In the case of the next speaker, however, we will attempt to have a question and answer period after his discourse, and if you have questions to put to him, I would very much appreciate your using the floor microphones which are spotted around at various locations.

As our world grows smaller and our CATV industry grows larger, it is important that we be familiar with what is happening in CATV outside our country. We are particularly fortunate today to have with us a man who can give us from intimate experience a picture of techniques being used in the United Kingdom and in Western Europe, and a glimpse into the future as he sees it from his vantage point.

He is an American abroad, and it is a real pleasure to introduce to you Mr. J. R. (Jack) Evans, Managing Director of Teleng Limited in England. He will speak on "The Advance of CATV Techniques in Europe".

MR. J. R. EVANS: Thank you very much, Bill. I am extremely pleased to be here this week at the NCTA Convention and am honored to have the opportunity to address this session. The growth of CATV Systems in the United States has been quite remarkable over the last few years, and now, after meeting so many of you for the first time this week, I am not at all surprised with the results you are obtaining.

In Great Britan today, anyone doing anything unusual or out of the ordinary in the Telecommunications field is likely to be labelled a "pirate". You have undoubtedly read of the famous pirate ships broadcasting off our shores. Although these pirates have been attacked by the Government, the BBC, (which is a power unto itself), and recording Companies, to name only a few, the service they are providing is in great demand and a force has been created too strong to combat. The Government is now trying to make local broadcasting legal, the BBC is rallying its forces in an effort to meet this demand of local broadcasting, and at the same time subdue all competition. I have not heard what action the recording Companies are taking; however, I imagine they have shuttle boats delivering records to destinations on the high seas.

CATV operators in Europe have at many times in the past found themselves in the same boat, in that they have had to set the pace and virtually force advancement through. The only thing is that CATV operators have been called worse names than "pirates". Actually, there are CATV systems operating in Europe today in countries whose laws forbid these operations. I shall not refer to these systems specifically for fear of promoting a "buccaneers scrimmage" prematurely.

The theme of today's session is "Look Ahead", and I am to tell you of "The Advance of CATV Techniques in Europe". This is of course a vast subject, and I could not even outline the major headings involved in this very specialized industry in the few minutes available to me. Therefore I shall limit my remarks to the general overall picture of the industry today in the light of what has been done, and what we shall be doing in the future.

In order to understand present CATV operation in Europe, we must first briefly look back into history and this will be confined really to English history. CATV systems on the European Continent have only been erected during the last few years which I will explain and come to later.

Relay began in England in the early 1920's. One of the first systems to be installed was in Lytham St. Annes in 1922, and radio programmes were distributed over pairs of wires. Radio relay systems sprung up all over the country in areas of poor radio reception and by 1939 there were approximately 500,000 subscribers being served. Expansion ceased during the war, but it is interesting to note that these systems played an important part in the early warning in cities such as London.

After the war when television became available, the same areas of poor recep-

tion for radio were equally poor for television. The existing operators were faced with the new problem of distributing T.V. and new thinking and ingenuity had to be applied. You must visualize that these operators had miles of cables erected which represented very large investments. The natural approach was to develop a system to include provision for television which would fit in with the existing networks as much as possible. The H.F. (High Frequency) system was evolved.

Very briefly the technique used in this system is as follows: Normal off air T.V. broadcast signals are demodulated. The video signal then remodulates an H.F. carrier and distributed on a pair of wires, the accompanying sound signal being impressed on the same pair, but at high level audio frequency. Each channel therefore demands a pair of conductors and these are usually provided in the form of a multi-pair cable. Special television terminal units are required to receive these signals and standard domestic T.V. sets can only be used if modified, or by the attachment of special frequency conversion adaptors.

The H.F. system has been developed to a great extent over the years and the technical as well as the commercial achievements can only be admired.

However this is only one of the two basic types of distribution systems in Great Britain today. The other is the coaxial type of CATV, known as the VHF (Very High Frequency) system, which follows essentially the same technique which has always been employed universally by you in this Country. I am associated with the latter.

