

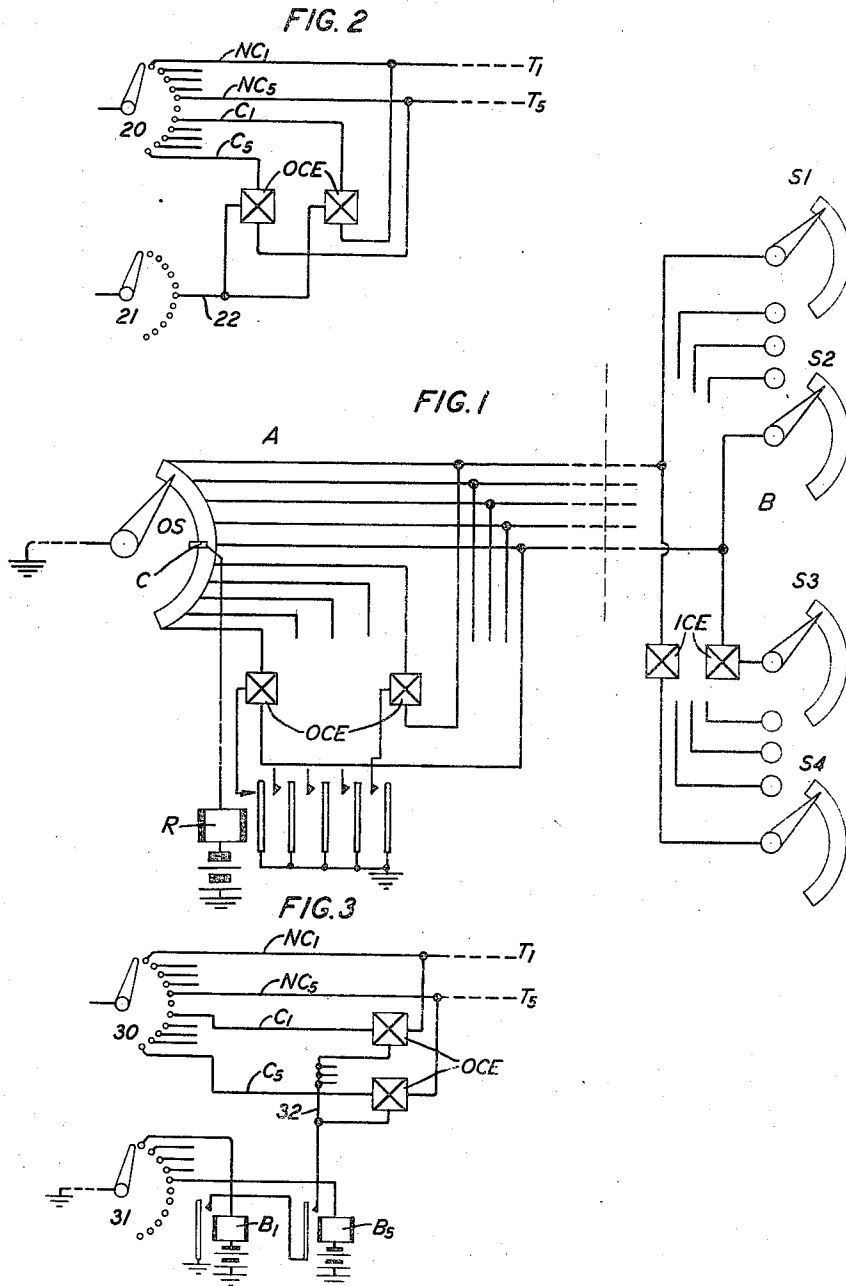
Nov. 29, 1938.

E. A. BROFOS

2,138,594

TELEPHONE SYSTEM

Filed Jan. 7, 1936



INVENTOR  
E. A. BROFOS  
BY *Wm. D. Fenney*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,138,594

## TELEPHONE SYSTEM

Einar A. Brofos, London, England, assignor to  
Western Electric Company, Incorporated, New  
York, N. Y., a corporation of New York

Application January 7, 1936, Serial No. 57,915  
In Great Britain January 18, 1935

## 6 Claims. (Cl. 179—18)

This invention relates to trunking systems and particularly to automatic and semiautomatic telephone or telegraph systems.

