

A. H. DYSON.  
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 6, 1905. RENEWED APR. 19, 1906.

1,148,665.

Patented Aug. 3, 1915.

3 SHEETS—SHEET 1.

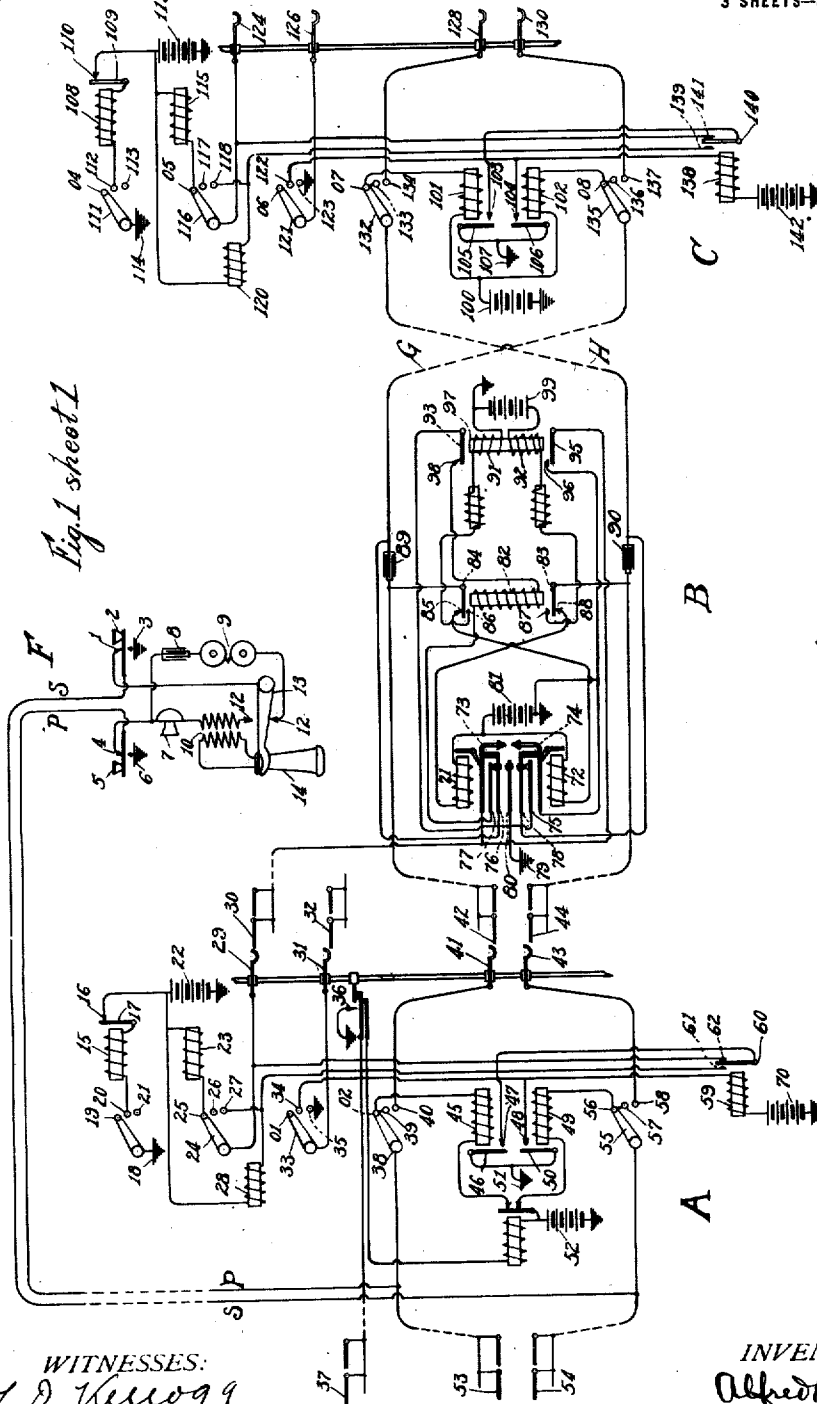


Fig. 1 sheet 1

WITNESSES:

L. D. Kuoq9  
G. C. Muller.

INVENTOR.

Alfred H. Dyson

A. H. DYSON.  
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 6, 1905. RENEWED APR. 19, 1906.

1,148,665.

Patented Aug. 3, 1915.

3 SHEETS—SHEET 2.

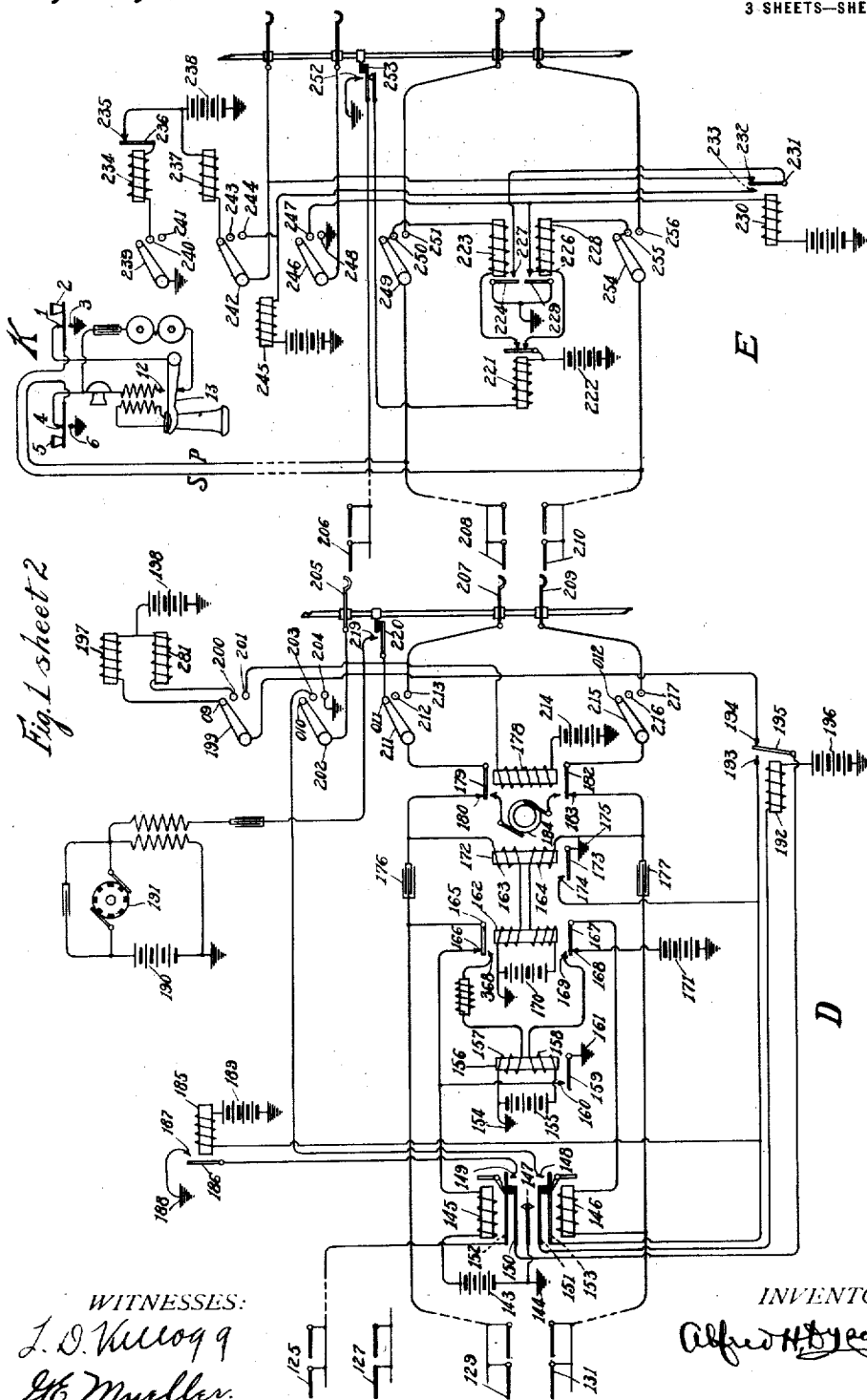


Fig. 1 sheet 2

WITNESSES:

L. O. Kellogg  
H. C. Muller.

INVENTOR.

Alfred H. Dyson

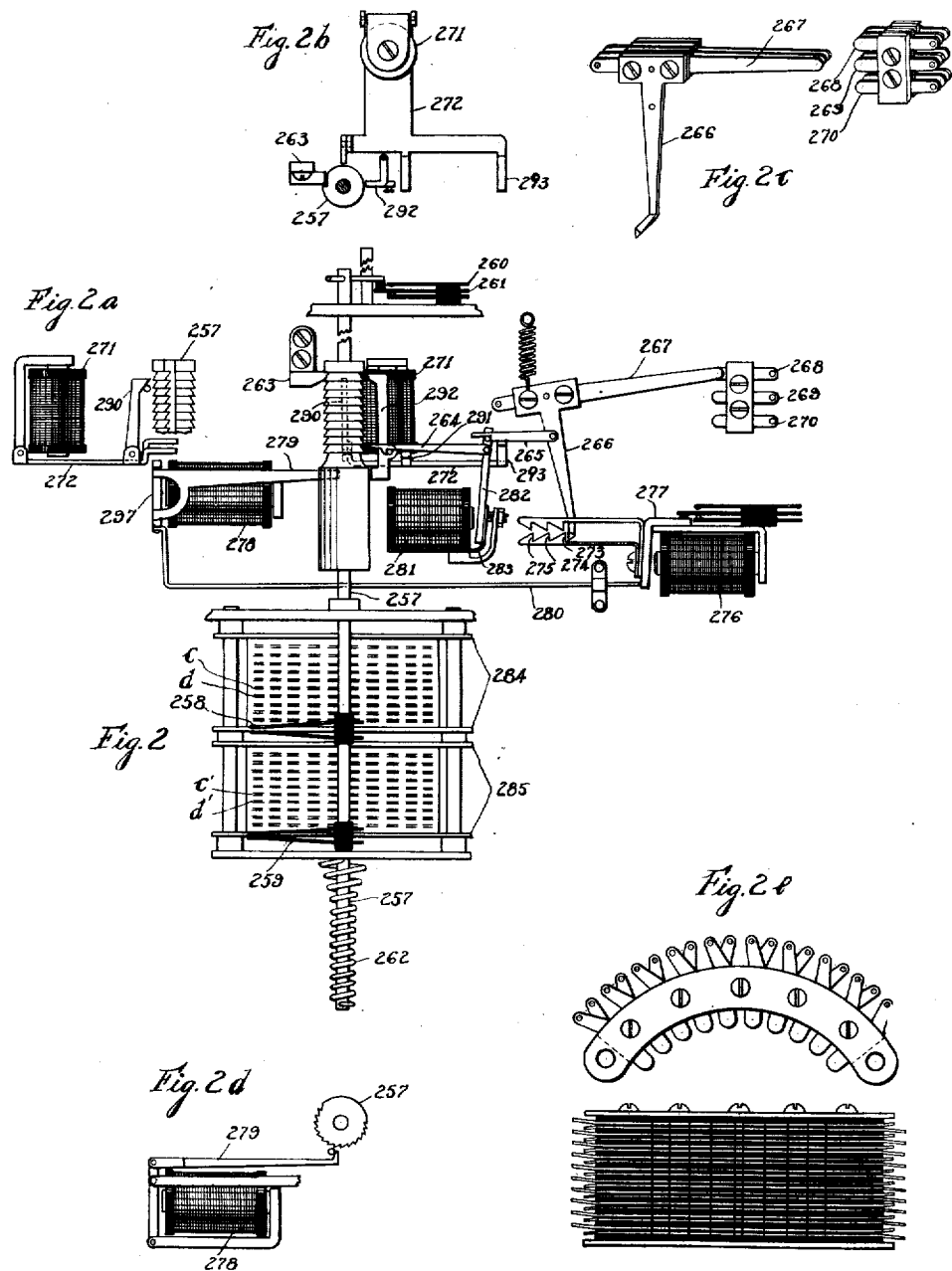
A. H. DYSON.  
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 6, 1905. RENEWED APR. 19, 1906.

