TWO-WAY EXPERIENCE WITH DIAL-A-PROGRAM AT DENNIS PORT

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In the hub type network of Dial-a-Program the requirement for two-way transmission of data, voice or vision is met in a very simple and straight forward manner. Indeed, Dial-a-Program is potentially a complete communication network carrying not only television programs in the ordinary sense but telephone and full band width picturephone as well. Figure 1 shows the general arrangement for the distribution of television programs. Subscribers select their desired program from those available at the program exchange by remote control. All vision signals are carried in the channel 3-9 MHz on identical phase locked carriers. Each subscriber is connected to the exchange by means of two balanced pairs in a multipair cable of special construction known as Qwist(TM). A cross section of these two pairs is shown in Figure 2 where a comparison is also given of the three pairs of telephone cable which are required for the narrow band picturephone service. The larger pair in the Qwist unit carries the television program and the smaller pair, which has a usable band width up to about 3 MHz, may be used in various ways. In the simplest case it is used only for the control signals which operate the selector switch in the exchange.

Two-way for Voice

The next step is to use it also for telephone purposes as is being done in the Dial-a-Program system now being installed in the Health Sciences Communications Center of Case Western Reserve University at Cleveland, Ohio. A change-over relay is fitted both at the subscriber and exchange ends of the smaller pair, which simply transfers the circuit to the telephone instrument at the subscriber's end and the internal telephone exchange at the other end whenever the circuit is not being used for the control of the vision selector switches. The transfer is automatic and vision selection is given priority so that as soon as the dial is moved off normal for vision selection the circuit is transferred for the purpose. The arrangement is shown in Figure 3.

Sharing the circuit in this way for one purpose or the other is quite satisfactory in many cases, particularly where the telephone is being used as an adjunct to the television pictures in an educational situation such as that at Case Western Reserve University. In other circumstances, for example where Dial-a-Program is used as a universal communications network in a new community, such sharing would be unacceptable and the smaller pair can be allocated exclusively to the telephone. At some slight additional cost the control signals for the vision selector switch can be combined with the vision signals on the larger pair and this has been on demonstration on one subscriber's connection at Dennis Port.

The community network might then be arranged as in Figure 4. The diagram shows the telephone pairs as taken right back to a conventional telephone exchange but the layout fits in well with proposals to use digital signals for the telephone. Conversion to digital form can conveniently be carried out at the wide band program exchanges and the telephone signals for a group of subscribers can be concentrated together and then carried over a single circuit in the wide band trunk routes. Combination of the two services, telephone and cable television, in this way does, of course, have a very favourable effect on the economics.

Two-way for Vision

The larger pair in the Qwist unit is usable up to about 16 MHz without too much difficulty from crossview. As the 3 to 9 MHz is used for outward transmission of vision signals, this leaves the channel 9 - 16 MHz available for inward transmission. Since in the ordinary way there are no amplifiers between the exchange and the subscriber, one may go to any outlet on the system and plug in a camera or other source, modulate the signal on to 16 MHz carrier and send it back to the exchange.

At the exchange the return signals are separated out by high and low pass filters, their frequency is changed to the standard 3 - 9 MHz channel and they are then available for application like any of the other signals, to one of the exchange bus-bars and for transmission over one circuit in the multi-coaxial cable which forms the trunk route between exchanges. Where the number of subscribers requiring to use the two-way vision facility simultaneously is few, problems with crossview, due to beats between their respective carriers will be unlikely to arise and it is sufficient to use a reasonably stable oscillator as the carrier source and a demodulator-modulator at the exchange end. This is the arrangement, which has been on demonstration for the past year at Dennis Port, Cape Cod, is shown as a block diagram in Figure 5. The sound signal generated at the subscriber's premises may be carried in various ways but the simplest is to send it back using the audio frequency base band as shown in Figures 5 and 6.

When it is probable that two subscribers whose circuits are contained within the same 6 Qwist cable will require two-way transmission at the same time, then it is necessary that their carriers should be locked together. To achieve this the arrangement shown in Figure 6. is adopted. The master oscillator which we will assume for the moment is located at the local exchange, provides the carrier at roughly 8 MHz which is used for all outgoing channels. A tapping is taken from this source and the frequency divided by four to give a signal at about 2 MHz which is filtered to get rid of harmonics and applied to a hybrid transformer unit which is plugged into the subscriber's circuit when he requires two-way transmission. The 2 MHz pilot signal is sent out over the larger pair of the Qwist being multiplexed with the go and return vision signals also on that pair. At the subscriber's end the 2 MHz pilot is filtered and out multiplied by eight to give the return signal carrier at 16 MHz approximately.

