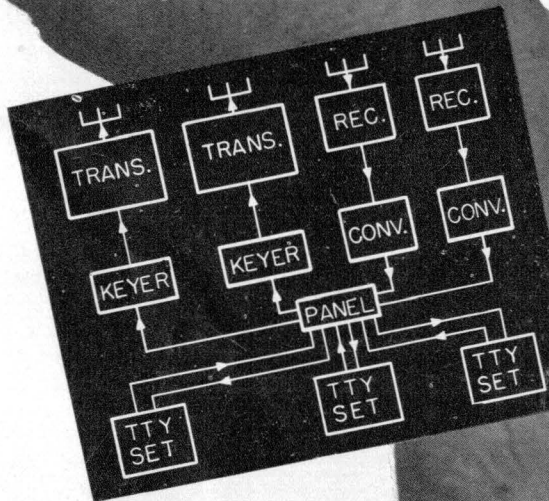
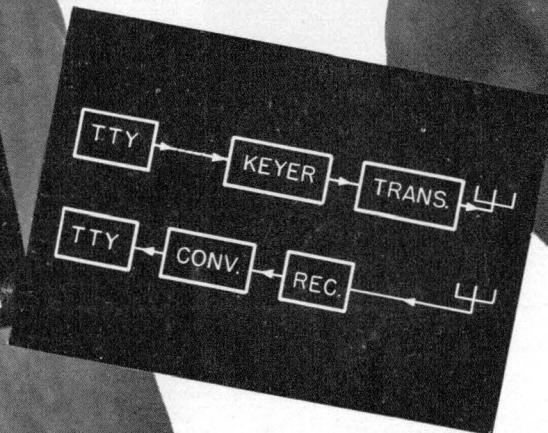


# Teletype is here to stay



Typical large-ship installation includes a transfer panel to permit independent use of all units.



Simple radio-teletype system for shipboard use. Separate transmitting and receiving frequencies are employed.

■ Seldom has any piece of communication equipment gained as rapidly in importance as the radio operated teletypewriter. Teletypewriter equipment is not new, nor is the idea of operating it over a radio link. The equipments have been giving excellent service for many years over land lines, that being the primary purpose for which they were designed. Only recently, however, has it been possible to operate the teletypewriter (TTY for short) in a thoroughly dependable manner over long-haul radio circuits. This is because the TTY printer is a mechanical device and is therefore not always able to discriminate between the desired signals and those introduced by interference or static. New high-performance radio equipment and techniques developed during the last few years are now capable of

furnishing satisfactory TTY signals. A system of "frequency-shift" keying (see p. 5) increases signal-to-noise ratio and greatly reduces certain types of interference. Modern receivers having exceptional frequency stability and other refinements were necessary before the full benefits of this system could be realized.

## TTY AND THE NAVY

The first large-scale use of radio TTY by the Navy was to take over the steady grind of long-haul point-to-point administrative traffic between major shore stations. Here a truly prodigious amount of traffic is handled in a very orderly manner by a minimum of equipment and operating personnel. These are the cir-



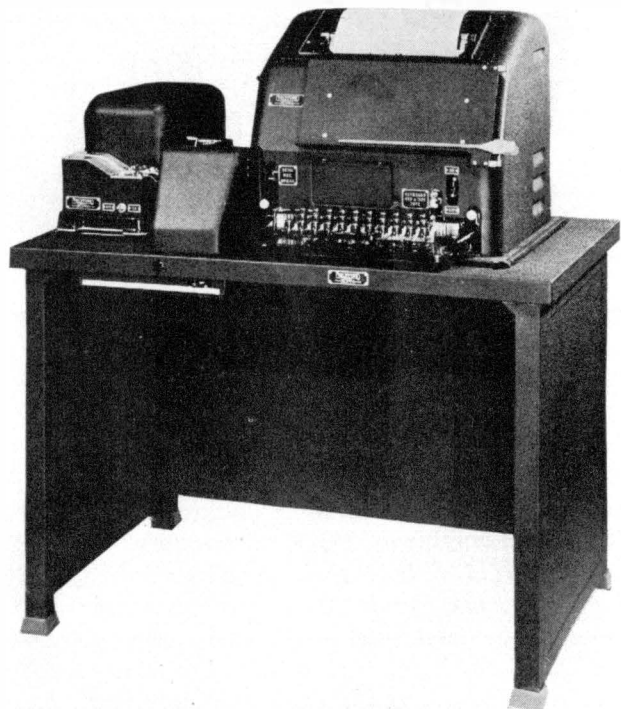
*This No. 15 page printer is the basic teletypewriter unit.*

