lines for only six seconds.

Communication Circuit: On about the 15th of each month the telephone company checks the siren lines without producing any siren sound.

*Note: A resident near each site reports by postal card whether or not the sirens produced the usual "growl."

Date of Contact: July 17, 1962

Location: Boston, Massachusetts

Person Contacted: Mr. Waldo Pisco
Deputy Director of Civil Defense
Phone: HI 2-3020

SYSTEM DESCRIPTION:

Main Control Point: Police Headquarters Building
154 Berkley St.

Alternate Control Point: None

Outdoor Warning Devices: 122 100 db electrically driven sirens
Federal Sign and Signal Company

Siren Control System: Orders to sound an attack warning signal on the sirens are given from the control point by means of the police and fire teletype network. An officer on duty at each precinct office manually operates a toggle switch to sound the siren on that particular circuit. Each circuit is composed of a landline pair connecting the toggle switch to the bank of relays which apply ringing voltage to telephone type relay at each siren. The siren lines are constantly being monitored for open or shorted conditions.

Area Communication Circuit: Fifty Bell and Lights devices are installed at key locations throughout Boston. The units are activated by the usual telephone type special dial at the control point.

SYSTEM TESTING:

Outdoor Warning Devices: The siren system is operated to sound a two minute steady signal on the first and third Friday of each month at 12 noon.

Communication Circuit: No information.

Date of Contact: July 17, 1962

Location: New York City, New York
Office of Civil Defense
135 E. 55th Street

Person Contacted: Mr. Martin H. Meaney
Deputy Director of Civil Defense
Phone: PL 8-2300

SYSTEM DESCRIPTION:

Main Control Point: Police Headquarters

Alternate Control Point: Each of the five boroughs Police Headquarters.

Outdoor Warning Devices:

| | |
|---|---|
| 99 | 2 HP electric sirens |
| 1 | 3 HP electric sirens |
| 600 | 5 HP electric sirens |
| 1 | 7.5 HP electric sirens |
| 1 | 15 HP electric sirens |
| 32 | 40 HP electric sirens |
| 734 | |

Siren Control System: Orders to sound an attack warning signal on the sirens are given from the control point by means of the police teletype network. An officer on duty at each precinct office would then manually turn on, off, and time all the sirens tied by landlines to his precinct by means of a push button switch.

Area Communication Circuit: All key offices and most public buildings are equipped with a Bell and Lights warning system device which would be energized along with the siren system in the event of an attack. There are 1600 of these devices used in the city and form what is called the Air Raid Network.

SYSTEM TESTING:

Outdoor Warning Devices: All sirens are tested once a month on a pre-arranged day during which the "Alert" and "Take Cover" signals are sounded. The tests* are held on any Tuesday, Wednesday, or Thursday of the month at 11:00 a.m. The public is informed of the test 3 or 4 days in advance by radio, TV, and newspaper publicity.

Communication Circuit: The 1600 Bell and Lights devices are tested at 9:30 a.m. and 7:00 p.m. Monday through Friday.

*Mr. Meaney stated that policemen report on the operation of each siren during a test and observe if the sirens sound the signals properly and if the sound levels are normal. An average of 10 to 12 of the 734 sirens are reported deficient during the winter months.

APPENDIX B

RADIO CONTROL SURVEY RECORDS

Fort Worth July 31, 1962

1. Number of sirens in this system that are radio controlled. 25

2. Is the dialing equipment used to remotely control any other devices no or call individuals no ? If so, about how many _____ (devices) _______ (individuals)?

3. What numbers must be dialed for the following siren signals: Alert ______, Take Cover ______, Test ______ or Other ______.

   Program box (tone actuation box) associated with radio actuation of sirens has 3 push buttons on it (one when pushed will sound the Alert signal, another when pushed will sound the Take Cover signal, and the third button is the Test position which is a simple push to actuate and push to stop, a manual operation. This program box contains a tone oscillator controlled by motor driven cams, 1 cam controls the Alert signal, the other cam controls the Take Cover signal. When any one of the 3 push buttons is depressed the tone oscillator modulates the transmitter with a 2828 cps tone (this is a single tone system).

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal?

   Manufacturer's Name General Electric

   Model Number 4 EC 23 A 1

   or other (describe) Type Number EC 23 A

   This is a cam actuated tone system controlled by timer controlling motor in the program box which operates the timing cycles (3 minutes duration for Alert signal; 3 minutes duration on Take Cover signal warbling on 15 second cycles. When the 3 minute duration cycle is completed, tone actuation stops. In order to sound the sirens again it would be necessary to press the push button for the desired signal, thus setting off another 3 minute cycling.