When this signal is received at the exchange it is mixed with the third harmonic of the 8 MHz master oscillator to give a 40 MHz intermediate frequency and this in turn is mixed with the harmonic and a modulated 8 MHz signal results which is phase locked to the other channels and is ready after amplification for application to one of the bus-bars. Equipment operating on this principle will be installed later this year at Case Western Reserve University.

REDIFFUSION DIAL-A-PROGRAM LOCAL DISTRIBUTION NETWORK FOR TV GENERAL ARRANGEMENT

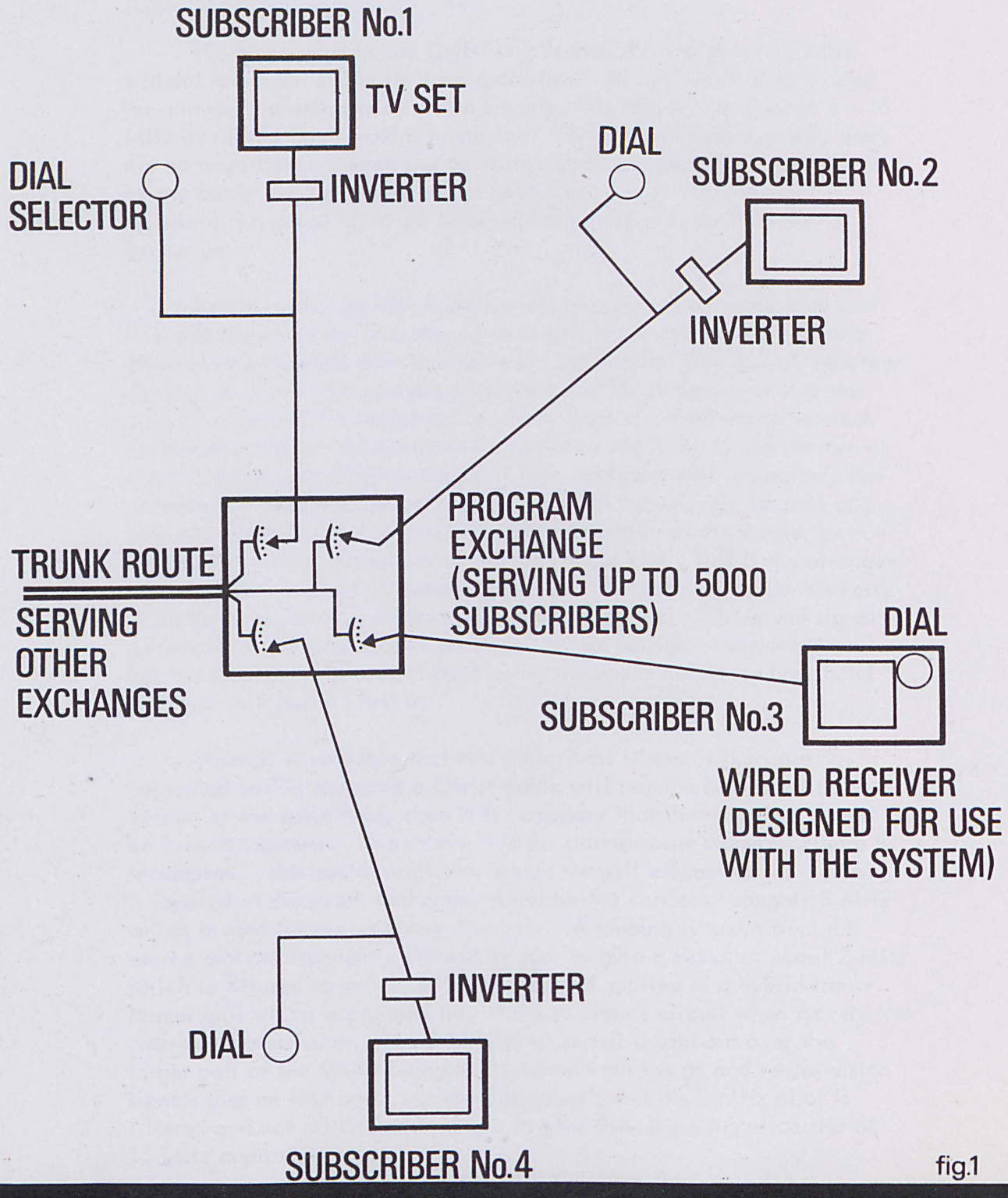
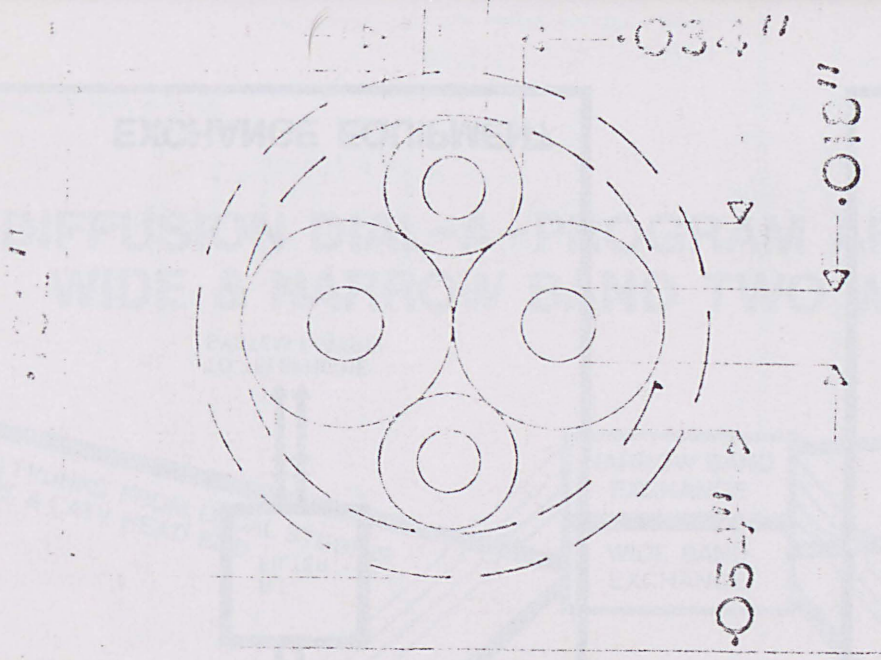