VHF systems were first installed in England in 1951. Growth in the use of VHF techniques has been steady, and today there are over 200 systems in operation. The majority of these are considered small, i.e. less than 10,000 houses wired but there are a number of systems with 20,000 - 25,000 houses wired. In this figure of 200 quoted, I am not of course including the many hundreds of small housing estates which are wired and are not licensed by the Post Office.

Until recently this VHF camp had not been exploited by large capital interest as had the HF camp, but the gap is more than being made up.

So - we have two types of systems in Great Britain, the HF and the VHF. The total number of Television relay subscribers is approximately 670,000 and HF type systems predominate in subscriber numbers at present. However, in recent years the swing has been towards the VHF system, and I am confident that the terrific expansion of the CATV industry, which is just upon us in Europe, will be via VHF techniques. (Incidentally it is of interest to mention here that in addition to TV subscribers, there are still approximately 900,000 sound radio relay subscribers only. These numbers are however, decreasing rather than increasing annually).

I believe that VHF techniques will obviously become the standard distribution method in Europe. Experts have written lengthy theses for both camps and books have virtually been written promoting the arguments of both sides. But it is essentially a local argument, politically and capitally loaded and except for establishing the present position of CATV in Great Britain, as I have tried to do, this need not be further developed by me here.

Leaving the British scene for a moment we can now look at Europe. CATV operation as I mentioned earlier, is very new.

There have been a number of radio relay systems operating for years, but until four years ago, only a few limited attempts were made to distribute television via cables, and these were not a great success generally because of immature technical application, but also we must consider here that television popularity is far behind what it is in the United States and in Great Britain. The variety of programs is limited and the number of homes with a television set are relatively few. Even today homes with television receivers are only 20% - 30% of the total in most large cities.

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Mountain Home, Ark.
Munising, Mich.
Myrtle Beach, S. C.
Ocala, Fla.
Ottawa, Ill.
Salisbury, Md.
Shippensburg, Pa.
Stamford, N. Y.
Stamford, Texas
Streator, Ill.
Tallahassee, Fla.
Tyrone, Pa.
Wheatland, Wyo.
Wilmington, N. C.

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However, the first successful multi-channel VHF system to be installed in Europe was erected in Namur, Belgium, by Coditel. Today there are three such systems in Belgium. The other two are in Liege and Verviers. The three systems are now distributing to some 10,000 subscribers, (5) five TV programs of four different transmission standards, and up to 32 FM radio programmes, over quite extensive coaxial networks, reaching up to six miles or more. An indication of the channel reception and distribution is given in SLIDE I.

Slide One

Subscriber's receiver			Stations received by CODITEL		
Television programmes	Channel selector switch position	Standard	Name	Band	Channel
Belgian Fr.	8	Belgian 819 / Belgian 625	WAVRE ... or LIEGE	III / I	8 / 3
Belgian Fl.	10	Belgian 625	WAVRE ...	III	10
French * ...	12	Lille 819 ...	LILLE	III	F8A
Dutch	4	Europe CCIR	ROERMOND	III	5
German ...	2	Europe CCIR	AIX or ... ... LANGENBERG	IV / III	24 / 9

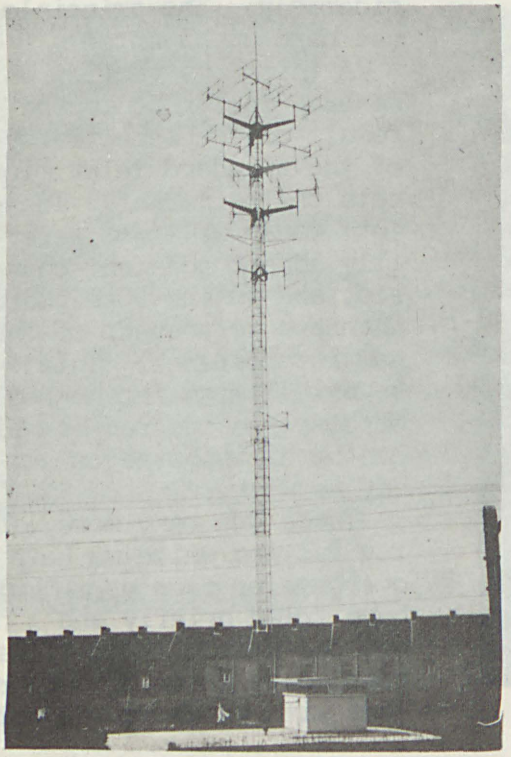
* Without any guarantee, according to propagation conditions.