5. Is the siren system regularly tested in some way? Describe.

   On a rotating schedule, 3 sirens are tested every 9 weeks by two different City departments. The Electrical Division of the Traffic Engineering department checks the operating and electrical components of the sirens; the Communications Division of the Department of Public Works checks the radio activating equipment (transmitting, receiving and control equipment). Occasionally they "growl" the sirens momentarily to test. The whole system generally is tested and audibly twice a year, but on no specific schedule.

Region 5
Location Denton, Texas

Austin, Texas August 14, 1962

1. Number of sirens in this system that are radio controlled. 13

2. Is the dialing equipment used to remotely control any other devices no or call individuals no ? If so, about how many ______ (devices) ________________(individuals)?

3. What numbers must be dialed for the following siren signals: Alert_______, Take Cover _______, Test_______ or Other _______?

   This system uses a Secode Sender (L 3201) to program the appropriate signals to the sirens. This Sender has a dial arrangement and by dialing different 3 digit codes, pulses are sent through a transmitter over the City Police radio frequency to the sirens. At each siren a Secode decoder (L 3101) receives the pulses from a radio receiver associated with each siren location. There are small timer wheels in this equipment with pins so arranged to make a switch contact which in turn throws a relay which activates the siren. The timer wheel for the "Alert" signal makes a complete cycle in 3 minutes and stops. The "Take Cover" signal is controlled by another timer wheel with additional pin settings which on a timed cycling arrangement will make switch contact thereby interrupting the flow of power to the siren momentarily and then restoring power to continue siren sounding, repeating this procedure until the full 3 minute cycle has been concluded, at which time it stops.

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal. (See Item 3 above.)

   Manufacturer's Name Secode

   Model Number Receiver (L 3101), Sender (3101)

5. Is the siren system regularly tested in some way? Describe.

   The sirens are tested audibly the first Friday of each month by sounding for 3 minutes each the "Alert" and the "Take Cover" signals in sequence. They also have a portable Secode sender which permits them to check sirens individually by disconnecting siren and using the Secode sender to trip the decoder connected to each siren.

Region 5

Location Denton, Texas

1. Number of sirens in this system that are radio controlled. 26

2. Is the dialing equipment used to remotely control any other devices no or call individuals no ? If so, about how many none (devices) none (individuals)?

3. What numbers must be dialed for the following siren signals: Alert 156, Take Cover 158, Test ____ or Other ____?

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal?

   Manufacturer's Name General Electric & Secode

   Model Number Remote Control Unit 4EC28A1 Rev F
   Tone Transmitter P17489017G-1 Rev G
   Transmitter 4EP4A - 3 Rev D, Decoder RPD-612 Type 1859

   or other (describe) Length of run controlled by manually dialing the sirens on and off. A timer set for 8 seconds and 4 seconds off provides the warble. This timer opens and closes the switch that turns the sirens on and off.

5. Is the siren system regularly tested in some way? Describe.

   All sirens sound tested first Saturday of each month. Full time siren maintenance employe regularly checks each siren during the month.

Region 6

Location Kansas City, Missouri

1. Number of sirens in this system that are radio controlled. All (21)

2. Is the controlling equipment used to remotely control any other devices yes or call individuals yes. If so, about how many 5 (devices) 2 (individuals).

3. What letters must be pushed for the following siren signals: Alert LH, Take Cover PK, Test same as Alert & Take Cover, Other ________. This is Motorola Quik-Call equipment.

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal? 1/3 RPM Synchronous motor.

   Manufacturer's Name Scraam-Master Corporation

   Model Number 8 Model 20 HP DETT-125 db - FCDA Specification 103
   13 Model 10 HP TT-115 db - FCDA Specification 101
   or other (describe).

5. Is the siren system regularly tested in some way? Describe.

   Tested monthly - Individual siren is disconnected from Radio-Tone receiver and radio equipment is tested by pushing tone button. Then siren is tested by pushing control button without starting siren cycle. All sirens are also activated periodically to test radio siren equipment.

Region Region 6
Denver Federal Center, Bldg. 50
Denver 25, Colorado

Location Colorado Springs, Colorado

1. Number of sirens in this system that are radio controlled. 9

2. Is the dialing equipment used to remotely control any other devices no or call individuals no ? If so, about how many ______ (devices) ______ (individuals)?

3. What numbers must be dialed for the following siren signals: Alert 169458 , Take Cover 169456 , Test 169454 or Other Reset 169452 .