circuits that have proved the efficiency and reliability of the system. Later, the service was extended to advanced base headquarters and to most AGC's. Although many TTY installations were only temporary and experimental, there has been sufficient information concerning them to precipitate a veritable deluge of requests for equipment. Elaborate plans are being made for the future of TTY in the Navy, and a program is already underway to automatically provide ships and stations with equipment as rapidly as it becomes available. The sudden demand for equipment so exceeds production, however, that no quantity shipments can be made until after November. By next year many ships will probably be able to copy all their Fox schedules by TTY, and special UHF harbor circuits employing TTY will provide all communication while in port.

## ADVANTAGES OF TTY

Most obvious of all the advantages of the TTY is its speed. Although some operators can receive plain language at 60 words per minute, they cannot do it for long periods of time. On a circuit where traffic is mostly code groups, the average speed over a long period seldom exceeds 15 w.p.m., and is often as low as 5 w.p.m. A teletypewriter, with its inherent speed of 60 w.p.m., will therefore move at least four times as much traffic as an operator sending by hand. More important is the fact that the addition of a TTY at each end of a circuit would increase the traffic capacity at least as much as adding three or four additional transmitters, receivers, and operators at each end. Actually, two TTY's would usually be installed at each end to permit simultaneous sending and receiving on two different frequencies (*duplex* operation), this arrangement again doubling the capacity of the system.

As far as accuracy is concerned, TTY sending is as subject to operator errors as any other system. But when transmissions (or tape perforating) are monitored by the operator, it permits him to see, in plain language, an exact replica of the transmission. The TTY printer is inherently accurate, and will not introduce garbles unless they are present in the input signals. However, under conditions of difficult radio reception the TTY will naturally fail to produce perfect copy, as is the case with any other system. By the use of frequency-shift keying, the TTY is probably as good under these



*The No. 19 TTY Set includes facilities for perforating and transmitting tape.*

severe conditions as conventional radio telegraphy, and may at times be even better.

An important advantage of TTY is that traffic can be relayed automatically by means of perforated tape. A tape perforating machine can be operated by the incoming signal, and this tape can then be retransmitted over as many circuits as necessary by mechanical means.

An advantage of TTY over certain other means of high-speed communication is that the copy is produced in a form which can be used immediately, and does not have to be transcribed by hand before it is of any value.