The system, the equipment, and all associated equipment used were entirely developed and supplied by my Company.

Coditel have also installed a small system in Tramelan, Switzerland, and are expanding in that country, and now beginning to install a system in the town of La Chaux de Fonds. This virtually is the CATV operation in Europe and brings us up to date giving the brief background history.

To round off the general overall picture, I must now say a few words with regard to the practical application of CATV operation, because it is completely different from the applications used in your country. It is important to realize that these determining factors demand an entirely different concept.

Slide Two



As I have just shown on SLIDE I, we are faced with a number of different standards - 405, 625,819, line band widths ranging from 4 to 14 mc/s, positive, and negative modulation, AM & FM sound. These variations all add to the complexity of system design.

From the physical aspect of the wiring, our respective problems are worlds apart. In Europe the CATV operator receives a concession from a Local Authority, and tied to this concession are many restrictions with regard to the construction and erection. Street crossing are limited, (and in many places they must be underground), spans via poles or umbrella type wiring which is con-

Slide Three

Designation			Standard					
				Video			Sound	
Programme	Band	Cha. Nr	Band width MHz	Line Nr	Mod.	Freq. MHz	Mod.	Freq. MHz
Belgian Fl.	I	2	7	625	pos.	48,25	A3	46,75
Belgian Fr.		3	7	819 625	pos.	55,25	A3	60,75
Dutch ...	III	5	7	625	neg.	175,25	FM	180,75
French ...	III	F8A	14	819	pos.	185,25	A3	174,10
Luxemburg	III	7	7	625	neg.	189,25	FM	194,75
Belgian Fr.	III	8	7	819 625	pos.	196,25	A3	201,75
German ...	III	9	7	625	neg.	203,25	FM	208,75
Belgian Fl.	III	10	7	625	pos.	210,25	A3	215,75
Belgian Fr.	III	11	7	819 625	pos.	217,25	A3	22,75
German ...	IV	24	7	625	neg.	495,25	FM	500,75
German ...	IV	26	7	625	neg.	511,25	FM	516,75
German ...	IV	29	7	625	neg.	535,25	FM	540,75
German ...	IV	—	7	625	neg.	etc.	FM	—
German ...	V	*	7	625	neg.	*	FM	*

* At least to our knowledge, no receiving tests have been carried out so far on Band V.

Slide Four

sidered general practice in this country is not allowed at all.

The Post Office will not considerer allowing the cables to go on their poles etc. The operator can only then get his cables throughout an area by placing them on private property, and to do this wayleaves are required from each land owner. Wayleaving is considered the most difficult part of installing any network in England and it can be expensive. Only when routes have been wayleaved, can planning be finalized. Absentee land owners is only one of the many problems and headaches involved.

SLIDE 4 shows a typical street wire. The cable is clipped here under the eaves.

SLIDE 5 shows an estate wired in Bath. We see here a typical example of the subscriber feeder technique. The illustration here is of a Teleng tapper unit.

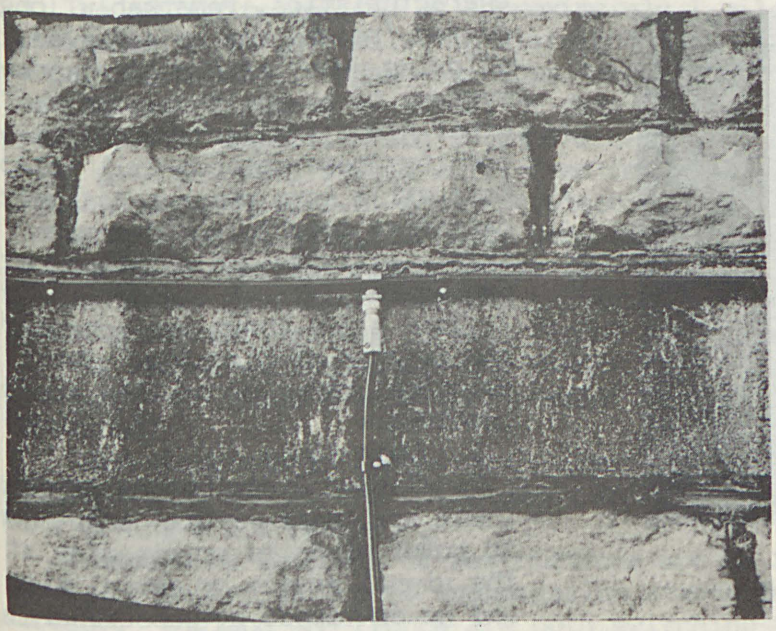
SLIDE 6 is a close up of this unit. As you can see the main distribution cable is not broken at all and because of simple operation, installation time is reduced considerably. The principle use here is patented.