1,148,665.

Patented Aug. 3, 1915.

3 SHEETS—SHEET 3.



WITNESSES:  
L. D. Killog q  
G. C. Mueller

INVENTOR.  
Alfred H. Dyson

# UNITED STATES PATENT OFFICE.

ALFRED H. DYSON, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO  
KELLOGG SWITCHBOARD AND SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

## TELEPHONE SYSTEM.

1,148,665.

Specification of Letters Patent.

Patented Aug. 3, 1915.

Application filed February 6, 1905, Serial No. 244,379. Renewed April 19, 1906. Serial No. 312,663.

*To all whom it may concern:*

Be it known that I, ALFRED H. DYSON, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates particularly to telephone exchange systems in which the connection of subscribers' lines is secured by automatic mechanism at the central office actuated under control of switching mechanism at subscribers' stations.

A feature of my invention consists in introducing between two automatic switches, used in establishing a connection, auxiliary apparatus and circuits adapted to accomplish the usual inter-action between said switches, employing two conductors only for accomplishing the said inter-action.

In the systems which I have had especially in mind in developing my invention, three or more conductors between switches are used in performing the usual functions of the switches, and my invention, when applied to trunking systems between exchanges, obviates the necessity of extending these three or more conductors from one exchange to the other and thus allows a considerable saving in the expense of installing trunking circuits between exchanges.

In the automatic telephone exchange systems referred to, there is provided for each switch a release magnet operated, upon the establishment of an earth connection by mechanism associated with another switch. In case two switches used in establishing a connection are in different exchanges, the earth connection used in performing the release operation might be of a potential different from that of the earth at the exchange where the switch to be released is located, and the release operation might be rendered unreliable on account of this difference of potential. I therefore provide, in connection with my invention, means whereby I effect the release of each switch used in making a connection from an earth connection established at the exchange in which the switch is located.

These and other features of my invention will appear at length in the following detailed description.