The object of the invention is to increase the efficiency and economy in operation of automatic and semiautomatic trunking systems.

The invention consists broadly in providing a trunking arrangement in which carrier channels become available for use when all of the non-carrier channels are busy.

According to a feature of the invention, a switching device prepares the carrier channels in a group of trunks for use when all or nearly all of the non-carrier channels are engaged. The carrier equipment thus made available for use may be either single channel or multichannel carrier equipment.

A feature of the invention is a trunk selecting arrangement in which carrier channels are provided over the trunks of a group and in which all of the non-carrier channels of these trunks are first choice with respect to carrier channels.

Another feature of the invention is a trunk selecting switch in which a switching device is actuated upon the wipers having tested all or nearly all of the first choice outlets and before the wipers begin testing of overflow outlets, the switching device being effective to make the overflow outlets available for use.

The drawing which forms a part of this specification illustrates schematically a portion of a telephone system in which the invention is embodied. Referring to the drawing,

Fig. 1 represents a rural automatic telephone exchange A, another automatic exchange B, and a group of trunks for use on calls from exchange A to exchange B, each of the trunks being arranged for carrier operation;

Figs. 2 and 3 show alternative arrangements for rendering the carrier apparatus operative.

In the system shown, a group of five trunks is provided for extending calls from exchange A to exchange B, each trunk being represented by a single conductor. By the provision of carrier apparatus OCE in office A and carrier apparatus ICE in office B, each of the trunks may be used to complete, at one time, two different conversational connections; the trunk constitutes in one connection a carrier channel and in the other connection a non-carrier channel for the transmission of voice currents. The ten channels thus afforded by the five trunks are connected in office A to a group of terminals in the bank of a selector switch OS and to corresponding groups of terminals in the banks of other selec-

tors similar to OS. Each of the selectors comprises a plurality of wipers and an electromagnetically controlled stepping mechanism for advancing the wipers into engagement with an idle set of terminals in a desired one of a plurality of groups of terminals. While only one wiper and one terminal arc, consisting of the single terminal C, are visible in Fig. 1, it is, of course, understood that the switch OS includes the other wipers and the other arcs, to the terminals of which the talking conductors of the ten channels are separately connected. The conductors of each of the five trunks are connected directly to the first five sets of terminals in the group and are connected through the individual carrier equipments OCE to the next five sets of terminals in the group. Thus, the non-carrier channels are all first choice with respect to the carrier channels; and a carrier channel will not be selected by any of the selectors OS unless all of the non-carrier channels are busy. In office B, each of the trunks is connected to two selector switches, one for completing a connection over the non-carrier channel and the other for completing a connection over the carrier channel. The selectors S1, S2 for use in completing non-carrier channel connections are connected directly to the trunk conductors, and the selectors S3, S4 for use in completing carrier channel connections are connected to the trunk conductors through the individual carrier equipments ICE. Each of the selectors S1, S2, S3, S4 also comprises a plurality of wipers and an electromagnetically controlled stepping mechanism for advancing the wipers into engagement with an idle set of terminals in a desired one of a plurality of groups.

Since the five non-carrier channels are first choice with respect to the five carrier channels, the carrier equipment may normally be inert, thereby preventing unnecessary consumption of energy. It is, of course, well known that the heating elements of thermionic devices associated with a carrier channel must be energized and that there is an appreciable time after closing of the energizing circuit before these devices become operative. If then the carrier equipment of a channel is not energized prior to selection of the channel, there is an undesirable delay after selection before the channel is of any use. To eliminate this delay without causing an unnecessary increase in the energy consumed, the thermionic devices of the carrier channels are energized before selection but not until all of the first choice non-carrier channels are busy.