A third restriction which we have in Europe is the result of the selectivity of the standard television sets on the market. These sets today will not generally accept adjacent channels, and we must use guard channels to prevent co-channel interference. This severly limits the number of possible programmes which can be distributed on any VHF network.

There are many more limiting factors which we have to overcome or face up to but I have tried briefly and I hope not too sketchily to illustrate only a few of our problems with which you do not

Slide Five

Slide Six



have to contend in your operation.

And now "Looking Ahead". What is in store for Europe? Well, of course there are more television and radio programmes coming, color, Pay T.V.!!

I have to qualify here that my remarks with regard to the future are based on my personal views and the views of my Company, and I wish to portray our appreciation of the situation and our approach to find the correct solutions.

A CATV system erected today in Europe must be capable of distributing the following, if it is to be fully utilized:

1. At least 9 off air TV broadcast programmes.
2. 30 + FM radio programmes
3. Pay T.V. programmes

It also must cover a large area, say 100,000 to 150,000 houses from one aerial site and be commercially acceptable and reliable in providing the service.

With regard to I there are areas now where six T.V. programmes are required to be distributed. The schedule now planned for new stations to be opened will increase this to 9 channels in certain areas on the Continent in the next few years alone.

Re. 2, this number of FM radio programmes is now available in many areas.

Re. 3, if Pay TV is going to succeed, and a great many in this country are putting their shirts on it succeeding, it is only natural that it be one of several services on a CATV system.

Our reasoning goes something like this:-

1. Pay TV can be transmitted over the air or distributed via cable. Transmission over the air is highly unlikely because there is hardly enough air space to handle the other services already planned. Actually this is one of my strongest reasons for believing that CATV operation will soon be a necessity. There is already a world tendency for telecommunications to go back to wire, and I am sure that statistics will show that more and more cable is being laid each year. In Europe especially the situation is that there are many Countries in a restricted area, all with their respective services. Interference now is quite a problem, and I shudder to think what it will be like in a few years time.

2. Distribution via cable is the natural environment for Pay TV because of the security and the control it offers.

3. Television off air broadcasting in Europe is such that CATV systems will be in most cities within the next 15 years.

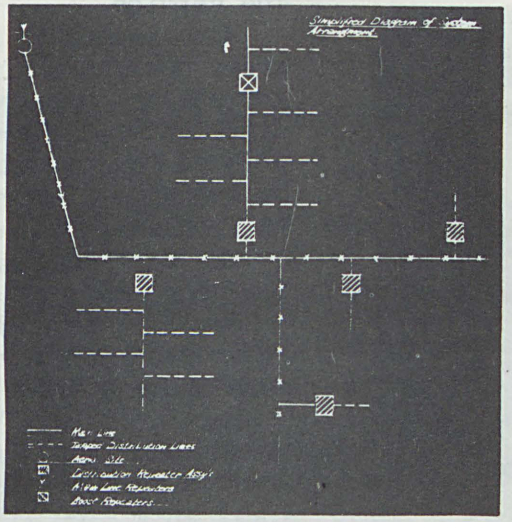
4. A Pay TV operation via cable requirement is that only large areas of the population can support such a service.

5. Our conclusion is that a system is required where both services can share the same facilities, thereby carrying only a proportion of the fixed overheads.

Someone, somewhere, has said that the problem must first be recognized and then a goal set, before any achievement can be made. I think we have done this.