Referring to the drawings, I show in Figure 1, consisting of Sheets 1 and 2, a sym-  
55  
5  
10  
15  
20  
25  
30  
35  
40  
45  
50  
60  
65  
70  
75  
80  
85  
90  
95  
100  
105  
110  
115  
120  
125  
130  
135  
140  
145  
150  
155  
160  
165  
170  
175  
180  
185  
190  
195  
200  
205  
210  
215  
220  
225  
230  
235  
240  
245  
250  
255  
260  
265  
270  
275  
280  
285  
290  
295  
300  
305  
310  
315  
320  
325  
330  
335  
340  
345  
350  
355  
360  
365  
370  
375  
380  
385  
390  
395  
400  
405  
410  
415  
420  
425  
430  
435  
440  
445  
450  
455  
460  
465  
470  
475  
480  
485  
490  
495  
500  
505  
510  
515  
520  
525  
530  
535  
540  
545  
550  
555  
560  
565  
570  
575  
580  
585  
590  
595  
600  
605  
610  
615  
620  
625  
630  
635  
640  
645  
650  
655  
660  
665  
670  
675  
680  
685  
690  
695  
700  
705  
710  
715  
720  
725  
730  
735  
740  
745  
750  
755  
760  
765  
770  
775  
780  
785  
790  
795  
800  
805  
810  
815  
820  
825  
830  
835  
840  
845  
850  
855  
860  
865  
870  
875  
880  
885  
890  
895  
900  
905  
910  
915  
920  
925  
930  
935  
940  
945  
950  
955  
960  
965  
970  
975  
980  
985  
990  
995  
1000  
1005  
1010  
1015  
1020  
1025  
1030  
1035  
1040  
1045  
1050  
1055  
1060  
1065  
1070  
1075  
1080  
1085  
1090  
1095  
1100  
1105  
1110  
1115  
1120  
1125  
1130  
1135  
1140  
1145  
1150  
1155  
1160  
1165  
1170  
1175  
1180  
1185  
1190  
1195  
1200  
1205  
1210  
1215  
1220  
1225  
1230  
1235  
1240  
1245  
1250  
1255  
1260  
1265  
1270  
1275  
1280  
1285  
1290  
1295  
1300  
1305  
1310  
1315  
1320  
1325  
1330  
1335  
1340  
1345  
1350  
1355  
1360  
1365  
1370  
1375  
1380  
1385  
1390  
1395  
1400  
1405  
1410  
1415  
1420  
1425  
1430  
1435  
1440  
1445  
1450  
1455  
1460  
1465  
1470  
1475  
1480  
1485  
1490  
1495  
1500  
1505  
1510  
1515  
1520  
1525  
1530  
1535  
1540  
1545  
1550  
1555  
1560  
1565  
1570  
1575  
1580  
1585  
1590  
1595  
1600  
1605  
1610  
1615  
1620  
1625  
1630  
1635  
1640  
1645  
1650  
1655  
1660  
1665  
1670  
1675  
1680  
1685  
1690  
1695  
1700  
1705  
1710  
1715  
1720  
1725  
1730  
1735  
1740  
1745  
1750  
1755  
1760  
1765  
1770  
1775  
1780  
1785  
1790  
1795  
1800  
1805  
1810  
1815  
1820  
1825  
1830  
1835  
1840  
1845  
1850  
1855  
1860  
1865  
1870  
1875  
1880  
1885  
1890  
1895  
1900  
1905  
1910  
1915  
1920  
1925  
1930  
1935  
1940  
1945  
1950  
1955  
1960  
1965  
1970  
1975  
1980  
1985  
1990  
1995  
2000  
2005  
2010  
2015  
2020  
2025  
2030  
2035  
2040  
2045  
2050  
2055  
2060  
2065  
2070  
2075  
2080  
2085  
2090  
2095  
2100  
2105  
2110  
2115  
2120  
2125  
2130  
2135  
2140  
2145  
2150  
2155  
2160  
2165  
2170  
2175  
2180  
2185  
2190  
2195  
2200  
2205  
2210  
2215  
2220  
2225  
2230  
2235  
2240  
2245  
2250  
2255  
2260  
2265  
2270  
2275  
2280  
2285  
2290  
2295  
2300  
2305  
2310  
2315  
2320  
2325  
2330  
2335  
2340  
2345  
2350  
2355  
2360  
2365  
2370  
2375  
2380  
2385  
2390  
2395  
2400  
2405  
2410  
2415  
2420  
2425  
2430  
2435  
2440  
2445  
2450  
2455  
2460  
2465  
2470  
2475  
2480  
2485  
2490  
2495  
2500  
2505  
2510  
2515  
2520  
2525  
2530  
2535  
2540  
2545  
2550  
2555  
2560  
2565  
2570  
2575  
2580  
2585  
2590  
2595  
2600  
2605  
2610  
2615  
2620  
2625  
2630  
2635  
2640  
2645  
2650  
2655  
2660  
2665  
2670  
2675  
2680  
2685  
2690  
2695  
2700  
2705  
2710  
2715  
2720  
2725  
2730  
2735  
2740  
2745  
2750  
2755  
2760  
2765  
2770  
2775  
2780  
2785  
2790  
2795  
2800  
2805  
2810  
2815  
2820  
2825  
2830  
2835  
2840  
2845  
2850  
2855  
2860  
2865  
2870  
2875  
2880  
2885  
2890  
2895  
2900  
2905  
2910  
2915  
2920  
2925  
2930  
2935  
2940  
2945  
2950  
2955  
2960  
2965  
2970  
2975  
2980  
2985  
2990  
2995  
3000  
3005  
3010  
3015  
3020  
3025  
3030  
3035  
3040  
3045  
3050  
3055  
3060  
3065  
3070  
3075  
3080  
3085  
3090  
3095  
3100  
3105  
3110  
3115  
3120  
3125  
3130  
3135  
3140  
3145  
3150  
3155  
3160  
3165  
3170  
3175  
3180  
3185  
3190  
3195  
3200  
3205  
3210  
3215  
3220  
3225  
3230  
3235  
3240  
3245  
3250  
3255  
3260  
3265  
3270  
3275  
3280  
3285  
3290  
3295  
3300  
3305  
3310  
3315  
3320  
3325  
3330  
3335  
3340  
3345  
3350  
3355  
3360  
3365  
3370  
3375  
3380  
3385  
3390  
3395  
3400  
3405  
3410  
3415  
3420  
3425  
3430  
3435  
3440  
3445  
3450  
3455  
3460  
3465  
3470  
3475  
3480  
3485  
3490  
3495  
3500  
3505  
3510  
3515  
3520  
3525  
3530  
3535  
3540  
3545  
3550  
3555  
3560  
3565  
3570  
3575  
3580  
3585  
3590  
3595  
3600  
3605  
3610  
3615  
3620  
3625  
3630  
3635  
3640  
3645  
3650  
3655  
3660  
3665  
3670  
3675  
3680  
3685  
3690  
3695  
3700  
3705  
3710  
3715  
3720  
3725  
3730  
3735  
3740  
3745  
3750  
3755  
3760  
3765  
3770  
3775  
3780  
3785  
3790  
3795  
3800  
3805  
3810  
3815  
3820  
3825  
3830  
3835  
3840  
3845  
3850  
3855  
3860  
3865  
3870  
3875  
3880  
3885  
3890  
3895  
3900  
3905  
3910  
3915  
3920  
3925  
3930  
3935  
3940  
3945  
3950  
3955  
3960  
3965  
3970  
3975  
3980  
3985  
3990  
3995  
4000  
4005  
4010  
4015  
4020  
4025  
4030  
4035  
4040  
4045  
4050  
4055  
4060  
4065  
4070  
4075  
4080  
4085  
4090  
4095  
4100  
4105  
4110  
4115  
4120  
4125  
4130  
4135  
4140  
4145  
4150  
4155  
4160  
4165  
4170  
4175  
4180  
4185  
4190  
4195  
4200  
4205  
4210  
4215  
4220  
4225  
4230  
4235  
4240  
4245  
4250  
4255  
4260  
4265  
4270  
4275  
4280  
4285  
4290  
4295  
4300  
4305  
4310  
4315  
4320  
4325  
4330  
4335  
4340  
4345  
4350  
4355  
4360  
4365  
4370  
4375  
4380  
4385  
4390  
4395  
4400  
4405  
4410  
4415  
4420  
4425  
4430  
4435  
4440  
4445  
4450  
4455  
4460  
4465  
4470  
4475  
4480  
4485  
4490  
4495  
4500  
4505  
4510  
4515  
4520  
4525  
4530  
4535  
4540  
4545  
4550  
4555  
4560  
4565  
4570  
4575  
4580  
4585  
4590  
4595  
4600  
4605  
4610  
4615  
4620  
4625  
4630  
4635  
4640  
4645  
4650  
4655  
4660  
4665  
4670  
4675  
4680  
4685  
4690  
4695  
4700  
4705  
4710  
4715  
4720  
4725  
4730  
4735  
4740  
4745  
4750  
4755  
4760  
4765  
4770  
4775  
4780  
4785  
4790  
4795  
4800  
4805  
4810  
4815  
4820  
4825  
4830  
4835  
4840  
4845  
4850  
4855  
4860  
4865  
4870  
4875  
4880  
4885  
4890  
4895  
4900  
4905  
4910  
4915  
4920  
4925  
4930  
4935  
4940  
4945  
4950  
4955  
4960  
4965  
4970  
4975  
4980  
4985  
4990  
4995  
5000  
5005  
5010  
5015  
5020  
5025  
5030  
5035  
5040  
5045  
5050  
5055  
5060  
5065  
5070  
5075  
5080  
5085  
5090  
5095  
5100  
5105  
5110  
5115  
5120  
5125  
5130  
5135  
5140  
5145  
5150  
5155  
5160  
5165  
5170  
5175  
5180  
5185  
5190  
5195  
5200  
5205  
5210  
5215  
5220  
5225  
5230  
5235  
5240  
5245  
5250  
5255  
5260  
5265  
5270  
5275  
5280  
5285  
5290  
5295  
5300  
5305  
5310  
5315  
5320  
5325  
5330  
5335  
5340  
5345  
5350  
5355  
5360  
5365  
5370  
5375  
5380  
5385  
5390  
5395  
5400  
5405  
5410  
5415  
5420  
5425  
5430  
5435  
5440  
5445  
5450  
5455  
5460  
5465  
5470  
5475  
5480  
5485  
5490  
5495  
5500  
5505  
5510  
5515  
5520  
5525  
5530  
5535  
5540  
5545  
5550  
5555  
5560  
5565  
5570  
5575  
5580  
5585  
5590  
5595  
5600  
5605  
5610  
5615  
5620  
5625  
5630  
5635  
5640  
5645  
5650  
5655  
5660  
5665  
5670  
5675  
5680  
5685  
5690  
5695  
5700  
5705  
5710  
5715  
5720  
5725  
5730  
5735  
5740  
5745  
5750  
5755  
5760  
5765  
5770  
5775  
5780  
5785  
5790  
5795  
5800  
5805  
5810  
5815  
5820  
5825  
5830  
5835  
5840  
5845  
5850  
5855  
5860  
5865  
5870  
5875  
5880  
5885  
5890  
5895  
5900  
5905  
5910  
5915  
5920  
5925  
5930  
5935  
5940  
5945  
5950  
5955  
5960  
5965  
5970  
5975  
5980  
5985  
5990  
5995  
6000  
6005  
6010  
6015  
6020  
6025  
6030  
6035  
6040  
6045  
6050  
6055  
6060  
6065  
6070  
6075  
6080  
6085  
6090  
6095  
6100  
6105  
6110  
6115  
6120  
6125  
6130  
6135  
6140  
6145  
6150  
6155  
6160  
6165  
6170  
6175  
6180  
6185  
6190  
6195  
6200  
6205  
6210  
6215  
6220  
6225  
6230  
6235  
6240  
6245  
6250  
6255  
6260  
6265  
6270  
6275  
6280  
6285  
6290  
6295  
6300  
6305  
6310  
6315  
6320  
6325  
6330  
6335  
6340  
6345  
6350  
6355  
6360  
6365  
6370  
6375  
6380  
6385  
6390  
6395  
6400  
6405  
6410  
6415  
6420  
6425  
6430  
6435  
6440  
6445  
6450  
6455  
6460  
6465  
6470  
6475  
6480  
6485  
6490  
6495  
6500  
6505  
6510  
6515  
6520  
6525  
6530  
6535  
6540  
6545  
6550  
6555  
6560  
6565  
6570  
6575  
6580  
6585  
6590  
6595  
6600  
6605  
6610  
6615  
6620  
6625  
6630  
6635  
6640  
6645  
6650  
6655  
6660  
6665  
6670  
6675  
6680  
6685  
6690  
6695  
6700  
6705  
6710  
6715  
6720  
6725  
6730  
6735  
6740  
6745  
6750  
6755  
6760  
6765  
6770  
6775  
6780  
6785  
6790  
6795  
6800  
6805  
6810  
6815  
6820  
6825  
6830  
6835  
6840  
6845  
6850  
6855  
6860  
6865  
6870  
6875  
6880  
6885  
6890  
6895  
6900  
6905  
6910  
6915  
6920  
6925  
6930  
6935  
6940  
6945  
6950  
6955  
6960  
6965  
6970  
6975  
6980  
6985  
6990  
6995  
7000  
7005  
7010  
7015  
7020  
7025  
7030  
7035  
7040  
7045  
7050  
7055  
7060  
7065  
7070  
7075  
7080  
7085  
7090  
7095  
7100  
7105  
7110  
7115  
7120  
7125  
7130  
7135  
7140  
7145  
7150  
7155  
7160  
7165  
7170  
7175  
7180  
7185  
7190  
7195  
7200  
7205  
7210  
7215  
7220  
7225  
7230  
7235  
7240  
7245  
7250  
7255  
7260  
7265  
7270  
7275  
7280  
7285  
7290  
7295  
7300  
7305  
7310  
7315  
7320  
7325  
7330  
7335  
7340  
7345  
7350  
7355  
7360  
7365  
7370  
7375  
7380  
7385  
7390  
7395  
7400  
7405  
7410  
7415  
7420  
7425  
7430  
7435  
7440  
7445  
7450  
7455  
7460  
7465  
7470  
7475  
7480  
7485  
7490  
7495  
7500  
7505  
7510  
7515  
7520  
7525  
7530  
7535  
7540  
7545  
7550  
7555  
7560  
7565  
7570  
7575  
7580  
7585  
7590  
7595  
7600  
7605  
7610  
7615  
7620  
7625  
7630  
7635  
7640  
7645  
7650  
7655  
7660  
7665  
7670  
7675  
7680  
7685  
7690  
7695  
7700  
7705  
7710  
7715  
7720  
7725  
7730  
7735  
7740  
7745  
7750  
7755  
7760  
7765  
7770  
7775  
7780  
7785  
7790  
7795  
7800  
7805  
7810  
7815  
7820  
7825  
7830  
7835  
7840  
7845  
7850  
7855  
7860  
7865  
7870  
7875  
7880  
7885  
7890  
7895  
7900  
7905  
7910  
7915  
7920  
7925  
7930  
7935  
7940  
7945  
7950  
7955  
7960  
7965  
7970  
7975  
7980  
7985  
7990  
7995  
8000  
8005  
8010  
8015  
8020  
8025  
8030  
8035  
8040  
8045  
8050  
8055  
8060  
8065  
8070  
8075  
8080  
8085  
8090  
8095  
8100  
8105  
8110  
8115  
8120  
8125  
8130  
8135  
8140  
8145  
8150  
8155  
8160  
8165  
8170  
8175  
8180  
8185  
8190  
8195  
8200  
8205  
8210  
8215  
8220  
8225  
8230  
8235  
8240  
8245  
8250  
8255  
8260  
8265  
8270  
8275  
8280  
8285  
8290  
8295  
8300  
8305  
8310  
8315  
8320  
8325  
8330  
8335  
8340  
8345  
8350  
8355  
8360  
8365  
8370  
8375  
8380  
8385  
8390  
8395  
8400  
8405  
8410  
8415  
8420  
8425  
8430  
8435  
8440  
8445  
8450  
8455  
8460  
8465  
8470  
8475  
8480  
8485  
8490  
8495  
8500  
8505  
8510  
8515  
8520  
8525  
8530  
8535  
8540  
8545  
8550  
8555  
8560  
8565  
8570  
8575  
8580  
8585  
8590  
8595  
8600  
8605  
8610  
8615  
8620  
8625  
8630  
8635  
8640  
8645  
8650  
8655  
8660  
8665  
8670  
8675  
8680  
8685  
8690  
8695  
8700  
8705  
8710  
8715  
8720  
8725  
8730  
8735  
8740  
8745  
8750  
8755  
8760  
8765  
8770  
8775  
8780  
8785  
8790  
8795  
8800  
8805  
8810  
8815  
8820  
8825  
8830  
8835  
8840  
8845  
8850  
8855  
8860  
8865  
8870  
8875  
8880  
8885  
8890  
8895  
8900  
8905  
8910  
8915  
8920  
8925  
8930  
8935  
8940  
8945  
8950  
8955  
8960  
8965  
8970  
8975  
8980  
8985  
8990  
8995  
9000  
9005  
9010  
9015  
9020  
9025  
9030  
9035  
9040  
9045  
9050  
9055  
9060  
9065  
9070  
9075  
9080  
9085  
9090  
9095  
9100  
9105  
9110  
9115  
9120  
9125  
9130  
9135  
9140  
9145  
9150  
9155  
9160  
9165  
9170  
9175  
9180  
9185  
9190  
9195  
9200  
9205  
9210  
9215  
9220  
9225  
9230  
9235  
9240  
9245  
9250  
9255  
9260  
9265  
9270  
9275  
9280  
9285  
9290  
9295  
9300  
9305  
9310  
9315  
9320  
9325  
9330  
9335  
9340  
9345  
9350  
9355  
9360  
9365  
9370  
9375  
9380  
9385  
9390  
9395  
9400  
9405  
9410  
9415  
9420  
9425  
9430  
9435  
9440  
9445  
9450  
9455  
9460  
9465  
9470  
9475  
9480  
9485  
9490  
9495  
9500  
9505  
9510  
9515  
9520  
9525  
9530  
9535  
9540  
9545  
9550  
9555  
9560  
9565  
9570  
9575  
9580  
9585  
9590  
9595  
9600  
9605  
9610  
9615  
9620  
9625  
9630  
9635  
9640  
9645