## THE EQUIPMENT

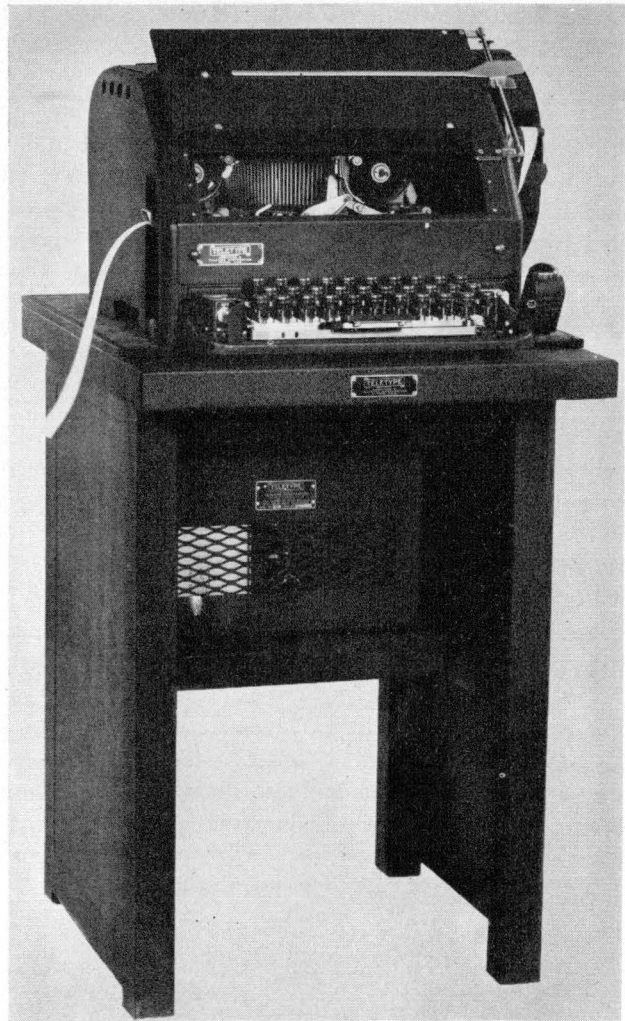
Navy TTY equipment differs only slightly from the time-proven commercial models you have seen in newspaper and telegraph offices. They will be provided with a few new features and refinements, and will be protected against shock and vibration. Internal parts will be protected against corrosion. But they look about the same.

Probably the most basic of the equipments is the Model No. 15 Teletypewriter shown in the illustration. It is a page-printer (prints copy on a *page*, rather than on a narrow *tape*) equipped with a keyboard, and may be used for either sending or receiving. The page-printer will monitor outgoing transmissions so that the operator will not have to send "blind," and the resulting copy provides an ideal log. Actually, separate machines are used for sending and receiving so that both operations can be accomplished simultaneously on different frequencies, thereby utilizing the full traffic-handling ability of every unit in the system.

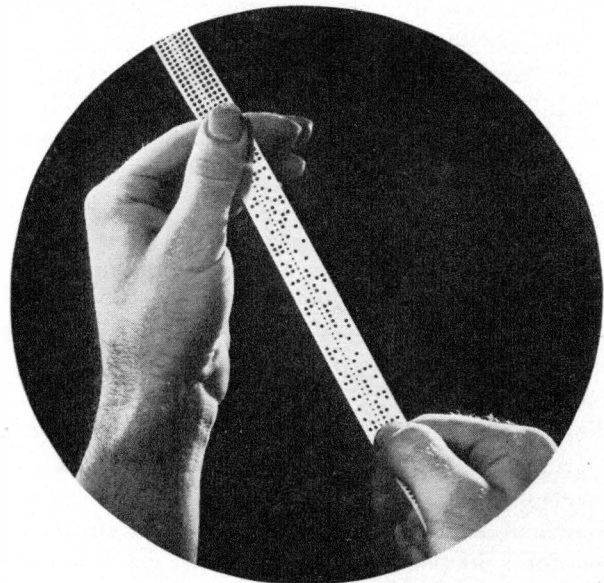
The simplest possible shipboard installation would therefore consist of two TTY's with their associated operator's tables and power supplies, a keyer, a converter, and a suitable transmitter and receiver, as shown in the small block diagram.

The keyer just mentioned provides the method for frequency-shift keying of the transmitter. This unit is known as the Model FSA Frequency-Shift Keyer, and must be located adjacent to the transmitter. To permit attachment of a keyer, however, the transmitter must first be modified by installing a Coupler Unit and associated Interconnections Panel. At present these kits of attachments may be installed only in TBA, TBK, TBM and TBL transmitters, but adapters are being designed to permit their use with the TCK, TCZ and TDE.

The converter serves an opposite function to the keyer, in that it converts the received frequency-shift signal back to the DC telegraph signal necessary to operate the TTY printer. Models FRA and FRG Frequency-Shift Receiver Converters are not yet available in final form, although an interim equipment, the FRC, is available in limited quantity. These equipments are



*The No. 14 TTY is used to relay messages. The table illustrated is for shore-use only, as special anti-shock and vibration mountings are required aboard ship.*



*Perforated tape produced by the No. 19 TTY Set can be transmitted automatically.*

associated directly with the receiver, Models RBB and RBC being the ones most suitable for this purpose at present.