We have now a system which will meet the above requirements which we call System D. This system employs principally a special design of "distributed" type repeater of low gain, with exceptionally good noise and cross modulation characteristics, which enables the very wide frequency spectrum of 8-225 MC/S to be fully utilized.

Slide Seven



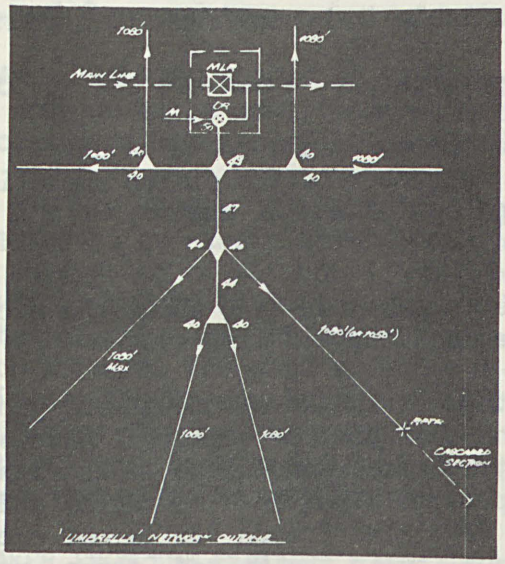
Without the restriction and operational difficulties which would normally occur with multi-channel operation employing more normal type of 'distributed' circuit type repeaters. Because of these outstanding repeater characteristics, remarkably long system 'reach' can be achieved, allowing very large multi-channel systems to be built up. On the other hand, smaller systems employing these methods will possess still more reserve against cascading troubles, and ensure simple policing and maintenance procedures.

This slide shows the schematic diagram of planning. Two principal types of cabling are involved:-

1. Main Lines
2. Tapped Distribution Lines

These are 'semi virgin' point to point circuits originating at the signal source or aerial site and never tapped by subscriber connections, but teed into branching or distribution repeaters

Slide Eight



to generate spurs for further main line network extensions, or for tapped distribution lines. These are lines to which subscribers connections are made. To obtain the optimum repeater cascading performance, the main lines are operated at a max. signal level of 30 dbmV, with min. of 17 dbmV which gives a required repeater gain of 13 db. It can be shown that a gain of this order represents the optimum for repeater cascadeability.

The tapped distribution lines (No. 2) are all generated from distribution repeater assemblies, with a launch level of up to 50 dbmV.

From this high level the maximum use of cable splitting is used to provide the largest possible 'coverage' network without further repeaters. (This may cover up to 300 houses). Normally, to extend beyond this coverage the main line network is used or extended to a further distribution repeater assembly teed to the main line network, but when advantageous limited extension to any 'arm' of the distribution network can, if the noise and Xmod limitations of -43 db are not exceeded, be achieved by use of standard repeaters used as boosters.

The AGC units located at approximately 1 mile intervals are control units for inclusion at intervals, in distribution main, or trunk lines to mitigate variations of level caused by cable temperature and repeater mains supply etc. The (patented) method employed, of obtaining the required control bias, avoids difficult VHF amplification in excess of that necessary for signal amplification only, giving a mosy stable unit, free from uncertainties inherent with amplified signal frequency or D.C. amplifier techniques.

The ALC unit, here, for wide band distribution systems, operates from a control or pilot carrier placed above 200 Mc/s. The gain of the unit throughout the amplifier operating spectrum is varied in relation to the level of the controlling carrier, giving partial signal level control on a wide band system.

The unit is intended for use with a succeeding repeater unit Type 228 from the output of which the control carrier is extracted by means of a tee unit (provided)

CATV operators in Europe are of course looking forward to easement of many restrictions, and to the advancement in development of techniques which will make living a lot easier.

Examples of easement of restrictions are as follows:

1. Standardization of transmission standards. There is evidence of this already. England and France are both switching to 625 line standard of a type.

2. Improved selectivity of TV sets. Set manufacturers are placing sets on the market now with improved electricity and when this higher standard is made universal, adjacent channels can be used.

3. Provisions made by the planners of new towns for the erection of a CATV sytem. Many new towns are being built in Europe and especially in England. A CATV system is being considered as a public utility service to go in a house along with the electricity, telephone, gas, and water. Conduits can be provided for under street crossings, cavities made available in houses for flush mounted wall outlet units, etc.