vided with wipers which are adapted, under the control of subscribers, to be placed in engagement with terminals of tertiary switches (in the system shown, ordinarily called "connector switches") which are common for connection to a certain group of subscribers. When the subscriber has placed his first selector switch in electrical connection with the second selector switch and then has placed the second selector switch in electrical connection with the connector switch, he is enabled to direct the movements of step-by-step mechanism of the connector switch in such a manner as to cause wipers, forming terminals of the said connector switch, to engage contact points which form the terminals of any individual subscriber's line in the group to which the connector switch is common for connection. The system, which I have shown, may be used for telephone systems having several thousand subscribers, and subscribers' lines may terminate in one exchange or may be divided among several exchanges. In the system as shown, a connector switch would be common for connection to the lines of a hundred subscribers, and a second selector switch would be common for connection to a thousand subscribers. In other words, the wipers of a second selector switch are adapted, under the control of subscribers, to be placed in electrical connection with terminals of connector switches arranged in ten groups, the connector switches of each group being common for connection to one hundred subscribers. The numerical ratios given are arbitrary and, in practice, may be varied to suit special requirements.

I have shown in Fig. 2 an automatic switch mechanism of a type well known in the art, but it is to be understood that my invention does not consist in providing means for operating switches of this type in particular, but that switches of any approved construction may be employed.

I show in Fig. 1 a plurality of electromagnets, a portion of which is used especially for accomplishing circuit changes, and a portion of which is used for effecting movements of the main shafts of the automatic switches. In the following detailed description, I shall refer to electromagnets of the former class as "relays" and to those of the latter class as "magnets."

Where I have shown, in Fig. 1, armatures associated with electromagnets, it is to be understood that the armatures, as illustrated, are in their normal positions. When the electromagnets with which they are respectively associated are energized, the armatures will be attracted; and upon subsequent deenergization of the electromagnets with which they are respectively associated, they will return to their normal positions. The circuit changes, accomplished by the

energization of the said electromagnets and by the attraction of their armatures, may be readily understood from the illustration, and detailed description of their exact operation in each case is thought to be unnecessary.

While my invention is described in the following as employed for providing trunking facilities between two exchanges, I do not limit myself to that particular application of my invention, as it is of general application and may be applied in a variety of ways.

Referring first to Fig. 2, I show a shaft 257, the upper portion of which is provided with horizontal ratchet teeth, below which are provided vertical ratchet teeth. The said shaft is adapted to be moved vertically and with a rotary motion with respect to the banks of contact points 284 and 285. Upon the shaft are rigidly mounted two pairs of wipers 258 and 259 which, when the shaft is raised and turned, are adapted to be placed in contact with pairs of contacts shown in banks 284 and 285, respectively.

Referring to Fig. 2<sup>c</sup>, the structure of the rows of contacts may be readily understood. It will be noted that each bank of contacts consists, as illustrated in Fig. 2, of one hundred pairs of contacts arranged in vertical and horizontal rows of ten pairs each.

The mechanical operation of the switch is as follows: When magnet 271 is energized, its armature 272 is attracted and pawl 290, being mounted upon said armature, engages a tooth of the horizontal ratchet and raises the shaft one step up. Armature 272 is provided with arm 291 which, upon the first energization of magnet 271, raises arm 264, thereby disengaging it from the pin shown in the illustration upon dog 292 which latter thereupon moves toward the shaft and engages with its upper portion a tooth of the horizontal ratchet, maintaining shaft 257 in whatever position it may have been raised vertically by pawl 290. Armature 272 is also provided with arm 293 which, upon the first attraction of the said armature, lifts arm 265 out of engagement with the pin shown upon armature 282 of magnet 281, thereby releasing pawl 266 and rendering the said pawl movable when magnet 276 is operated. If a number of successive energizing impulses is imparted to the energizing winding of magnet 271, shaft 257 will be moved upward by the engagement of pawl 290 with the successive teeth of the ratchet it is adapted to engage, a number of steps corresponding to the energizing impulses imparted to the magnet, dog 292 maintaining the shaft in its raised position after each step.

Magnet 278 is adapted, by means of pawl

279 mounted upon armature 297, to effect a rotary movement of shaft 257 by causing the engagement of said pawl upon the energization of said magnet, with the vertical ratchet teeth of the shaft, moving pairs of wipers 258 and 259 with a rotary movement from left to right. Successive energizing impulses sent through the magnet 278 effect, by means of the said pawl 279, successive rotary movements of the shaft. The lower portion of dog 292 is adapted to engage, when the dog is disengaged as above described, the vertical ratchet teeth on the shaft and maintains the shaft in whatever rotated position it may be placed by successive energizations of magnet 278.

Referring now to magnet 276; upon its armature 277 is mounted a ratchet consisting of teeth 273, 274 and 275. When armature 277 is attracted by the energization of the magnet, the ratchet mounted thereon is drawn downward with respect to pawl 266, and upon the release of the armature the said pawl moves out of contact with tooth 273 and forward into contact with tooth 274. The said pawl being pivoted, and rigidly attached to arm 267, the said arm thereby is moved out of contact with contact point 268 upon which it normally rests and into contact with contact point 269, and a second attraction and release of armature 277 again causes the forward movement of pawl 266, moving arm 267 into engagement with contact point 270. It will be noted that in case magnet 276 is in an unenergized condition, each successive energization of magnet 278 will cause a forward movement of pawl 266 by means of arm 280 mounted on the armature of magnet 278 and engaging armature 277 of magnet 276. Tooth 275 prevents further forward movement of pawl 266 when said pawl engages said tooth.

There being ten horizontal ratchet teeth adapted to be used for securing vertical movements of the shaft and ten vertical ratchet teeth adapted to be used for securing rotary movements of the shaft, the pairs of wipers 258 and 259 may be placed in contact with any correspondingly placed pairs of contacts in banks 284 and 285 by sending suitable numbers of energizing impulses through magnets 271 and 278. Assuming that said wipers have been placed in contact with desired pairs of contacts in the said banks, the return of the wipers to their normal position, as shown in the illustration, is secured by the energization and deenergization of magnet 281, in the following manner: The energization of the said magnet attracts its armature 282 which moves forward arm 264 pivoted upon said armature in such a manner that it engages the pin upon dog 292; at the same time, the pin upon said armature 282 engages the off-

set on arm 265. Upon the deenergization of magnet 281, its armature is moved away from the core of the magnet by spring 283 which operates to draw dog 292 out of contact with the ratchets of the shaft and retains it in its withdrawn position. At the same time, arm 265 is drawn backward and, being pivoted to pawl 266, returns the said pawl to its normal position, as shown in the illustration. The withdrawal of dog 292 out of engagement with the ratchets upon shaft 257 allows the free movement of the shaft, and the torsion of spring 262 turns the shaft with a rotary motion opposite to that effected by pawl 279. When this motion has placed wipers 258 and 259 out of engagement with the last pairs of contacts to the left of banks 284 and 285, shaft 257 is moved downward by gravity and rests in its normal position shown in the illustration.

Referring to Fig. 2c, I show a plurality of arms associated with pawl 266 of which arm 267 is adapted to engage contact points 268, 269 and 270, the other arms being adapted to engage the other series of contact points mounted in association with those designated, respectively. This figure discloses means by which pawl 266 upon its movement may be adapted to effect a plurality of simultaneous circuit changes. It is evident that the number of circuit changes so effected may be varied as required.

Referring to Fig. 1, consisting of Sheets 1 and 2, I show at F substation apparatus consisting of key 5 with its associated anvils 4 and 6 controlling the circuit of limb P of the telephone line, key 2 and its associated anvils 1 and 3 controlling the circuit of limb S of the telephone line, transmitter 7, induction coil 10, receiver 14, hook lever 13, bell 9 and condenser 8. At A I show circuits and apparatus in diagrammatic form of a first selector switch associated with the line of subscriber F; at B, trunking apparatus and circuits connected by limbs G and H of a trunk circuit with a second selector switch C assumed to be located in an exchange other than that in which switch A and trunking apparatus B are located; at D, I show a connector switch and circuits adapted to cooperate with second selector switch C in establishing a connection; at K, I show subscribers' station apparatus similar to that shown at F; and at E, a first selector switch associated with the line of subscriber K, similar to that shown at A. Referring to the trunking apparatus and circuits shown at B, 30, 32, 42 and 44 represent contact points forming the terminals of the trunk circuit. These terminals are located in contact banks associated with first selector switch A, and are multiplied to other first selector switches. Relay 71 has its winding normally legged

to battery 81 from limb H of the trunk circuit through contact 83—88. When the said relay is energized, it attracts its armature which causes spring 76 to break its normal engagement with spring 77 and to engage spring 80, and also causes spring 73 to move toward spring 74 associated with relay 72. Relay 72 has its winding normally legged to battery 81 from limb G of the trunk circuit through contact 84—85. When energized, it attracts its armature, causing spring 78 to break its normal engagement with spring 75 and to engage spring 80, and also causes spring 74 to move toward spring 73. If the two relays 71 and 72 are simultaneously energized, the attraction of their armatures will cause the ends of springs 73 and 74 to engage. Relay 82 has its winding normally bridged between limbs G and H of the trunk circuit, its circuit being traced through contacts 93—98, 77—76, and 75—78. When the said relay is energized, its armatures 83 and 84 engage respectively anvils 87 and 86 and disengage anvils 88 and 85, thereby disconnecting the windings of relays 71 and 72 from limbs H and G of the trunk circuit. Relay 97 is differentially wound and, when its core is magnetized, attracts its armatures, closing contact 95—96 and opening contact 93—98. The opening of the latter contact breaks the circuit of relay 82. Condensers 89 and 90 are introduced into limbs G and H of the trunk circuit respectively, at points intermediate of the connections to said limbs establishing the bridge of relay 82 and the connections from the said limbs to the windings of relays 72 and 71, respectively. Limbs G and H of the trunk circuit terminate at second selector switch C in circuit changing arms 135 and 132, respectively.

