The teletype ETK.

Univocal combination teletype.

A. General considerations.

In principle the transmitting technique of the new apparatus is the same as that of the modern teletype.

Two control shafts at transmitter and receiver function synchronically in start-stop action during one rotation, causing each time the transmission of a character within this synchronous rotation of the control shafts.

Normal teletypes are constructed for very high speeds of 4oo characters a minute, by which an economic utilization of the expensive lines in civil service is ensured. These speeds naturally make heavy demands on technical requirements, with complicated mechanical functions that naturally combine high costs with unusual care and attendance of the machine.

For railway service a small, simply constructed and synoptical teletype is required; this simplification can be obtained by reducing the printing speed to 15o characters a minute.

A particularly important feature for this field of application is that faulty transmission, especially of numerals, by the receiver should be recognized as such. With ordinary teletypes a wrong character is depressed when transmission is disturbed. This defect can be remedied by dissecting the characters into elements, each element being transmitted and printed for itself. It is only the combination of the elements by depression that forms the characters so that in case of disturbance, instead of a wrong character a mutilated one is produced which is at once recognized as such by the receiver.

It seems certain that the combination characters present the most elegant solution of the task in question. The method itself is known from the technics of changeable numerals and characters by which all have to be presented with a minimum number of elements.

To be able to utilize the new teletype not only over galvanically connected lines but also over ordinary post lines with transformers and amplifiers, the apparatus is constructed for selective D.C. or acoustic frequency transmission. In this way an

A. Mosserli, Zürich 530 m · 8 3609

accurate teletype connection can be secured between any two public telephone exchanges, as the range of the ETK teletype is greater than the admissible rest attenuation of the civil telephone lines.

B. Fundamental operational action of the ETK teletype.

1. The combinations.

All the letters and numerals are formed from 14 elements with a maximum of 5 elements for each character. Fig. 1 shows these elements and the formation of the characters by combined depression.

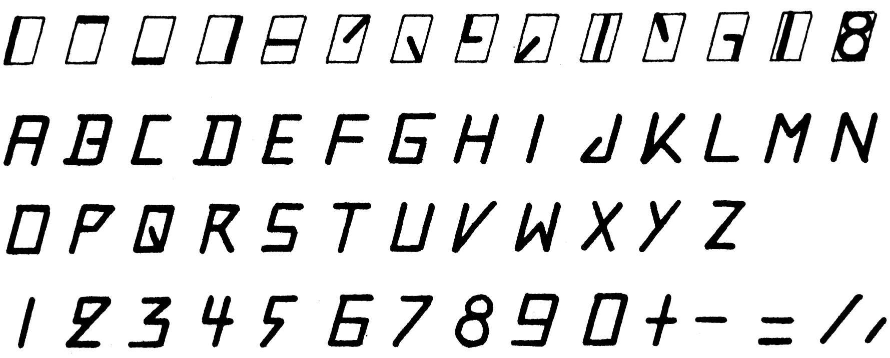

Fig.1

2. Principle of transmission of the characters.

The 14 elements are co-axially arranged to the rotary axis in a drum (type revolver) driven by the control shaft start-stop device. The tape runs transversely to the drum. The selected elements are depressed by a lever when the tape is motionless in order to obtain the required character by combination.

With a view to constant superintendence of the line, transmission is effected by closed circuit. The start of the control shaft of the receiver is induced by a current gap while the stop is effected by a current step at the end of the character combination. This method is already known from teletyping. In our further observations we may simply assume that during a rotation the control shafts of the transmitter and the receiver run synchronically without necessitating our going into technical details.

A. Moserli, Zürich 520 m - N 8610

The element to be depressed for obtaining a certain charater is selected as follows:

The depression of a key starts the control shaft in the receiver and transmitter, and during its rotation all the elements of the type revolver come under the lever in turn.

Release and depression of an element are obtained by a current gap. These current gaps are caused by the control shaft running synchronically in the transmitter with the character of the receiver each time in the position of the control shaft where the elements of the character to be transmitted are lying below the lever, whereby the pressure process of the character elements is controlled from the transmitter with the correct phasing.