Every operator looks forward to cheaper systems, which are easier to install and require little or no maintenance.

Components now becoming available are improving the position daily, and of course transistors are in the limelight. A number of transistor amplifiers are on the British market used in limited application and of course, we all encourage further advance.

SPEAKER FROM THE FLOOR: I would like to ask you, sir, about the picture quality, relative quality, between your system and our 525 line system.

MR. EVANS: On the picture quality, the British have done a very good job on the 405 line standard and is, I think, the best picture quality I have seen in the world. My experience is limited to the States and Europe. Regarding the 405 line standard - of course I, as a CATV operator like the 4 megacyles and I have wondered just why Britain has changed to 625. The French 819 is not exceptionally good. I would say that the standard of quality in the United States, mostly from the studio techniques available in the States, is much better than the normal 625 that we are getting on the Continent today.

SPEAKER FROM THE FLOOR: Do you use video at all or is it completely RF or do you have a mixture:

MR. EVANS: No, we use completely RF. The HF system, as I explained does demodulate the carrier to video and then remodulate a HF carrier. RF is still used.

SPEAKER FROM THE FLOOR: What sort of agreement did you make with the property owners when you attach to their homes?

MR. EVANS: Well, we have a very comprehensive contract that we make with the owner of each property with regard to liability. Of course the CATV operator is liable for any damage that is done on the property. To make this legal we do pay to the property owner a shilling a year. This is usually paid. However, there are different techniques which are used. It is ridiculous to make a check out for 14 cents a year and many times there are agreements by the various CATV operators to give this money to charity in a lump sum or do some local function for charity.

SPEAKER FROM THE FLOOR: Could you tell us something about the pattern of charges that are made?

MR. EVANS: Yes, the - Well any CATV operator is going to get as much money as he can for the services which he is providing. Four or five years ago it was standard in Britain to charge an installation fee of approximately 5 pounds, working that out quickly that is about 14 dollars and something, with a weekly charge of 2 shillings and 6 pence to 3 shillings a week. A shilling is 14 cents so three shillings would be 42 cents, a week. In more recent years we have had an awful lot of competition by the various CATV operators and there have been a limited number of what has been considered good concessions, so in order to obtain these concessions the competition has been vicious resulting in reduction

of the rates to the taxpayers of a particular local authority. The installation fee has fallen off completely and most systems are working on a charge of 3 to 4 shillings a week only. There are of course the normal terms of payment of paying annually or half yearly or quarterly with appropriate deductions in the - of the amounts.

SPEAKER FROM THE FLOOR: I believe I heard in your talk that you even now go back down to strip amplifiers with their individual AGC, I wonder if you would comment of the technical reason for that, and what you accomplish by it.

MR. EVANS: We do, at approximately every mile on trunk lines only, break up the signals, to single channel strips for control We have not found and we have used a lot of ALC units, wide band units. We have not found that this gives us the sufficient control of what has to be made up on the line due to temperature and main power variations. On the AGC strips we are, you must look forward, if we go over say 9 channels we must look forward to a lot of difficulty in the combining and splitting which does have to be done every mile and which is very, very expensive. Of course, we are trying to develop ALC units or wide band techniques along with perhaps equalizers which will give us the control which is required on these networks.

SPEAKER FROM THE FLOOR: I was interested in the problem ..(Unable to hear speaker)

MR. EVANS: No, that is not necessary assuming that your combined split units are all right.

On the ALC units which we are using now at every half mile, we are putting the carrier frequency above 200 megacycles because we know that we can get a better control starting at the high end of the band rather than having the generated signal, let's say at 75 megacycles which I understand is common in the States, but we are still using both types.

SPEAKER FROM THE FLOOR: (Unable to hear speaker)

MR. EVANS: We are trying to. Any other questions? Thank you very much. (Applause)

MR. W. K. HEADLEY: Thank you very much, Jack, for giving us a most absorbing look into things over your way, both as they are now and as they appear to be in the future.

We have come out very well on our time and I just want to say, Jack, we appreciate tremendously your coming here to this session this morning and it is a very great pleasure for all of us to have you here at our convention.