In the following detailed description, I shall assume that the horizontal rows of contacts designated *c* and *c'* in Fig. 2 are (regarding Fig. 2 as a first selector switch) terminals of ten trunk circuits associated with second selector switches located in an exchange wherein terminate lines of subscribers numbered from 5000 to 5999. I further assume for purposes of description that subscriber F desires to be connected with subscriber 5436. To accomplish this, subscriber F depresses and releases key 5 five separate times, thereby sending five impulses of current over limb P of the telephone line over the following path: from ground through contact 6—5, over limb P of the line, through contact 38—02, through the winding of relay 45 and to battery 52, thereby causing relay 45 to attract and release its armature 46 five times. Each attraction and release causes an impulse of current over the following path: from ground 51 through contact 46—47, through

contact 60—62, through contact 24—25, through the winding of magnet 23 and to battery 22, thereby causing five successive energizations and deenergizations of the said magnet 23. This magnet corresponds to magnet 271 (Fig. 2) and the energizations and deenergizations thereof described cause shaft 257 (Fig. 2) to be raised upward five steps by the engagement of pawl 290 with successive horizontal ratchet teeth of the said shaft, which places pairs of wipers 258 and 259 in positions horizontal with rows of contacts *c* and *c'*. Referring to Fig. 1, the first upward step of the shaft grounded contact 37 by means of anvil 36, thereby rendering the first selector switch busy and preventing connection being made with the line of subscriber F by any other subscriber. Subscriber F now depresses key 2 to make contact with anvil 3 and releases it. An impulse of current thereby results over the following path: from ground through contact 3—2, over limb S of the line, through contact 55—56, through the winding of relay 49 and to battery 52, thereby causing the energization and deenergization of relay 49. Armature 50 is attached and released, thereby causing the energization and deenergization of relay 59 by a momentary impulse of current flowing over the following path: from ground 51 through contact 50—48, through the winding of relay 59 to battery 70. Relay 59 corresponds to relay 276 (Fig. 2) and its energization and deenergization, as described with reference to said Fig. 2, moves pawl 266 out of engagement with ratchet tooth 273 and into engagement with ratchet tooth 274. Referring to Fig. 1, this accomplishes the following circuit changes: Arm 19 is moved into engagement with contact point 20; arm 24 is moved into engagement with contact point 26; arm 33 is moved into engagement with contact point 34; arm 38 is moved into engagement with contact point 39; and arm 55 is moved into engagement with contact point 57. Magnet 15 is energized upon engagement of arm 19 with contact point 20, by current over the following path: from ground 18, through contact 19—20, through the winding of said magnet, through contact 17—16 to battery 22. Magnet 15 corresponds to magnet 278 in Fig. 2, and the attraction of its armature moves shaft 257 (Fig. 2) with a rotary motion, by the engagement of pawl 279 with the vertical ratchet of the said shaft, one step, so that pairs of wipers 258 and 259 rest in engagement with the first pairs of contacts at the left of rows *c* and *c'*. These pairs of contacts are multiplied to other first selector switches and in case multiples of the first pairs are already in use, the contact of the said pairs corresponding to contact 32 (Fig. 1) will be grounded and relay 59

will be again energized and (referring to Fig. 2) said relay corresponding to relay 276 will prevent the movement of pawl 266 into engagement with ratchet tooth 275 until the said relay is deenergized.

Referring to Fig. 1, the circuit of magnet 15 is a make and break circuit and the magnet alternately is energized and deenergized as long as arm 19 rests in contact with contact point 20. Each energization of the said magnet moves the shaft one step with a rotary motion, wipers 258 and 259 engaging with each step successive pairs of contact points in rows *c* and *c'* (Fig. 2) until pairs are reached in which the contact corresponding to contact 32 in Fig. 1 is ungrounded or idle. This is assumed to occur when wipers 29, 31, 41, 43, engage respectively contacts 30, 32, 42, 44. As soon as this occurs, relay 59 in Fig. 1 is deenergized and, referring to the corresponding relay 276 in Fig. 2, pawl 266 moves into engagement with ratchet tooth 275. The following circuit changes thereby result (referring to Fig. 1): Arm 19 is moved into contact with contact point 21, thereby preventing further energization of magnet 15; arm 24 is moved into engagement with contact point 27; arm 33 is moved into engagement with contact point 35, thereby throwing ground upon contact 32 associated with the trunk circuit selected and its multiples, and rendering the said trunk circuit busy with respect to other subscribers; arm 38 is moved into engagement with contact point 40, and arm 55 into engagement with contact point 58. Subscriber F has now selected an idle second selector switch in an exchange other than that in which his telephone line terminates, the said second selector switch being associated with and adapted to be used in establishing connection with lines of subscribers numbered from 5000 to 5999. The second selector switch C may be of similar construction to the first selector switch A. The horizontal rows of contact points in banks 284 and 285 in Fig. 2 (regarding said Fig. 2 as a second selector switch) are terminals of connector switches adapted to be operated to select and establish connection with individual subscribers' lines, numbered as above specified. For purposes of description, I assume that the horizontal rows of contacts, designated *d* and *d'* in banks 284 and 285 (regarding Fig. 2 as a second selector switch) are terminals of ten connector switches adapted to be operated to select and make connection with lines of subscribers numbered from 5400 to 5499. Subscriber F now depresses and releases key 5 four times, thereby closing current over the following path: from ground, through contact 6—5, over limb P of the line, through contact 38—40, through contact 41—42, through contact 84—85, through

the winding of relay 72 and to battery 81. This flow is in four impulses, and relay 72 is energized and deenergized four times. Each energization and deenergization effects the attraction and release of its armature and causes an impulse of current to flow over the following path: from ground 79, through contact between springs 80 and 78, over limb H of the trunk circuit, through contact 132—07, through winding of relay 101 and to battery 100, thereby energizing and deenergizing relay 101 four separate times. Each energization and deenergization of relay 101 causes an impulse of current, through contact 105—103, through magnet 115 to battery 119, energizing and deenergizing the said magnet four times. The magnet 115 corresponding to magnet 271 in Fig. 2, the wipers of the second selector switch C are raised upward four steps and are placed in a position horizontal with respect to the horizontal rows of contact points *d* and *d'* (Fig. 2). Subscriber F now depresses key 2 and releases it, thereby causing an impulse of current to flow over the following path: from ground through contact 3—2, over limb S of the telephone line, contact 55—58, contact 43—44, contact 83—88, through the winding of relay 71 to battery 81, thereby causing the said relay 71 to be energized and deenergized. This energization and deenergization causes an impulse of current to flow over the following path: from ground 79, through contact between springs 80 and 76, over limb G of the trunk circuit, through contact 135—08, through the winding of relay 102 and to battery 100. This impulse energizes and deenergizes relay 102, attracting and releasing its armature and causing an impulse of current over the following path: from ground 107, through contact 106—104, through the winding of relay 133 and to battery 142. Relay 133 corresponding to relay 276 in Fig. 2, and magnet 108 corresponding to magnet 278 in Fig. 2, the shaft of the second selector switch is rotated in a manner similar to that described with reference to the first selector switch A, until its wipers are placed in engagement with contact points which are the terminals of an idle connector switch associated with the desired group of subscribers. This is assumed to occur when wipers 124, 126, 128, 130 engage respectively contacts 125, 127, 129, 131. When this occurs, relay 138 will be deenergized and arms 111, 116, 121, 132 and 135 will be moved respectively into engagement with contact points 113, 118, 123, 134 and 137.

Fig. 2 may be regarded as illustrating connector switch D with the change that the rows of contacts in the upper bank 284 may be rows of single contacts instead of being



arranged in pairs, and one of the wipers of pair 258 may be omitted. Arm 280 is omitted.

