The smallness of these differences merely serves to emphasise the statement made above to the effect that the decrease in k' due to the increase in the depth of the winding, as the number of turns is increased, is practically offset by the increase in the mean diameter of the coil brought about by the same cause, so that the product D^2k' remains practically a constant.

INDUCTANCES OF MULTILAYER COILS WITH VARYING NUMBER OF LAYERS.

No. of layers.	Total number of turns.	Mean diameter of coil (inches).	Inductance of coil (centimetres.)	Percentage deviation.
1	25	2·00	37,800	−2·5%
2	50	2·06	155,000	−0·1%
3	75	2·12	348,000	−0·2%
4	100	2·18	614,000	−1·0%
5	125	2·24	950,000	−1·8%
6	150	2·30	1,430,000	−0·4%
8	200	2·42	2,540,000	+2·2%
10	250	2·54	3,990,000	+2·8%

Wire — No. 25 d.c.c.; length of coil, l 0·75 in.

This, of course, will not always be the case, as the figures given above represent but one example out of many that might be chosen. The proportions there given, however, are on the general lines of those commonly met with in practical multilayer coils, in that the axial length of the coil is about a third of the mean diameter, or less. The general indications of the figures given, however, point to the occurrence of a rather larger variation from the proportionality of the inductance with the square of the number of turns, as the number of turns is further increased beyond a ten-layer coil (250 turns). The reason for this is that as the coil becomes deeper its shape approaches more closely to the square section, which is more economical of copper. As this shape is approached the value of k' suffers a smaller decrease, and consequently the increase in the value of D^2 overbalances the fall in k'. Unless, however, the coil is made very deep, the departure from the proportionality will not be very great, so that to a first approximation the above generalisation for the coil of few turns will also hold for the larger coils; viz., THAT THE MAXIMUM WAVELENGTH IS PROPORTIONAL TO THE NUMBER OF TURNS ON THE COIL.

The four cases of different limiting conditions that we have just considered, while by no means exhausting the possibilities will doubtless serve to indicate the factors affecting any statement connecting the maximum wavelength with the number of turns on the coil. It will be evident from the above that the best generalisation is that the wavelength is proportional to the number of turns on the coil, but it must be carefully borne in mind that this does *not* apply to a single-layer coil whether of the solenoid or pancake type, if changing the number of turns alters the axial length or radial depth, respectively, of the coil. In most other cases the generalisation is at least approximately true, provided that it must not be forgotten that the self-capacity of the coil has been neglected in this consideration, and therefore that if a form of coil is used which has a very high self-capacity the conclusions that have been reached may be modified considerably.

The results that have been obtained above may also be found of some use when arranging tapping points on a coil to obtain different values of the maximum wavelength. Here, again, however, the self-capacity, and also the "dead-end" capacity of unused parts of the coil, will introduce modifications, which will affect the results. Use may be made of the k' curves in a very similar manner to that outlined above for the predetermination of tapping points on coils of various shapes, either when the successive taps are to give equal increments of the wavelength, or equal increments of the inductance.

The Transatlantic Tests

SUCCESS OF BRITISH AMATEURS AND PRIZE AWARDS

AS announced in our issue dated December 24th, signals from several U.S. amateur stations have been heard in this country. An examination of the reception logs that have been received has brought to light many interesting facts and it is hoped to deal with these more in detail in later issues as space permits. It is possible to state at the moment that signals from American amateurs have been heard in this country at eight British amateur stations, these stations in some cases being operated jointly by more than one experimenter. Some of the signals were also heard at the Hague (Holland) and at Nice (France).

As may be remembered, the tests extended from midnight of December 7th-8th to 6 a.m. (G.M.T.) on December 17th, and lasted for six hours each night. The first two-and-a-half hours of each test period—viz., from midnight until 2.30 a.m., was a free-for-all period in which many transmitting stations were taking part, the different districts into which the U.S. amateur stations are divided for inspection purposes being allocated periods of 15 minutes in turn. Thus practically all the A.R.R.L. radio stations had in turn a chance of transmitting during one 15-minute period each night, the exact time of this ½-hour period being changed on each night of the Tests. As some of

the stations from which signals were intercepted were heard during this free-for-all period, it is not possible to verify their reception other than by the characteristics of the signals heard, and by the period during which they were heard. The other transmissions, however, during the remaining 3½ hours each night were each allocated a definite five-letter code word, by means of which the reception could be verified. Signals from five American stations were picked up complete with correct code-words, etc., viz. :—

1AFV
1ZE
2BML
2FP
and **2ZL.**

Calls were also heard during the free periods from—

1RU
1UN
1XM
2ZC
and **2RU**; the last one being a little uncertain.

In addition to the above regular schedule of transmissions, an additional special U.S. station was erected just before the beginning of the tests on Mr. Godley's recommendation after he had preliminarily investigated the receiving conditions on this side, and found them somewhat different to his expectations. This station, call letters **1 BCG,** was erected by a group of prominent U.S. Radio amateurs including E. H. Armstrong, the inventor of the well-known supersonic heterodyne receiver. This station was equipped with valve transmitters with an input of 1 kW, and giving about 600 watts of high frequency energy in the antenna circuit. It operated on a wavelength of close on 200 metres.

Although this station was allocated a definite position in the transmission schedule, by cabled information from the Traffic Manager of the American Radio Relay League, it also made special transmissions to Mr. Godley over prolonged periods, and despatched messages to him.

Very loud signals were heard from this station by five of the British competitors, while it was also heard in Holland.