fig.1

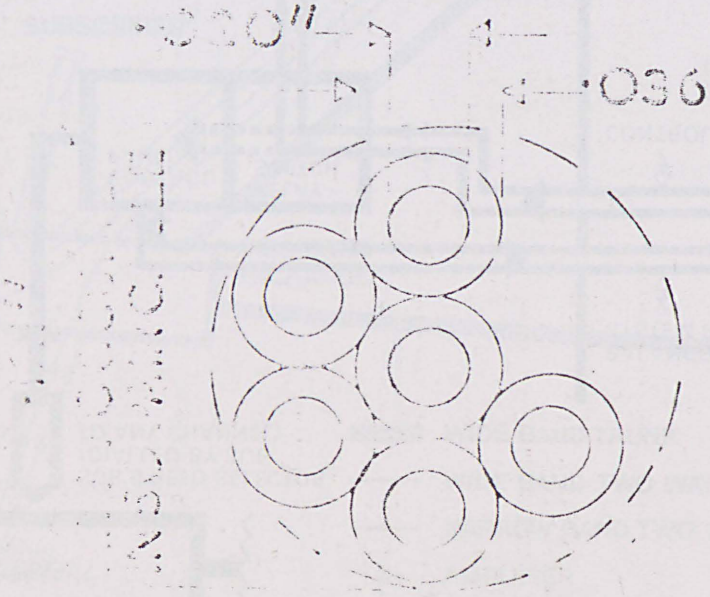


REDIFFUSION QUIST CABLE

USABLE UP TO 15 MHz.

ATTENUATION 1·55dB/100FT. AT 10MHz

PRICE AS 1/6 PART OF SHEATHED 6 QWIST (12 PAIR CABLE) CA 165 1·4 CENTS/FT.