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal.

   Manufacturer's Name Federal Sign & Signal Company

   Model Number AR

5. Is the siren system regularly tested in some way? Describe

   Yes, each Saturday at 12:00 noon for two minutes. Steady blast.

Region Region VI
Denver Federal Center, Bldg. 50
Denver 25, Colorado

Location Jefferson County, Colorado

1. Number of sirens in this system that are radio controlled. __16__

2. Is the dialing equipment used to remotely control any other devices __no__ or call individuals __no__? If so, about how many ________ (devices) ________ (individuals).

3. What numbers must be dialed for the following siren signals: Alert __166__, Take Cover __168__, Test __162__ or Other __Re-arm 164__.

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal?

   Manufacturer's Name __Federal Sign & Signal Company__

   Model Number __AR and AF__

   or other (describe) __Remote controls RC 5 & 6 are used to complete the control of the individual sirens.__

5. Is the siren system regularly tested in some way? Describe.

   Each Wednesday at 1300 hours, 162 is dialed. This lights an indicator lamp in each of the siren control cabinets, which remains lit until turned off by a local police officer, between 0800 and 1200 hours the next Wednesday. This system necessitates dialing 164 prior to either 166 or 168, but it has tremendously reduced the outside interference problem which resulted in false soundings of not only individual sirens, but in some instances series of sirens.

Region __Region 6 Denver Federal Center, Building 50 Denver 25, Colorado__

Location __Olathe, Kansas (Johnson County)__

1. Number of sirens in this system that are radio controlled. ___17___

2. Is the dialing equipment used to remotely control any other devices ___no___ or call individuals ________. If so, about how many ________ (devices) ________(individuals) ________.

3. What numbers must be dialed for the following siren signals:
Alert ___1541___, Take Cover 1541-1521 & 1541-1521 in continuous sequence, Test 1541 and 1521 or after 15 seconds
Other ________.

4. What equipment determines the length of siren run and provides the warble in the Take Cover signal?

Manufacturer's Name ___General Electric___

Model Number ___CO-30-N Receivers___

or other (describe) ___Secode 30 Receivers and RPD-634___

B 2 KL Special Decoders

5. Is the siren system regularly tested in some way? Describe.

Each Monday afternoon at 5:00 p.m. the system is tested by use of the radio control and sounding the sirens for 15 seconds.

Region 6
Region ___Denver Federal Center, Building 50___
Denver 25, Colorado

Location ___Lincoln, Nebraska___

# APPENDIX C

## RECORDS OF MEETINGS WITH CIVIL DEFENSE OFFICIALS AND EQUIPMENT SUPPLIERS

Date of Visit: April 12, 1962

Location: Federal Sign & Signal Plant
136th & Western Avenue
Blue Island, Illinois

Person Contacted: Messrs. Ray Greving, Regional Sales Mgr.
Earl Gosswiller, Chief Engineer
Frank Eick, Asst. Chief Engineer
Phone: FU 9-3400

INFORMATION OBTAINED:

Frank Eick described and demonstrated the features of their OCD certified sirens (rated over 100 db @ 100 ft.) with particular emphasis on the factors important for "growl" testing.

Their Thunderbolt Model 1000 is widely used as an outdoor warning device. This unit would be difficult to growl test from a remote location due to the fact that a test pulse as short as one second causes the low inertia 2 HP chopper motor to rotate fast enough to produce an audio pitch of perhaps 400 cps. At the same time, the one second pulse starts the higher inertia 7.5 HP blower motor, but due to the action of a time delay relay in the siren control circuit, power is actually maintained to this motor about eight seconds after the end of the starting pulse. The net result of this is a full volume output for about 15 seconds which rises quickly to an audio pitch of about 400 cps and slowly descends to a stop.

A 7.5 HP vertical type siren was energized in a test chamber and was effectively "growl" tested with a power application for about 2 seconds. Full output was delivered with power applied for 5 seconds.

Sound levels are measured in an anechoic chamber using a condenser microphone and a General Radio Sound Level Meter #1551-A. The measurements are taken at a distance of ten feet from the source. The shape of the sound wave can be viewed on an oscilloscope. The wave can be analyzed with respect to the magnitude of its component frequencies with a General Radio Octave-Band Noise Analyzer #1550. Siren sound energy is found primarily in the octave from 1200 to 2400 cps.

The time delay relay used in the Thunderbolt control panel is Agastat #NE-22 (8 seconds delay after loss of coil voltage).