Fig. 2 gives a fundamental illustration of the action of the ETK teletype. The drum and the impulse transmitter are represented in divisions from 0 to 360°. All the processes shown in Fig. 2 occur during a rotation of the control shafts so that 0 time corresponds to the start and Tu to the stop of the shaft. The drawing illustrates the transmission of the letter R, for which the elements 1,2,6,7 and 8 have to be depressed.

The depression of the key R starts the synchronous rotation of the receiver and transmitter control shafts. While the drum brings all the individual characters under the lever the feeler of the impulse transmitter running in phase with the drum induces the current gaps required for releasing the pressure process.

The setting of the voltage required for a special character of the 14 elementary segments is accomplished by means of a relay set controlled by the key being depressed at the time.

C. Technical structure of the ETK teletype.

1. General observations.

Each character is transmitted by releasing a characteristic combination of current gaps during one rotation of the control shafts. In Fig. 3 we have the current picture of the letter R. In addition to the current gaps 2,4,8,11 and 13 required for the selection of the elements a start gap and a stop step are provided which release the control shaft for one rotation. The combinations for the letter R from 5 elements are already shown in Fig. 2.

2. Drive.

The ETK teletype is driven by a universal motor which may be fed by a 24-volt battery or via a transformer from the A.C. network. The number of revolutions of the motor is kept constant by a centrifugal switch.

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3. Transmitter.

When a key is depressed the transmitter starts the machine and transmits the required combination of current gaps to the line. This is accomplished by utilizing 3 members: 1) key, 2) relay set, 3) impulse transmitter in the shape of a collector with 16 divisions.

Every character has its own key. The shift key required with the ordinary teletype is unnecessary, thus simplifying attendance.

The relay set consists of 15 small, simple relays, 14 of which are for the character elements and one for the starting current gap.

The key is diagrammatically illustrated in Fig. 4; it is uniform in shape and construction for all the characters. Only the required contacts are connected at a time.

When a key is depressed the relays corresponding to the character elements (1 to 5 according to the letter) and the relay A for the starting gap are operated. All the relays have rest contacts inserted into the impulse transmitter with 16 divisions (Fig.5). The switching of relay and keys is seen in Fig. 6 on which, however, only the key for R is fully illustrated.

The key is automatically held in its depressed position till the character has been transmitted; all the other keys are locked during this time.

4. Receiver.

The function of the receiver is to depress the elements of a character during a rotation of the control shaft and to convey the tape one step forward after depression.

The current gaps induced by the transmitter control the receiving magnet E which releases the printing mechanism when dropped in a current gap and thus prints the character element arranged in this gap. After each fall of the lever caused by a current gap it is again mechanically brought to the magnet system so that when the closed circuit is subsequently interrupted the lever remains tight and the element lying below it is not printed. If the closed circuit is again interrupted the receiver magnet lever drops and another character element is printed.

After a rotation the control shaft is checked by the stop pin and the tape moved forward by 1 division, thus releasing the receiver for the reception of the next character.

5. UV univocal transmission.

The fundamental structure of the switching for UV service is shown in Fig. 7. The carrier frequency is 1500 cycles. The amplifier supplies all the voltage requireds for driving

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the machine. The change over form D.C. to UV service can be accomplished by simply throwing a switch.

6. Current feed.

The apparatus can be fed, as required, either from the A.C. network or a 24-volt battery. The driving motor is constructed as rotary converter and supplies the line voltage of 60 volts for battery drive.

7. Pratical design of the ETK teletype.

Photo 1 is a total view of the machine. The keyboard in front is similar to that of an ordinary typewriter. There is no need to shift from letters to numerals, which facilitates attendance as compared with ordinary teletypes.

The tape control lamp is seen above the keyboard; it shows a light when a new roll has to be inserted.

The tape leaves the machine at the back on the left. A panel window enables the printed characters to be checked at once on the type revolver.