Using the keyboard, it is impossible to transmit by hand with sufficient rhythm and accuracy to attain the full 60 w.p.m. speed limit of the No. 15 TTY. To permit continuous operation at synchronous speed, therefore, a system of machine-transmitting by means of a perforated tape is provided. Although the tape perforator is a built-in accessory to a special No. 15 TTY, it does not impose an upper limit on the speed of the operator as in the case of keyboard hand-sending. The tape may then be transmitted automatically at 60 w.p.m. by a Transmitter-Distributor. The No. 19 set provides these features, and is a complete equipment consisting of an XRT 114 Operator's Table, REC 30 Rectifier, a Transmitter-Distributor, and the No. 15 page-printer equipped with Tape Perforator.

Stations relaying a large amount of traffic would ordinarily be required to make up tapes for all incoming messages that are to be relayed. But this may be done automatically by employing a No. 14 send-receive Typing Reperforator, which simultaneously perforates and types the corresponding characters along the edge of the same tape. This unit is also necessary when using Sigtot or off-line cryptographic devices with TTY systems.

The various standard units described above were designed to offer extreme flexibility in establishing systems to fill all requirements. Transfer panels permit independent use of all parts of every equipment, thus assuring maximum utility for the system. This is illustrated in the block diagram of a typical installation for a large ship. Here the TTY equipment may be patched to operate in any manner required.

## PERSONNEL

The large-scale introduction of shipboard TTY will certainly not make Radiomen unnecessary, although it may often make their work somewhat easier. Radiomen should have no particular trouble in learning to tune and adjust the receivers to give optimum performance. As these adjustments are rather fussy and have to be done more or less scientifically, it is necessary actually to understand the principles involved. Receiving equipment requires rather constant attention, making it imperative that Radiomen remain alert and pay particular attention to details at all times. The TTY printer is almost entirely mechanical in its operation, but requires a great amount of knowledge and skill in order to maintain it properly. The machine is a marvel in perfection of design, and is built to operate continuously and for a lifetime. Regular servicing and adjustment are essential. And it is one piece of gear that you just can't blunder into. Tinkering is out! Practically every

part is provided with adjustments, and many of these must be made with micrometer precision. Many Radiomen will probably go to special schools for a course in TTY maintenance.

The Radio Technician need not be unduly alarmed about the maintenance of the electrical portion of the TTY and associated apparatus, as it does not differ greatly in this respect from other electronic equipments.

## DEHYDRATOR FIELD CHANGE

■ To prevent the compressor from running continuously after the initial duty cycle in the event that the unloader valve fails to close after releasing the pressure from the check valve on the initial air charge, the Bureau of Ships has released the following information to radar personnel using Model 2200/22 Dehydrators:

Removal of the unloader valve from air circuit affects SC/SK/SA/SR installations. No kit is needed.

One 1/4" copper sealing bonnet will be required. These are the steps to follow: 1. Remove the 1/4" copper tubing which extends from the back side of the unloader valve (14) to the bottom side of the air check valve (15), as shown in the figure. 2. Replace the flared-fitting nut on the unloader valve to prevent the thread from becoming burred. 3. Seal off the outlet on the bottom side of the air check valve, which was opened by removing the 1/4" copper tubing, with a 1/4" sealing bonnet and the flared-fitting nut removed in step 1.

With the unloader valve removed from the air circuit, the air check valve will not seat as quickly as before. However, the removal of the unloader valve will prevent the compressor from running continuously which was the result of the unloader valve sticking in the open position.

The above change does not eliminate the possibility of the compressor running continuously should the unloader valve (13) fail to close. Since the unloader valve (13) is necessary to release the working pressure from the compressor on starting, it should be checked periodically to make sure that the valve is closed to the atmosphere when the compressor starts running.

The air check valves should be checked periodically to see that they seat properly.

—E. F. S. G.