Mr. Eich mentioned that the Esso Refinery located in New Jersey uses or considered using a large siren system for general outdoor alerting with a complex feedback of information to the activation point which let them know if the siren actually sounded the signal properly.

Date of Visit: May 8, 1962

Location: Michigan Bell Telephone Company (Flint Office)
502 Beach Street
Flint, Michigan

Persons Contacted: Messrs. Alton A. Miller, General Manager
Charles M. Steinhaus, Switchroom Foreman
Phone: 232-9930

INFORMATION OBTAINED:

Mr. Steinhaus is responsible for the proper functioning of the telephone equipment which controls and energizes the Bell and Lights units (18) and outdoor sirens (11) in the city of Flint. Routine maintenance of this equipment is performed under his direction. A switchman stands by at the Bell and Lights equipment bay during the daily test (Monday through Friday at noon). He manually disables the siren control circuits for this test so that the operator at the control point can not turn the sirens on by mistake. A log is kept of every Bell and Lights signal received. The date, time started, and time ended is recorded. Any malfunction of the telephone company or customer equipment is recorded. A report is submitted weekly to the Civil Defense Co-Ordinator at Bell Telephone in Detroit.

It is important that the Bell and Lights lines and the decoding circuitry in the signal boxes are trouble free. The daily test of the "Preliminary" and "End Attack Warning" alarms assures a high degree of readiness of this equipment. A daily test of the "Alert" and "Attack" alarms wherein all sirens are activated is highly desirable from an equipment standpoint, and this is under consideration at the present time. A small part of the siren control system, the direct line pair, is being monitored continuously for open, false ground, and foreign battery conditions. Should any one of these malfunctions occur on any one of the lines, an alarm is sounded which takes precedence over any other switchroom alarm. Since this room is in constant attendance, the trouble is quickly attended to.

In the event a scheduled test is not activated at the designated control point on time, the switchroom man can call the City or State Police radio control rooms on direct telephone handsets attached to the equipment bay.

Date of Visit: June 12, 1962

Location: Chesapeake & Potomac Telephone Company
930 H. Street N.W.
Washington D.C.

Person Contacted: Mr. Jack Alexander
Asst. Sales Manager, Industrial & Commercial
Security Control Office
Phone: EX 2-8281

INFORMATION OBTAINED:

Mr. Alexander mentioned that he was not associated with Civil Defense at the telephone company at the time that the system was converted for silent testing but that he has since become aware of problems that initially were encountered. The problem that occurred most frequently was that the counters at the siren sites would read many more counts than they should. The result was that it would be impossible to determine whether or not the test signal was properly transmitted and received.

He said that the majority of the false signals were caused by telephone company repairmen accidentally putting a transient on the siren lines while trying to locate pairs by the battery-headphone method. Since then all security circuits have been guarded by appropriate insulators. Another source of transients was 60 cycle power lines routed too close to siren lines thereby inducting voltages sufficient to pull in the a.c. relay. As recently as last December a particular siren in the system would operate at random times during the evening. The false signal was found to be generated by power line induction caused by abnormally high outdoor Christmas tree lighting loads.

Date of Contact: June 25, 1962

Location: Denver Federal Center
Building 50
Denver, Colorado

Person Contacted: Mr. Angelo Matassa
Warning Officer - Region 6
Phone: BE 7-8831 Ext. 6772

INFORMATION OBTAINED:

Activation Devices: Federal Air Raid Timer Model AR is used in most systems for starting and stopping the warning signals. A telephone dial (Bell and Lights type) is used in St. Louis, Missouri to activate the timing equipment at central office.

Control Circuits: Landlines leased from the Mountain States Telephone and Telegraph Company are the most commonly used means for remote control in Region 6. Remote control by VHF (Sheriff's frequency) radio is used in Jefferson County, Colorado - Lincoln, Nebraska; and Colorado Springs, Colorado. This special use of existing radio equipment which normally handles only voice communications, is accomplished through the use of special tone generator at the transmitter and special decoding receivers at each siren location. These radio systems in this region were installed by Motorola and use coding and decoding devices built by the Secode Corporation of San Francisco. Detailed information on the design and operation of this type siren control system has been requested from Secode.

Sound Devices: Mr. Matassa was aware of only one gasoline engine driven siren in Region 6, namely in St. Louis, Missouri. All types of electrically driven sirens are used however. Two towns in the region, Salina, Kansas and Grand Island, Nebraska, use a public address electronic warning system. Recordings of either of the public warning signals are played over clusters of 100 watt speakers installed on poles throughout a city which is then followed by a voice description of the impending danger. The amplifiers and speakers are manufactured by the Altec Lansing Corporation and the sound signals are sent to the amplifier-speaker sites by telephone lines.