Photo 2 is a side view of the machine. On the right is seen the contact spring sets for tensioning the impulse transmitter; on the left is the control shaft with impulse transmitter, slide coupling, driving wheel, type revolver and paper feed.

Photo 3 gives an excellent view of the control shaft with impulse transmitter collector and feeler, the printing mechanism with type revolver and the paper transport with paper roll. Between the keyboard and the control shaft is seen the bolt nose which is operated from the control shaft.

Zurich (Switzerland), April 12th, 1945.

DR. E. GRETENER
INGENIEURBUREAU
Kornhausbrücke 3 · Zürich

A. Messerli, Zürich - 520 m - S 361

Fig. 2

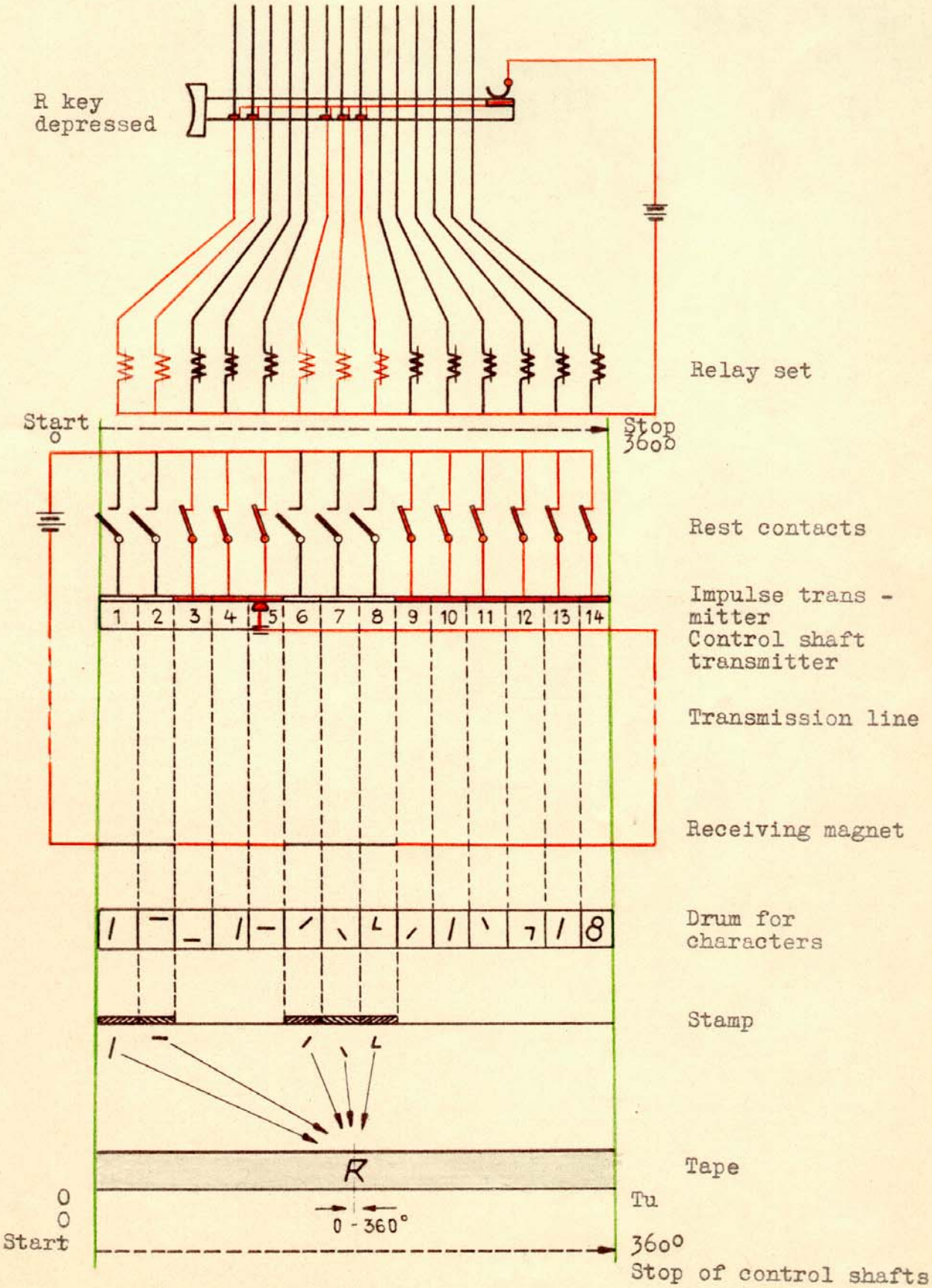

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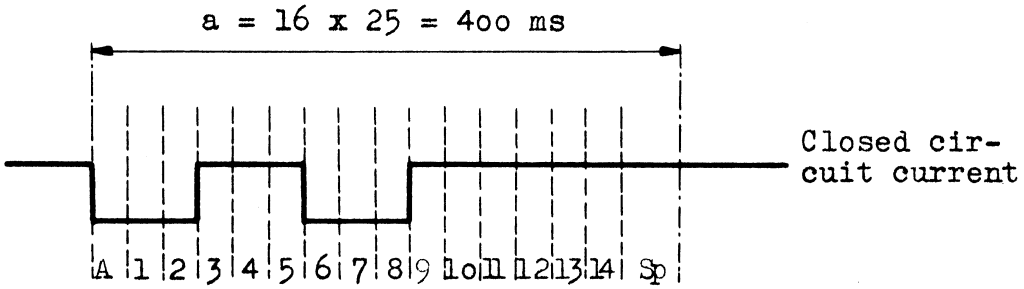
Fig. 3

Current picture of the letter R.

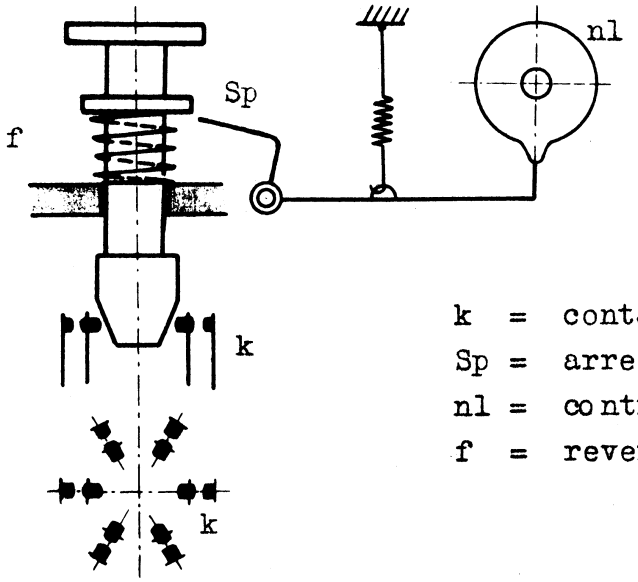


a = Total length of a character
A = Starting current gap
1-14 = Current steps of the character elements
Sp = Arrest step

The total length of a character was 1947 changed to 200 ms

Fig. 4

Uniform key with lock



k = contacts
Sp = arresting rail
nl = control cam for the arresting rail
f = reversing spring

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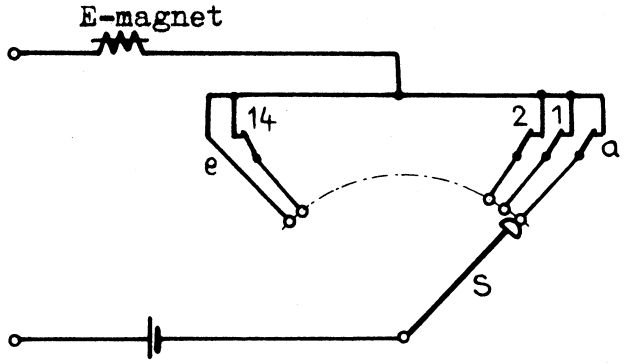
Fig. 5