When any selector OS advances its wipers to the fifth set of terminals, one of the wipers (which wiper is visible in Fig. 1) engages contact C and closes a circuit for operating relay R; and relay R closes ground connections for rendering the carrier equipments operative prior to selection of a carrier channel by any of the selectors having access thereto.

In the arrangement shown in Fig. 2, the talking conductors of the five trunks T1, T5 are connected directly to the first five sets of terminals of arcs 20 to form non-carrier channels NC1, NC5 and through the individual carrier equipments OCE to the last five sets of terminals to form carrier channels C1, C5. No channels are connected to the one or more sets of terminals between the last set used for non-carrier operation and the first set used for carrier operation, but the sixth terminal of the control arc 21 is connected to each of the carrier equipments OCE; so that, as soon as any hunting one of the selectors having access to this group of ten channels finds all of the non-carrier channels busy and the control wiper 21 is advanced to the sixth terminal, a circuit is completed over conductor 22 for preparing the carrier equipments OCE for use prior to engagement of the wipers of arcs 20 with the set of terminals to which the first carrier channel C1 is connected.

The arrangement shown in Fig. 3 is similar to that of Fig. 2 except that busy relays B1 to B5 are provided, one for each of the non-carrier channels. Upon seizure of each of the non-carrier channels and as long as the channel is busy, the associated busy relay is operated in a circuit through the wiper of the arc 31 of the seizing selector. With all of the non-carrier channels busy, all of the busy relays B1, B2 will be operated thereby closing a circuit over conductor 32 for preparing the carrier equipments OCE for operation. When once seized, each carrier channel may be arranged to continue its own energization, until the conversation is completed and the channel released, even though one or more of the busy relays have in the meantime been released due to release of the associated non-carrier channel.

What is claimed is:

1. In a trunking system, a group of trunks, a carrier and a non-carrier channel over each trunk, and means for automatically making the carrier channels available and ready for use only when all of the non-carrier channels are busy.

2. In a communication system, a group of trunks, a carrier channel and a non-carrier channel over each of said trunks, and a trunk selecting switch arranged to prepare the carrier channels for use and select an idle carrier channel

only if all of the non-carrier channels are busy the preparation of said carrier channels for use being prior to selection of a carrier channel.

3. In a communication system, a group of trunks, a normally inert carrier channel and a non-carrier channel over each of said trunks, a trunk selecting switch comprising a set of wipers and an associated bank of terminals, said channels being connected to the terminals of the switch so as to give the wipers access to all of the non-carrier channels before giving access to the carrier channels, and means associated with said switch and operative before the wipers of the switch engage the terminals of the first carrier channel for energizing said carrier channels.

4. In a communication system, a group of trunks, normally inert carrier equipment associated with each of said trunks, a carrier and a non-carrier channel over each trunk, a hunting switch comprising a set of wipers and an associated bank of terminals, said channels being connected to the terminals so as to give the wipers access to all of the non-carrier channels before giving access to the carrier channels, and switching means effective when all of the non-carrier channels are busy for preparing the carrier channels for operation, the preparation of said carrier channels for operation being prior to selection of a carrier channel by said switch.

5. In a communication system, a group of trunks, normally inert carrier equipment associated with each of said trunks, a carrier and a non-carrier channel over each trunk, a hunting switch comprising a set of wipers and an associated bank of terminals, said channels being connected to the terminals so as to give the wipers access to all of the non-carrier channels before giving access to the carrier channels, and switching means rendered effective by the wipers of said switch after testing all of the non-carrier channels and before reaching the first carrier channel for preparing the carrier channels for operation.

6. In a communication system, a group of trunks, normally inert carrier equipment associated with each of said trunks, a carrier and a non-carrier channel over each trunk, a switch for selecting an idle one of said channels, all of the non-carrier channels being first choice with respect to said carrier channels, a relay associated with each non-carrier channel for operation upon seizure of the channel, and means comprising contacts of all of said relays for energizing the carrier equipment associated with the carrier channels.

EINAR A. BROFOS.