Regarding Fig. 2 now as illustrating the connector switch selected as above described, the third horizontal rows of contacts from below in banks 284 and 285 are assumed to be the terminals of the subscribers' lines numbered from 5431 to 5440. Subscriber F now sends, by means of key 5, three impulses of current through the winding of relay 72 in the manner already described. In this case, the three energizations and deenergizations of relay 72 establish impulses of current over the following path: from ground 79, through contact between springs 80 and 78, over limb H of the trunk circuit, contact 132—134, contact 128—129, contact 165—166, through the winding of relay 145 to battery 143. These impulses of current cause the energization and deenergization of relay 145 three times and, its armature being attracted and released three times, three impulses of current are caused to flow over the following path: from ground 144, through contact 147—150, through contact 195—194, through contact 199—09, through the winding of magnet 197 to battery 198. Magnet 197 in the connector switch corresponding to magnet 271 in Fig. 2, the shaft of the connector switch is raised three steps upward, placing the wipers of the said switch in a position horizontal with the third rows of contacts in banks 284 and 285. Subscriber F now sends one impulse of current over limb S of the telephone line through the winding of relay 71 in the manner already described. The armature of the said relay is attracted and released, which causes an impulse of current over the following path: from ground 79, through contact between springs 80 and 76, over limb G of the trunk circuit, through contact 135—137, contact 130—131, through the winding of relay 146, through contact 167—168 to battery 171. Relay 146 is thereby energized and deenergized and attracts and releases its armature, causing an impulse of current to flow over the following path: from ground 144, through contact 147—151, through the winding of relay 192 to battery 196. Relay 192 corresponds to relay 276 in Fig. 2 and its energization and deenergization, due to the above flow of current, causes pawl 266 to be moved out of engagement with ratchet tooth 273 and into engagement with ratchet tooth 274, accomplishing (referring to Fig. 1) the following circuit changes: Arm 199 is moved into engagement with contact point 200; arm 202 is moved into engagement with contact point 203; arm 211 is moved into engagement with contact point 212; and arm 215 is moved into engagement with contact point 216. Subscriber F now causes, by means of key 5, six impulses of current to flow through relay 72, which causes relay 145 to be energized and deenergized six times in the manner already described. The armature of relay 145 is attracted and released six times and causes six impulses of current flow from ground 144, through contact 199—200, through the magnet 281 to battery 198. Magnet 281 corresponding to magnet 278 in Fig. 2, the six impulses of current above described cause shaft 257 (Fig. 2) to be rotated six steps, which brings the wipers of the switch into contact with the sixth contacts in banks 284 and 285, counting from left to right, of the third horizontal rows from below which contacts are the terminals of the line of the desired subscriber No. 5436. This (referring to Fig. 1) means that wipers 205, 207 and 209 are placed in engagement with contact points 206, 208 and 210 respectively, which are terminals of first selector switch E of subscriber K. Subscriber F now depresses and releases key 2 once, thereby sending an impulse of current through the winding of relay 71 energizing and deenergizing the said relay and causing the attraction and release of its armature. This causes an impulse of current to flow from ground 79 over limb G of the trunk circuit, through the winding of relay 146 to battery 171. The armature of relay 146 is attracted and released. In case the line of K is already in use, contact point 206 will be grounded and an impulse of current results over the following path: from grounded contact point 206, wiper 205, through contact 202—203, through contact 148—153, through the winding of magnet 185 to battery 189. This impulse causes the energization and deenergization of the said magnet. Magnet 185 corresponding to magnet 281 (Fig. 2), its energization and deenergization causes the withdrawal of dog 292 (Fig. 2) from engagement with the ratchets of shaft 257, and allows the shaft to return to its normal position in the manner previously described. Pawl 266 is, by the energization and deenergization of magnet 281, returned to normal position, shown in the illustration. This (referring to Fig. 1) restores arms 199, 202, 211 and 215 to their normal positions. Subscriber F now removes receiver 14 from the switch hook, which causes hook lever 13 to move into engagement with anvil 12, and depresses and releases key 5 which, under the conditions just described, causes him to receive a signal that the desired subscriber's line is busy, in the following manner: The depression of key 5 causes the energization of relay 72 in the manner already described. The energization of relay 72 causes the energization of relay 145 in the manner described with reference to the operation of the connector switch. Arm 199 being at this time in its normal position,

shown in the illustration, the energization of relay 145 causes the energization of magnet 197 which causes an upward step of the shaft of the connector switch which allows  
 5 contact spring 220 to engage anvil 219. This cuts busy back machine 191 into the receiving circuit of subscriber F and gives the characteristic busy signal, as soon as key 5 is released, over the following circuit:  
 10 from the said busy back machine, through contact 219—220, through contact 011—211, through contact 179—180, through condenser 176, through contact 129—128, through contact 134—132, through limb H  
 15 of the trunk circuit, through condenser 90, contact 44—43, contact 58—55, over limb S of the telephone line and through the substation of subscriber F, returning over limb P of the line to battery 171. Upon receiving the busy signal, subscriber F depresses simultaneously keys 2 and 5, replaces his receiver on the hook and releases the keys. This causes the release of second selector C and first selector A by the energization and  
 20 deenergization of their respective release magnets 120 and 28 in the manner herein-after described.

In case at the time the wipers of the connector switch are placed in engagement with  
 30 the contact points forming the terminals of the line of subscriber K, the said line is idle, contact point 206 will be insulated from earth, and the depression and release of key 2 of subscriber F and the consequent energization and deenergization of relay 192 will effect the following circuit changes: Arm 199 is brought into engagement with contact point 201; arm 202 into engagement with contact point 204, thereby establishing a  
 40 ground connection to contact point 206 and its multiples and rendering the line of subscriber K busy with respect to other subscribers; arm 211 is brought into engagement with contact point 213; and arm 215 into engagement with contact point 217. Release magnet 185 in this case fails to operate, owing to the absence of ground connection to contact 206 at the time subscriber F causes the energization of relay 146.

Subscriber F now depresses key 5 and releases it, establishing a flow of current over limb P of the telephone line through relay 72 to battery 81, causing the attraction of the armature of the said relay and establishing a flow of current over a path as follows:  
 50 from ground 79, through contact between springs 80 and 78, over limb H of the trunk circuit, through contact 165—166, through winding of relay 145 to battery 143, thereby energizing the said relay and causing the attraction of its armature, which establishes a path for the flow of current as follows: from ground 144, through contact  
 60 147—150, through contact 195—194, through contact 199—201, through the winding of

relay 178 to battery 214. Relay 178 is thereby energized and attracts its two armatures 179 and 182, thereby cutting ringing generator 184 into the metallic circuit of the line of subscriber K and causing the bell  
 70 of the said subscriber to ring.

Subscriber K in response to the call removes his telephone from the hook, whereupon hook lever 13 engages anvil 12, establishing a path for a flow of current as follows: from the grounded side of battery 170, through one winding of relay 162, through winding 163 of relay 172, through contact 180—179 (relay 178 being at this time deenergized), through contact 211—213,  
 80 contact 207—208, over limb P of the line of subscriber K, returning over limb S of the said line, through contact 210—209, through contact 217—215, through contact 182—183, through winding 164 of relay 172, through  
 85 the other winding of relay 162 to the active side of battery 170. Relay 172 is differentially wound and, under the above conditions, its core remains neutral or non-magnetized.

The above described flow of current causes the energization of relay 162 which attracts armature 165 into engagement with anvil 368, and armature 167 into engagement with  
 95 anvil 169. A path for the flow of current is thereby established as follows: from ground 154, through winding 157 of relay 156, through contact 368—165, contact 129—128, contact 134—132, over limb H of the trunk circuit, through contact 78—75,  
 100 through contact 93—98, through the winding of relay 82, through contact 77—76, over limb G of the trunk circuit, through contact 135—137, contact 130—131, through the winding of relay 146, through contact  
 105 167—169, through winding 158 of relay 156 and to the active side of battery 155.

The above described flow of current energizes relay 82 and attracts armature 84 into engagement with anvil 86, and armature 83 into engagement with anvil 87, at the same time opening the circuits, at the said armatures 84 and 83, of relays 71 and 72. The energization of relay 82 establishes a path for the flow of current as follows:  
 115 from grounded side of battery 99, through winding 91 of relay 97, through contact 86—84, through contact 42—41, contact 40—38, over limb P of the telephone line of subscriber F, through the talking circuit of the substation of F, returning over limb S of the telephone line, through contact  
 120 55—58, through contact 43—44, through contact 83—87, through the winding 92 of relay 97 to the active side of battery 99.

Subscribers F and K are now in conversation, their transmitters being energized by currents from batteries 99 and 170 respectively, through condensers 89 and 177 in one side of the talking circuit and through  
 130

condensers 90 and 176 in the other side of the talking circuit.

When the subscribers have finished their conversation, each depresses keys 5 and 2 simultaneously and replaces his receiver. In case calling subscriber F has depressed simultaneously keys 5 and 2 associated with his substation before subscriber K has depressed the keys associated with his substation, the release of the switching mechanisms employed in the connection between the two subscribers will be effected in the following manner: The depression of key 5 shunts winding 91 of relay 97, while the simultaneous depression of key 2 continues a path for the flow of current from battery 99, through winding 92 of relay 97, over limb S of the telephone line to ground through contact 2-3. Relay 97 is differentially wound, its core becomes energized due to the unbalancing of its windings, and attracts armature 93 out of its normal engagement with anvil 98. This opens the circuit of relay 82, deenergizing the said relay and allowing its armatures 84 and 83 to return to their normal positions in engagement with anvils 85 and 88, respectively. This opens the circuit of relay 97 and causes its deenergization. Limbs P and S of the telephone line of subscriber F being at this time both grounded at the substation, relays 71 and 72 are simultaneously energized by current flowing over the paths already described with reference to the energizations of the said relays. Their armatures being thereby simultaneously attracted, a flow of current results over the following path: from the grounded side of battery 81, through contact between springs 74 and 73, through contact 30-29 of first selector A, through contact 24-27, through magnet 28 and to battery 22. Magnet 28 corresponds to magnet 281 in Fig. 2 and its energization places arms 264 and 265 in positions to accomplish the release and consequent return to normal of the mechanism of the first selector switch as soon as magnet 28 in Fig. 1 is deenergized. The simultaneous energizations of relays 71 and 72 established circuits as follows: from ground 79, through contact 80-76, over limb G of the trunk circuit, through contact 135-137, contact 130-131, through the winding of relay 146 energizing the said relay, through contact 167-169, through winding 158 of relay 156 and to the active side of battery 155; also a circuit from ground 79, through contact 80-78, over limb H of the trunk circuit, through contact 132-134, through contact 128-129, through contact 165-368, through winding 157 of relay 156 and to ground 154. Relay 156 being differentially wound, its winding 157 being short circuited, and current at this time flowing in winding 158, the core of the said relay is mag-

netized and attracts armature 159 into engagement with anvil 160. This establishes a path for the flow of current as follows: from ground 161, through contact 159-160, through the winding of relay 145 and to battery 143, thereby energizing the said relay. Relays 145 and 146 are now energized. The energization of relay 146 establishes a circuit from ground 144 through the winding of relay 192 to battery 196, whereby the said relay is energized and attracts its armature 195. Relay 145 being at this time energized, a path for the flow of current is established as follows: from ground 144, through contact 147-150, through contact 195-193, through winding of magnet 185 and to battery 189. Magnet 185 is thereby energized and attracts its armature 186, establishing a path for the flow of current as follows: from ground 188, through contact 187-186, through contact 149-152 (relay 145 being at this time energized), through contact 125-124, contact 116-118, through the winding of magnet 120 to battery 119. Magnets 185 and 120 corresponding each to magnet 281 illustrated in Fig. 2, the energizations of said magnets 185 and 120 place the switching mechanisms, with which they are respectively associated, in position to be released and returned to normal as soon as the said magnets are deenergized.

It will be noted that the continued energization of the three magnets, 185, 120 and 28, associated respectively with switches D, C and A, is dependent upon the continued energization of relays 71 and 72 of trunk circuit B. Subscriber F releases the two keys 5 and 2 associated with his substation, opening the circuits of relays 72 and 71, his receiver being at this time replaced on its hook. The resulting deenergization of the said relays opens the circuit of magnet 28, thereby deenergizing the said magnet and causing the return of the mechanism of switch A to normal. The deenergization of the said relay 71 also opens the circuits of relays 146 and 156 associated with switch D, and causes their deenergization. The deenergization of relay 146 opens the circuit of relay 192 causing the deenergization of the said relay; its armature 195 disengages anvil 193 opening the circuit of magnet 185 and causing the deenergization of the said magnet which causes the return of the mechanism of switch D to its normal position. The deenergization of magnet 185 opens the circuit of magnet 120 at contact point 186-187, thereby causing the deenergization of the said magnet 120 which causes the return of the mechanism of switch C to normal.