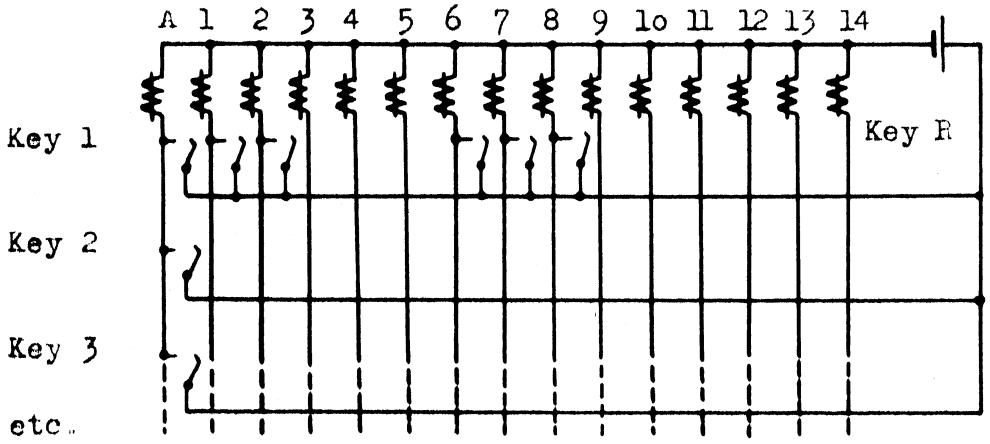
Switching of the impulse transmitter (for closed circuit current)



a = starting current gap
1-14= steps for the 14 character elements
e = contact of blocking step
S = switch arm of transmitter

Fig. 6

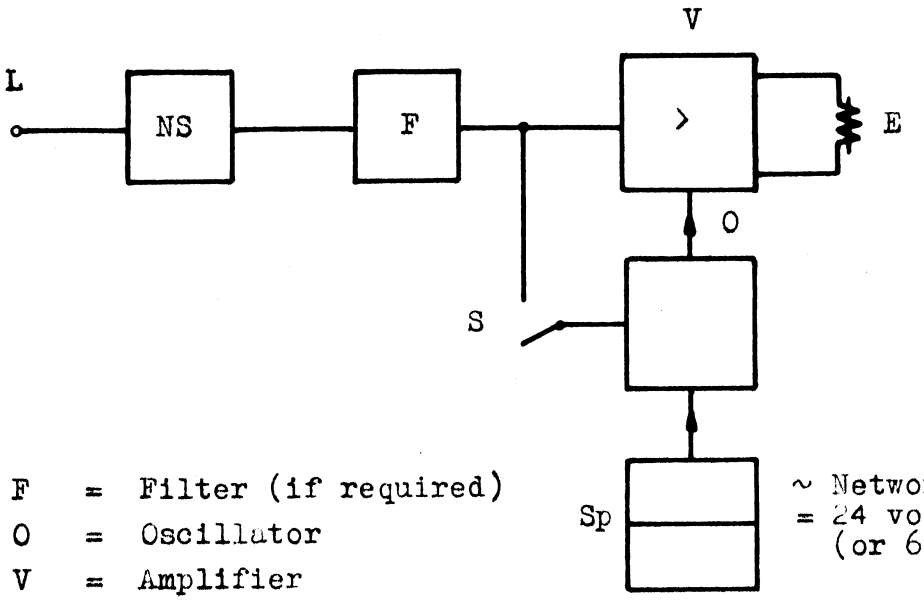
Arrangement of relays and keys



A = relay for starting current gap
1-14 = relays for 14 character elements

Fig. 7

Total switching for UV service



F = Filter (if required)
O = Oscillator
V = Amplifier
L = Transmitting line
NS = Numeral switch
Sp = Feeding apparatus
E = Receiving magnet
S = Transmitter contact

DR. E. GRETENER
INGENIEURBUREAU
Kornhausbrücke 3 · Zürich

A. Mosmerli, Zürich - 500 m - 8 8610