Date of Contact: June 26, 1962

Location: OCD Region 8 Headquarters
Everett, Washington

Person Contacted: Mr. Wilke E. Cruse
Communications Officer - Region 8
Phone: AL 9-7191

INFORMATION OBTAINED:

Activation Devices: A simple push-button with the operator timing the signal manually is used in many small systems composed of two or three sirens or whistles. In the larger systems either telephone equipment or the Federal Air Raid Timer is used to control sirens.

Control Circuits: Landlines leased from the local telephone companies are the only means used in Region 8 for the remote control of outdoor warning devices.

Sound Devices: Chrysler gasoline and a variety of electrically operated sirens are commonly used in the region. The few whistles still being used in the logging areas of Oregon are gradually being replaced by sirens.

Date of Contact: June 27, 1962

Location: OCD Region 7 Headquarters
Santa Rosa, California

Person Contacted: Mr. Roy I. Post
Communications Officer
Phone: LI 2-1680

INFORMATION OBTAINED:

Activation Devices: The Federal "Air Raid Timer" Model AR is used in most systems for starting and stopping the public warning signals. Bell and Lights telephone equipment is used to activate and time the signals in almost all systems in the state of California. A simple push-button control circuit is used in many small systems throughout the region.

Control Circuits: Landlines are leased from the local telephone companies, namely Mountain States, Pacific, and General Telephone and Telegraph in most of the systems in Region 7. Remote control of sirens in Los Angeles County and the cities of Burbank, San Jose and Pomona is accomplished through the use of tone coding equipment built by the Secode Corporation on Public Service VHF radio frequencies.

It has been said that all the sirens in the State of California can be controlled from one point. This is basically true since the local government offices in many of the towns in the state are served by the state Microwave Radio Network. This network was established to provide communications for all public service departments, but could be used to alert the entire state more rapidly, it is believed, than via the NAWAS network with telephone fan-out techniques.

Sound Devices: Mr. Post was aware of only two gasoline engine driven sirens in the region with both of those being Chrysler units. One is located in Santa Rosa, California and the other is in Phoenix, Arizona . All varieties of electrically driven sirens are used in the region including the Federal Thunderbolt.

Date of Contact: June 28, 1962

Location: OCD Region 5 Headquarters
Brackenridge Hall
Texas Womens University
Denton, Texas

Person Contacted: Mr. Charles S. Dickinson
Warning Officer - Region 5
Phone: DU 2-5491

INFORMATION OBTAINED:

Activation Devices: In most Region 5 warning systems the sirens are controlled by the Federal "Air Raid Timer" Model AR. In a few locations, one being Albuquerque, New Mexico, Bell and Lights telephone dialing equipment is used for control.

Control Circuits: Landlines leased from the local telephone companies are the most commonly used means for remote control in Region 5. A radio control system composed of equipment made by General Electric and Secode is used in Ft. Worth, Texas.

A similar radio system has just been installed in Austin, Texas and is currently being evaluated.

Sound Devices: Mr. Dickinson was not aware of any gasoline engine driven sirens or electronic voice devices being used in the region. With the exception of a few whistles, all outdoor warning devices are electrically operated sirens of all types.

Date of Contact: June 28, 1962

Location: OCD Region 1 Headquarters
Harvard, Massachusetts

Person Contacted: Mr. Robert E. Wiegand
Warning Officer - Region 1
Phone GL 6-3231

INFORMATION OBTAINED:

Activation Devices: Most warning systems are controlled by the Federal "Air Raid Timer" but in addition to these, a large percentage are controlled by a simple push button circuit which is used to manually start, stop, and time the siren sound. Though Bell and Lights warning systems are used in many Region 1 cities (with the exception of Vermont State), only in Nassau County are the sirens controlled by the special telephone dial.

Control Circuits: Landlines are used to link the individual sound producing devices to the control point in nearly all systems. There are a few radio control systems employing either Motorola Quik Call or GE-Secode equipment. Two radio control system locations are Monroe Country, New York and Troy, New Jersey.

Sound Devices: All types of electric sirens are used in Region 1 including the 40 hp siren manufactured by the Alfred Conhagen Co. of Staten Island. Gasoline engine driven sires are used in a few locations. They are manufactured by Chrysler Co. and Biersach and Niedermeyer Co. An electronic voice system is used in Hoboken, New Jersey.