While doubtless of considerable use to Mr. Godley, it is unfortunate that the signals from this station acted as a hindrance to some of the British amateurs, who picking them up, recognising that they were of American origin and not knowing the special nature of the station, copied the repeated calls and messages for hour after hour during the best nights of the tests, to the complete exclusion of possible signals from other American amateurs—signals which must have been there had they been tuned in if the exceptional transmission qualities of those particular nights is considered.

Of those who picked up the signals, by far the best reception was made by Mr. W. R. Burne, of Sale, Cheshire, who heard no less than seven different U.S. stations of those listed above (including **1 BCG**). Of these seven, three were individual period transmissions, and were picked up with the correct code-words, etc. The code word of a fourth was also very probably heard, but there was an error in the letters which throws a slight doubt upon the reception of this station. It is therefore considered that he should be awarded the prizes allocated to the most successful reception of the signals. The prizes to be awarded to Mr. Burne are therefore as follows, as the conditions attached to these awards have been complied with :—

Amateur Supplies Association :
A "Simplex" cabinet valve set.
E. M. Ashley, Ltd. :
Prize value £8.
G. Z. Auckland & Son :
Apparatus value £10.
Burnham & Co. :
First prize—Burndept Ultra III Receiver.
Butler & Co. :
Apparatus value £5.
Dubilier Condenser Co., Ltd. :
Condensers value £10.
Halliwell & Good, Ltd. :
Apparatus value £30.
The International Electrical Trading Combine :
A "Concertone Magnephone."
Marconi Scientific Instrument Co., Ltd. :
First prize value £25.
H. W. Sullivan :
Sullivan Wavemeter, value £35.

Some of the other prizes that have been offered will not be awarded as the conditions that were attached to them as to the use of apparatus manufactured by the firms in question have not been complied with.

Next in order of merit is Mr. H. H. Whitfield, of Hall Green, Birmingham, who heard two stations, in each case with correct code words, in addition to **1 BCG,** although he was only able to listen in for two nights during the Tests. The second prize offered by the Marconi Scientific Instrument Co. (value £15) and by Messrs. Burnham & Co. (a Burndept II receiver) have therefore been awarded to him.

Messrs. W. Corsham, of Harleeden Gardens, Willesden, London, N.W.10, and R. D. Spence of Craighead House, Huntley, Aberdeenshire, each heard signals from one station with correct code words. Mr. Corsham's reception was, however, effected, using three valves, whereas Mr. Spence used six, and therefore in the opinion of the judges Mr. Corsham is more deserving of the award of the more valuable of the two third prizes that have been offered, viz., a Burndept 1 receiver (value £6). The third prize (value £5) offered by the Marconi Scientific Instrument Co., Ltd., will therefore be awarded to Mr. R. D. Spence.

Messrs. A. E. Greenslade and E. McT. Reece working together at the British School of Telegraphy, Clapham Road, London, S.W.9, heard one station during the free period, in addition to **1 BCG.**

Mr. J. R. Forshaw of Ormskirk, near Liverpool, heard **1 BCG**; and Mr. T. Cutler of Southampton, heard **2 ZC** calling during the Test period.

The decision with regard to the award of the prize offered by Messrs. B. Hesketh for the best designed circuit will be announced later.

Descriptions, illustrated with photographs and circuit diagrams, of the various receiving stations

at which U.S. Amateur signals were heard will be published shortly in these columns.

Elsewhere in this issue will be found an account of Mr. Godley's experiences in this country, written by himself—an account which we were fortunately able to secure from him during the few hours that he had to spare in London after the finish of the Tests and before he sailed for the States. It will be seen from this account that although he had exceptional facilities granted to him as regards size of aerial, and freedom of choice of location, he was greatly hampered by the atmospheric conditions and physical discomforts under which he worked. His choice of the location that he adopted—viz. near the shore at Ardrossan (near Glasgow) was made on recommendation of that locality made to him by a number of radio engineers in America and elsewhere, but his choice involved working in a tent out in a field with the attendant discomforts attached thereto. The dampness of our climate as compared with the one to which he is accustomed, together with the exposure to heavy rains and cold at night proved a great strain to him, but we sincerely hope that on his return to his own land he will soon regain his usual good health and cheerfulness.

It is of interest to note that in all cases the aerials used by the successful British amateurs were within the limits imposed by the Post Office licenses, and were therefore very much smaller than the aerial system used by Mr. Godley.

Mr. Godley's aerial also possessed the advantage of eliminating some of the atmospheric interference as compared with an ordinary type of aerial.

It is indeed fortunate that the Tests on this occasion lasted for a longer period than last time (February, 1921), as the general results obtained by all the stations, including Mr. Godley's, show that the signals were heard on a few nights only. Apparently at the beginning of the Test period transmission was bad, but the signals gradually increased in strength during the next two nights and then faded right away again until nothing whatever was heard during the last nights of the Test.

Doubtless these changes were closely connected with the meteorological and other atmospheric conditions existing over the Atlantic at that time. This point is being investigated further, as the weather charts for that period are being collected. Had the Test only lasted the three days allocated on the previous occasion, it is quite likely that once again nothing would have been heard.

PHILIP R. COURSEY.

Exhibition of the Physical Society of London and the Optical Society

THE twelfth annual exhibition of the Physical Society of London and the Optical Society, was held on January the 4th and 5th at the Imperial College of Science, London.

Amongst the exhibits were several of special wireless interest. Marconi's Wireless Telegraph Company exhibited an automatic wireless alarm device which responds to a call from a vessel in