BRITISH POST OFFICE TELEPHONE CABLE CW1280.

3 PAIRS AS USED FOR VIDEOPHONE.

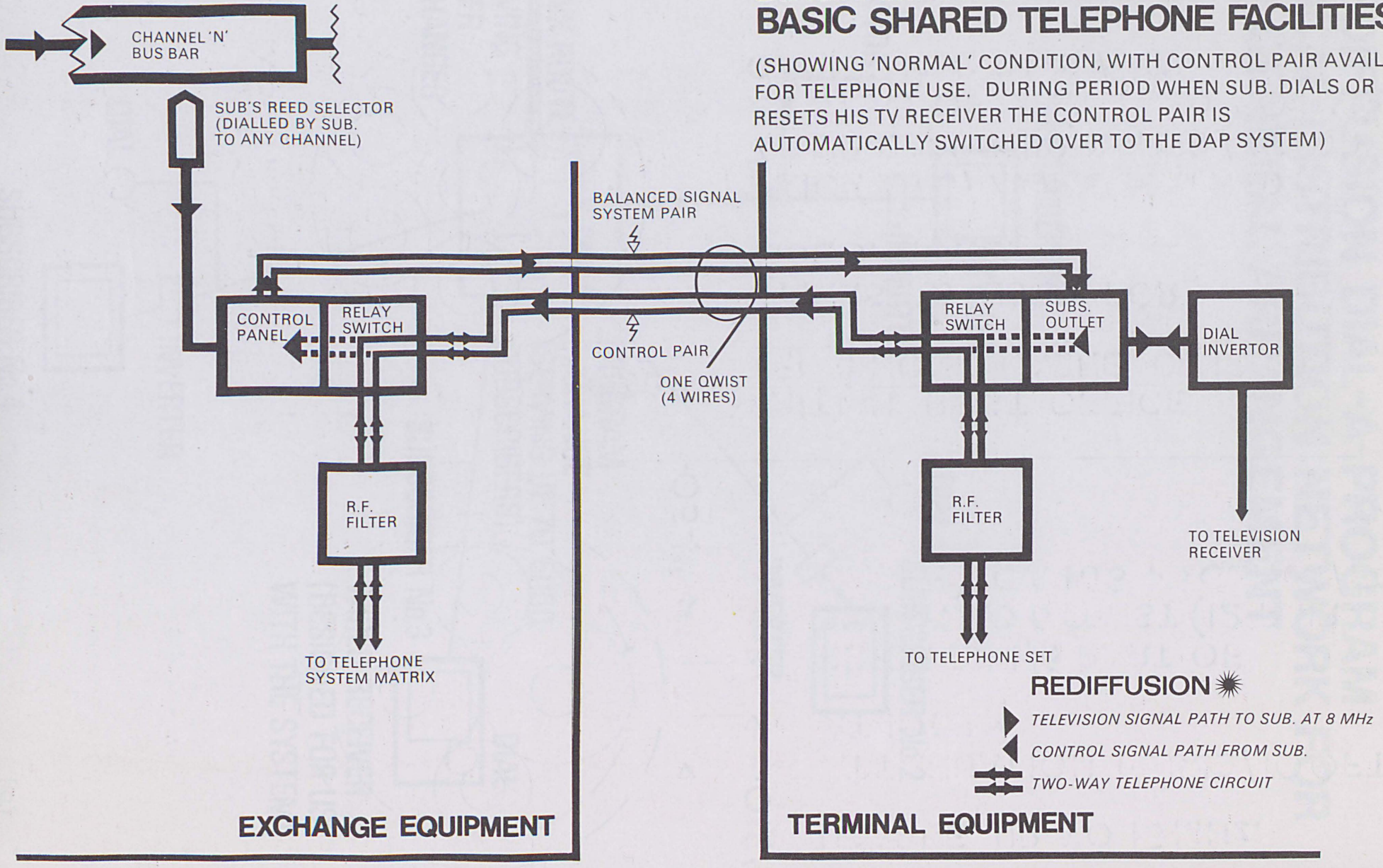
PRICE AS 3/7 OF SHEATHED 7 PAIR CABLE 1·9 CENTS/FT. OR AS 3/50 OF SHEATHED 50 PAIR CABLE 1·9 CENTS/FT.

CABLE CROSS SECTIONS AND PRICES COMPARED

Fig. 2.

DIAGRAMMATIC REPRESENTATION OF BASIC SHARED TELEPHONE FACILITIES

(SHOWING 'NORMAL' CONDITION, WITH CONTROL PAIR AVAILABLE FOR TELEPHONE USE. DURING PERIOD WHEN SUB. DIALS OR RESETS HIS TV RECEIVER THE CONTROL PAIR IS AUTOMATICALLY SWITCHED OVER TO THE DAP SYSTEM)



REDIFFUSION DIAL-A-PROGRAM ARRANGEMENT FOR COMBINED WIDE & NARROW BAND TWO WAY SWITCHED NETWORK

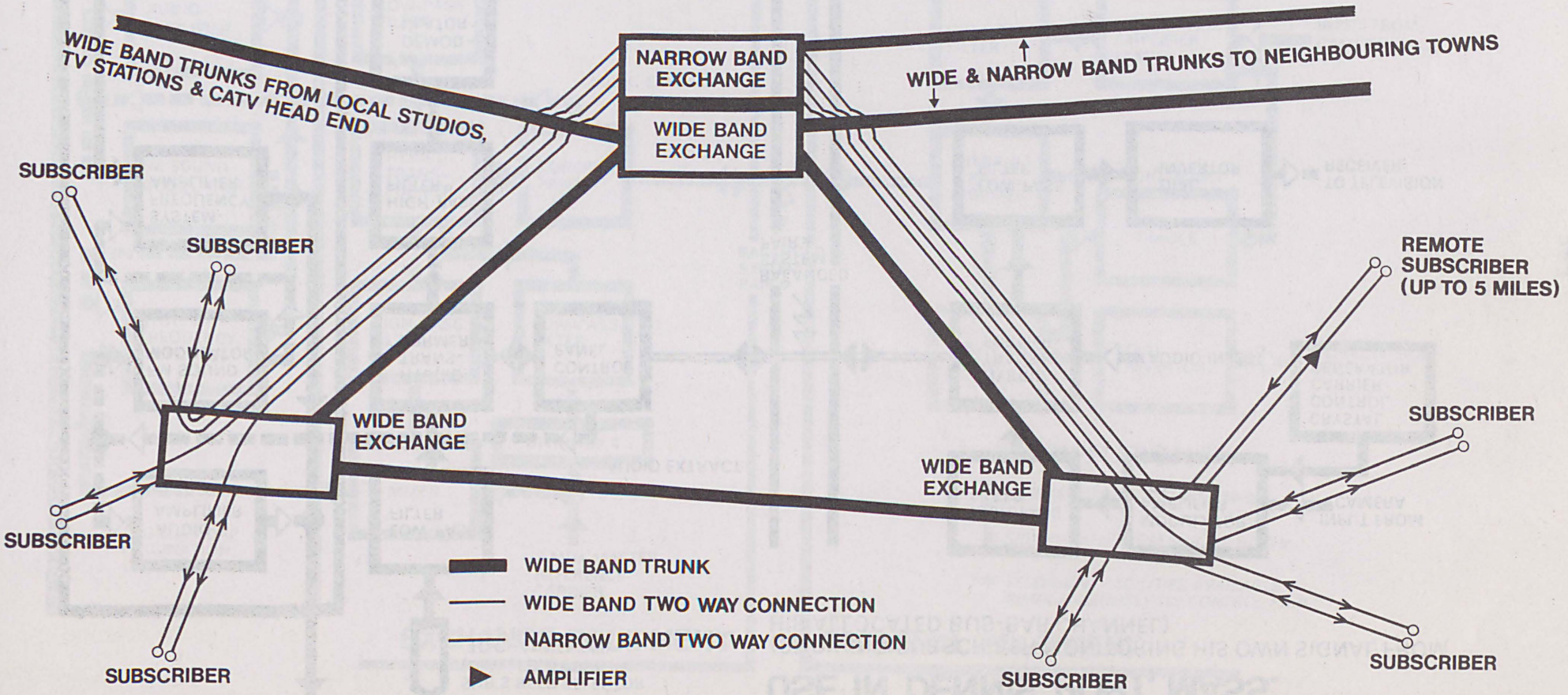


Fig. 4

DIAGRAMMATIC REPRESENTATION OF PROTOTYPE TWO-WAY SYSTEM IN USE IN DENNIS PORT, MASS.

(SHOWING SUBSCRIBER MONITORING HIS OWN SIGNAL FROM HIS ALLOCATED BUS-BAR CHANNEL)

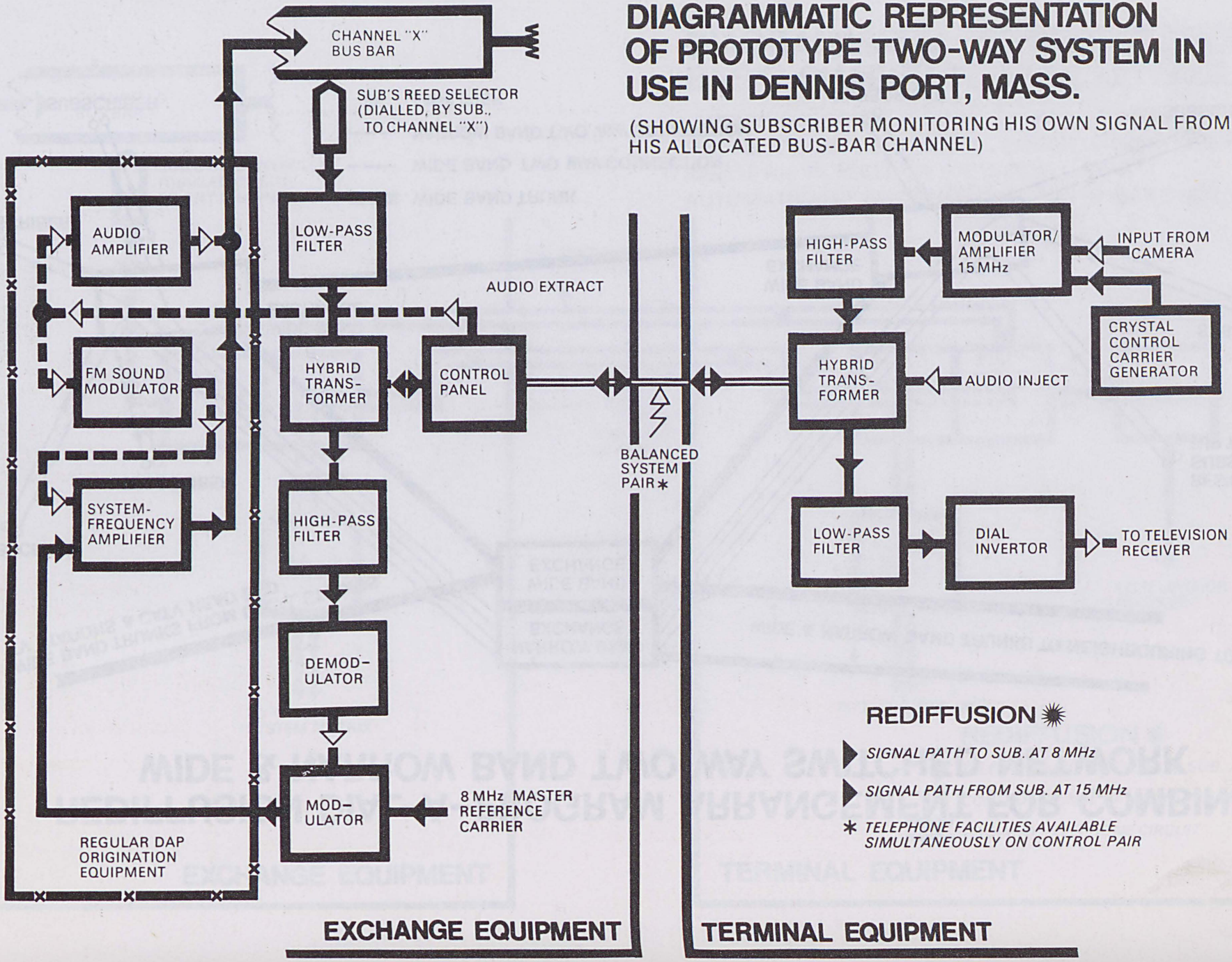


FIG. 5.

DIAGRAMMATIC REPRESENTATION OF FINAL SYNCHRONOUS TWO-WAY SYSTEM

(SHOWING SUBSCRIBER MONITORING HIS OWN SIGNAL FROM HIS ALLOCATED BUS-BAR CHANNEL)

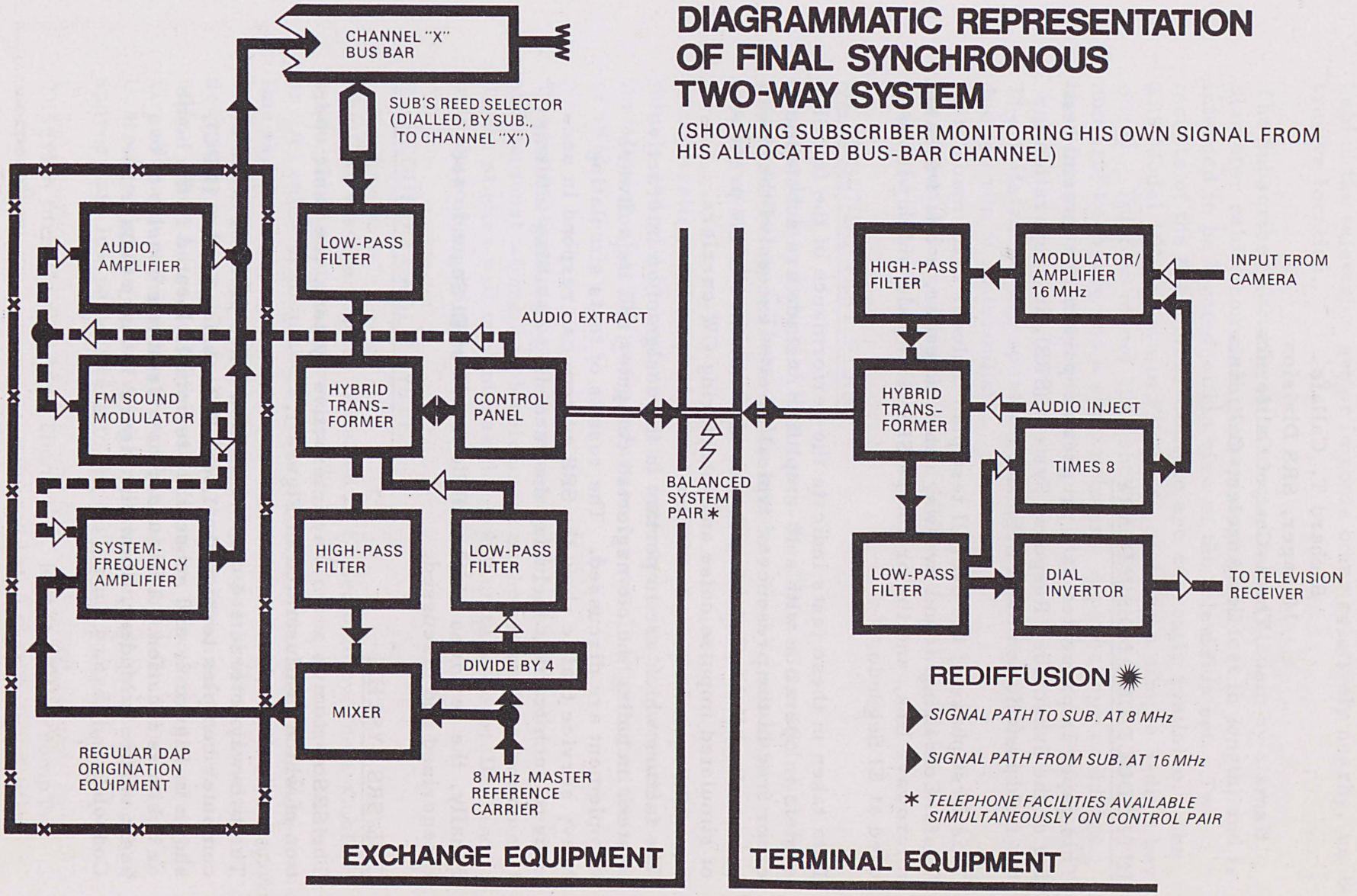


FIG. 6.