All apparatus at the central office, used in establishing the connection between subscribers F and K, has now been returned to

normal and the two subscribers are in positions to make or receive further calls.

It will be noted that when subscriber F simultaneously depresses his two keys 2 and 5 and releases them upon the termination of the conversation before subscriber K has simultaneously depressed the two keys associated with his substation, the act of subscriber K is of no effect, the release of the entire apparatus being accomplished from the substation of subscriber F.

In case subscriber K depresses keys 2 and 5 associated with his substation in advance of the corresponding act of subscriber F, winding 163 of relay 172 is shunted, due to the fact that subscriber K grounds limb P of his telephone line. Current continues to flow from battery 170 through winding 164 of the said relay 172, over limb S of the telephone line of subscriber K to ground at the substation. Relay 172 being differentially wound, its core is magnetized and its armature 173 is attracted to make engagement with anvil 174. A path for the flow of current is thereby established from ground 175, through contact 173—174, through the winding of magnet 185 to battery 189. Magnet 185 is thereby energized and when subscriber K releases keys 5 and 2, removing ground from the two limbs of his line at the substation, the circuit of relay 172 is opened, the relay deenergized, and armature 173 resumes its normal position, opening contact 174—173. This opens the circuit of magnet 185, causing the deenergization of the said magnet which deenergization causes the return of the mechanism of connector switch D to its normal position. The releasing of keys 2 and 5 by subscriber K, his receiver being at this time replaced, opens the circuit of relay 162, causing the deenergization of the said relay whereupon armatures 165 and 167 resume their normal positions in engagement with anvils 166 and 168, disengaging anvils 168 and 169.

Relay 82 associated with B is deenergized, due to the fact that its winding is connected between the negative side of battery 143 and the negative side of battery 171 which batteries are of equal voltage, or which may be one and the same battery. The deenergization of relay 82 causes armatures 84 and 83 to disengage anvils 86 and 87 respectively, and engage anvils 85 and 88 respectively, thereby opening the circuit of relay 97, cutting current from battery 99 out of circuit with the telephone line of subscriber F and reestablishing the bridges of relays 71 and 72 to the two strands of the talking circuit. When subscriber F simultaneously depresses keys 2 and 5 associated with his substation, and replaces his receiver on its hook, relays 71 and 72 will be simultaneously energized in the manner already described. Magnet 28 of first selector switch A will be

energized in the manner already described with reference to the preceding disconnect operations. Relays 145 and 146 associated with connector switch D are simultaneously energized by currents over the previously traced paths established by the energization of relays 71 and 72 respectively. The energization of relay 146 establishes a previously traced path for the flow of current, energizing relay 192 and attracting its armature 193 into contact with anvil 193. The energization of relay 145 establishes a path for the flow of current from ground 144 through contact 147—150, through contact 195—193, through the winding of magnet 185 to battery 189, causing the said magnet to be energized, whereby is established a path for the flow of current as follows: from ground 188, through contact 187—186, through contact 149—152 (relay 145 being at this time energized), through contact 125—124, through contact 116—118, through the winding of magnet 120 to battery 119, thereby energizing the said magnet.

When subscriber F releases keys 2 and 5, opening the line circuit at the substation, relays 71 and 72 are deenergized which deenergizations effect the deenergizations of magnets 185, 120 and 28 in the manner described with reference to the operations of release in the case in which subscriber F depressed keys 5 and 2 for releasing purposes before subscriber K depressed the keys associated with his substation. The deenergizations of magnets 120 and 28 cause the mechanisms of second selector switch C and first selector switch A, respectively, to return to their normal positions.

While I show in Fig. 1, for purposes of illustration, a plurality of batteries, it is to be understood that they may be one and the same battery.

In applying my invention to trunking between exchanges, one battery at each exchange may be employed.

When in the claims I use the expression, "primary relay," I mean a relay associated with an automatic switch, having the function of initiating or causing a primary or first movement, or set of movements, of the switch with which it is associated. Relays 45, 101 and 145 in Fig. 1 are such relays. When I use the expression, "secondary relay," I mean a relay associated with an automatic switch, having the function of initiating or causing a secondary or second movement, or set of movements, of the switch with which it is associated. Relays 49 and 102 are such relays. When I use the term, "secondary connector relay," I mean a relay associated with a connector switch, having the function of preparing for, or rendering possible, a secondary or second movement, or set of movements, of the connector switch with which it is asso-

ciated. Relay 146 is such a relay. When I use the term, "primary trunk relay," I mean a relay having the function of controlling or causing the response of a primary relay. Relay 72 is such a relay. When I use the term, "secondary trunk relay," I mean a relay having the function of controlling or causing the response of a secondary relay or secondary connector relay. Relay 71 is such a relay. When I use the term, "control relay," I mean a relay having the function of including a source of current in a conversational circuit, or in a portion of such a circuit, to supply current for talking purposes. Relay 82 is such a relay. When I use the term, "release magnet," I mean a magnet having the function of disconnecting an automatic switch. Magnets 28, 120 and 185 are such magnets.

I claim:—

1. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a trunk circuit in electrical connection with said line at the central office, a source of current associated with said circuit, a primary trunk relay and a secondary trunk relay for said circuit responsive to said calling mechanism, an automatic switch at the central office, two conductors extending said trunk circuit to said automatic switch, a primary relay for said switch responsive to currents controlled by said primary trunk relay and a secondary relay for said switch responsive to currents controlled by said secondary trunk relay.

2. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a trunk circuit in electrical connection with said line at the central office, a source of current associated with said circuit, a primary trunk relay and a secondary trunk relay for said circuit responsive to said calling mechanism, an automatic switch at the central office, two conductors extending said trunk circuit to said automatic switch, a primary relay for said switch responsive to currents controlled by said primary trunk relay, a secondary relay for said switch responsive to currents controlled by said secondary trunk relay and a release magnet for said switch responsive to currents adapted to be controlled by said circuit after the telephone line is switched for conversation.

3. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a trunk circuit in electrical connection with said line at the central office, a central source of current associated with said circuit, a primary trunk relay and a secondary trunk relay for said circuit responsive to said calling mechanism, a connector switch at the central office, two conductors extending said trunk circuit to said connector switch, a primary relay for said connector switch responsive to currents controlled by said primary trunk relay, a secondary connector relay responsive to currents controlled by said secondary trunk relay, mechanism controlled by said relays for making connection with a called subscriber's line, and a release magnet for said connector switch responsive to currents adapted to be controlled by said circuit after the telephone line is switched for conversation.

4. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a connector switch, a pair of conductors for said trunk circuit extended to said connector switch, and relays associated with said connector switch responsive to said trunk relays for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber.

5. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism at the substation, a first selector switch at the central office, connected to said line, a trunk circuit in electrical connection therewith, a connector switch, two main conductors only for said trunk circuit extended to and in electrical connection with said connector switch, a primary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a primary relay for said

connector switch responsive to said switching mechanism, a secondary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, and a secondary connector relay for said connector switch responsive to said switching mechanism.

6. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism at the substation, a first selector switch at the central office, connected to said line, a trunk circuit in electrical connection therewith, a connector switch, two main conductors only for said trunk circuit extended to and in electrical connection with said connector switch, a primary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a primary relay for said connector switch responsive to said switching mechanism, a secondary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a secondary connector relay for said connector switch responsive to said switching mechanism, and a release magnet for said connector switch responsive to said two switching mechanisms cooperatively employed when the telephone line is switched for conversation.

7. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism at the substation, a first selector switch connected to said line, a trunk circuit in electrical connection therewith, a connector switch, two main conductors only for said trunk circuit extended to and in electrical connection with said connector switch, a primary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a primary relay for said connector switch responsive to said switching mechanism, a secondary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a secondary connector relay for said connector switch responsive to said switching mechanism, means for placing said connector switch in electrical connection with a called subscriber's line and mechanism for causing current to be supplied

from a central source for talking purposes during conversation.

8. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism at the substation, a first selector switch connected to said line, a trunk circuit in electrical connection therewith, a connector switch, two main conductors only for said trunk circuit extended to and in electrical connection with said connector switch, a primary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a primary relay for said connector switch responsive to said switching mechanism, a secondary trunk relay and source of current in circuit therewith responsive to said calling mechanism, switching mechanism controlled by said relay, a secondary connector relay for said connector responsive to said switching mechanism, means for placing said connector switch in electrical connection with a called subscriber's line, mechanism for causing current to be supplied from a central source for talking purposes during conversation, and a release magnet for said connector switch responsive to said two switching mechanisms cooperatively employed when the telephone line is switched for conversation.

9. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a connector switch, a pair of conductors for said trunk circuit extended to said connector switch, relays associated with said connector switch responsive to said trunk relays for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber and means for supplying current from a central source for talking purposes during conversation.

10. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line

at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a connector switch, a pair of conductors for said trunk circuit extended to said connector switch, relays associated with said connector switch responsive to said trunk relays for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber and a release magnet individual to said connector switch, adapted to be controlled by said trunk circuit after the telephone line is switched for conversation.

11. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a connector switch, a pair of conductors for said trunk circuit extended to said connector switch, relays associated with said connector switch responsive to said trunk relays for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber, means for supplying current from a central source for talking purposes during conversation and a release magnet individual to said connector switch, adapted to be controlled by said trunk circuit after the telephone line is switched for conversation.

12. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, relays associated with said selector switch responsive to said trunk relays for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch and relays associated with said connector switch responsive to said trunk relays when said

switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber.

13. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversations, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, relays associated with said selector switch responsive to said trunk relays for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, relays associated with said connector switch responsive to said trunk relays when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber and means for supplying current from a central source for talking purposes during conversation.

14. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, relays associated with said selector switch responsive to said trunk relays for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, relays associated with said connector switch responsive to said trunk relays when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber, and release magnets individual to said selector switch and said connector switch respectively, responsive to said trunk relays when the telephone line is switched for conversation.

15. In a telephone system provided with



calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, a trunk circuit at the central office connected with said line, a primary trunk relay and a secondary trunk relay associated with said circuit responsive to said calling mechanism, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, relays associated with said selector switch responsive to said trunk relays for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, relays associated with said connector switch responsive to said trunk relays when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber, means for supplying current from a central source for talking purposes during conversation and release magnets individual to said selector switch and said connector switch respectively, responsive to said trunk relays when the telephone line is switched for conversation.

16. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, an automatic switch individual to said line at the central office, a trunk circuit at the central office, electromagnetic means for operating said switch responsive to said calling mechanism adapted to place said line in electrical connection with said circuit, electromagnetic switching devices associated with said circuit responsive to said calling mechanism when said circuit is connected with said line, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, electromagnets associated with said selector switch responsive to said switching devices for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, and electromagnets associated with said connector switch responsive to said switching devices when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber.

17. In a telephone system provided with

calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, an automatic switch individual to said line at the central office, a trunk circuit at the central office, electromagnetic means for operating said switch responsive to said calling mechanism adapted to place said line in electrical connection with said circuit, electromagnetic switching devices associated with said circuit responsive to said calling mechanism when said circuit is connected with said line, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, electromagnets associated with said selector switch responsive to said switching devices for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, electromagnets associated with said connector switch responsive to said switching devices when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber and means for supplying current from a central source for talking purposes during conversation.

18. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, an automatic switch individual to said line at the central office, a trunk circuit at the central office, electromagnetic means for operating said switch responsive to said calling mechanism adapted to place said line in electrical connection with said circuit, electromagnetic switching devices associated with said circuit responsive to said calling mechanism when said circuit is connected with said line, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, electromagnets associated with said selector switch responsive to said switching devices for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, electromagnets associated with said connector switch responsive to said switching devices when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber, and release mech-



anism for disconnecting said automatic switch, said selector switch and said connector switch, responsive to said switching devices when the telephone line is switched for conversation.

19. In a telephone system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination of a telephone line connecting a substation with the central office, calling mechanism for said line at the substation, a central source of current for operating purposes, an automatic switch individual to said line at the central office, a trunk circuit at the central office, electromagnetic means for operating said switch responsive to said calling mechanism adapted to place said line in electrical connection with said circuit, electromagnetic switching devices associated with said circuit responsive to said calling mechanism when said circuit is connected with said line, a selector switch, a pair of conductors for said trunk circuit extending to said selector switch, a connector switch, electromagnets associated with said selector switch responsive to said switching devices for causing the operation of said selector switch to place said selector switch in electrical connection with said connector switch, electromagnets associated with said connector switch responsive to said switching devices when said switch is connected with said selector switch for causing the operation of said connector switch to place it in electrical connection with the line of a called subscriber, means for supplying current from a central source for talking purposes during conversation and release mechanism for disconnecting said automatic switch, said selector switch and said connector switch, responsive to said switching devices when the telephone line is switched for conversation.

20. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism for said line at the substation, a pair of relays at the exchange adapted to be controlled by means of said mechanism, and a selector switch and a connector switch adapted to be successively operated, responsive to said relays, in establishing desired connections.

21. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism for said line at the substation, a pair of relays at the

exchange adapted to be controlled by means of said mechanism, a selector switch and a connector switch adapted to be successively operated, responsive to said relays, in establishing desired connections and mechanism adapted to be operated responsive to said relays when disconnection is desired for releasing said switches.

22. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism for said line at the substation, a pair of relays at the exchange adapted to be controlled by means of said mechanism, a selector switch and a connector switch adapted to be successively operated, responsive to said relays, in establishing desired connections, mechanism adapted to be operated responsive to said relays when disconnection is desired for releasing said switches, a central source of current and a relay at the exchange adapted to include said source in circuit with connected lines to supply current therefor for conversational purposes.

23. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism at the substation, a pair of relays at the exchange adapted to be controlled by means of said mechanism, a selector switch and a connector switch adapted to perform successive switching operations in connecting said line with a desired line, electromagnets for operating said selector switch adapted to be controlled by said relays and electromagnets for operating said connector switch adapted to be controlled by said relays.

24. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of a pair of electromagnets at the exchange adapted to be controlled from the substation, conductors associated with said electromagnets, and armature apparatus controlled thereby adapted to transmit switching currents over said conductors, a selector switch, electromagnets for operating said switch in circuit with said conductors and adapted to be operated by said currents, a connector switch, electromagnets for operating said switch, and apparatus for cutting said conductors out of circuit with the electromagnets of said selector switch after said electromagnets are operated, and

for cutting them into circuit with the electromagnets of said connector switch to render said switch controllable by currents transmitted over said conductors.

25. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line extending from a substation to the exchange, of calling mechanism at the substation adapted, under control of the subscriber, to effect the transmission of currents over the line, electromagnets at the exchange adapted to be controlled by means of said calling mechanism, conductors associated therewith and switching apparatus controlled by said electromagnets adapted to transmit currents over said conductors, a selector switch, contacts included in the mechanism thereof for continuing the circuit of said line to a desired line, and electromagnets for operating said switch adapted to be controlled by currents transmitted over said conductors by said apparatus after said selector switch is operated.

26. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism at the substation, relays at the exchange adapted to be controlled by means of said mechanism, a selector switch and a connector switch adapted to perform successive switching operations in connecting said line with a desired line, electromagnets for operating said selector switch adapted to be controlled by said relays, electromagnets for operating said connector switch adapted to be controlled by said relays and a central source of current and branches adapted to supply current therefrom to subscribers' lines for conversational purposes.

27. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of calling mechanism at the substation, relays at the exchange adapted to be controlled by means of said mechanism, a selector switch and a connector switch adapted to perform successive switching operations in connecting said line with a desired line, electromagnets for operating said selector switch adapted to be controlled by said relays, electromagnets for operating said connector switch adapted to be controlled by said relays, a central source of current and branches adapted to supply current therefrom to subscribers' lines for con-

versational purposes and release magnets for disconnecting said switches adapted to be controlled from the substation.

28. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of electromagnets at the exchange adapted to be controlled from the substation, conductors associated with, and armature apparatus controlled by said electromagnets adapted to transmit switching currents over said conductors, a selector switch, electromagnets for operating said switch in circuit with said conductors, and adapted to be operated by said currents, a connector switch, electromagnets for operating said switch, apparatus for cutting said conductors out of circuit with the electromagnets of said selector switch, after said electromagnets are operated, and for cutting them into circuit with the electromagnets of said connector switch to render said switch controllable by currents transmitted over said conductors and a central source of current and bridges adapted to supply current therefrom to subscribers' lines for conversational purposes.

29. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line connecting a substation with the exchange, of electromagnets at the exchange adapted to be controlled from the substation, conductors associated with, and armature apparatus controlled by said electromagnets adapted to transmit switching currents over said conductors, a selector switch, electromagnets for operating said switch in circuit with said conductors, and adapted to be operated by said currents, a connector switch, electromagnets for operating said switch, apparatus for cutting said conductors out of circuit with the electromagnets of said selector switch, after said electromagnets are operated, and for cutting them into circuit with the electromagnets of said connector switch to render said switch controllable by currents transmitted over said conductors, a central source of current and bridges adapted to supply current therefrom to subscribers' lines for conversational purposes and release magnets for said switches adapted to disconnect them under substation control.

30. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a telephone line extending from a substa-

tion to the exchange, of calling mechanism at the substation adapted, under control of the subscriber, to effect the transmission of currents over the line, a central source of  
 5 current, electromagnets at the exchange adapted to be controlled by means of said calling mechanism, conductors associated therewith and switching apparatus controlled by said electromagnets adapted to  
 10 transmit currents over said conductors, a selector switch and contacts included in the mechanism thereof for continuing the circuit of said line to desired lines, electromagnets for operating said switch adapted to be  
 15 controlled by currents transmitted over said conductors by said apparatus, a connector switch, contacts included in the mechanism thereof for continuing the circuit of said line to a desired line, electromagnets for oper-  
 20 ating said switch adapted to be controlled by currents transmitted over said conductors by said apparatus after said selector switch is operated and release magnets for said switches adapted to be operated under  
 25 substation control.

31. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 30 a calling subscriber's line connecting the substation with the exchange, of calling mechanism for the line at the substation, relays at the exchange adapted to be controlled by means of said mechanism, a called  
 35 subscriber's line and a selector switch and a connector switch at the exchange adapted to successively cooperate with said relays in connecting said lines.

32. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 40 a calling subscriber's line connecting the substation with the exchange, of calling mechanism for the line at the substation, relays at the exchange adapted to be controlled by means of said mechanism, a called sub-  
 45 scriber's line, a selector switch and a connector switch at the exchange adapted to successively cooperate with said relays in connecting said lines and a central source of current adapted to supply current to sub-  
 50 scribers' lines for purposes of conversation.

33. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 55 a telephone line connecting a substation with the exchange, of a relay at the exchange adapted to be controlled from the substation, a selector switch, an electromagnet, adapted to effect primary switching  
 60

movements of said switch, responsive to said relay, a connector switch, an electromagnet, adapted to effect primary switching movements thereof, responsive to said relay, a  
 70 second relay at the exchange adapted to be controlled from the substation and electromagnets for said switches respectively, adapted to permit secondary switching movements of said switches, responsive to  
 75 said second relay.

34. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 80 a telephone line connecting a substation with the exchange, of a relay at the exchange adapted to be controlled from the substation, a selector switch, an electromagnet, adapted to effect primary switching  
 85 movements of said switch, responsive to said relay, a connector switch, an electromagnet, adapted to effect primary switching movements thereof, responsive to said relay, a second relay at the exchange adapted to be  
 90 controlled from the substation, electromagnets for said switches respectively, adapted to permit secondary switching movements of said switches, responsive to said second relay and apparatus for restoring said  
 95 switches to normal adapted to be controlled from the substation.

35. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 100 a telephone line connecting a substation with the exchange, of a relay at the exchange adapted to be controlled from the substation, a selector switch, an electromagnet, adapted to effect primary switching  
 105 movements of said switch, responsive to said relay, a connector switch, an electromagnet, adapted to effect primary switching movements thereof, responsive to said relay, a second relay at the exchange adapted  
 110 to be controlled from the substation, electromagnets for said switches respectively, adapted to permit secondary switching movements of said switches, responsive to said second relay, apparatus for restoring  
 115 said switches to normal, adapted to be controlled from the substation and a central source of current and bridges adapted to supply current therefrom for operating and conversational purposes.

36. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with  
 120 a calling subscriber's line connecting the substation with the exchange, of calling mechanism for said line at the substation, a  
 125  
 130

central source of current for operating purposes, a relay at the exchange adapted to be controlled by said mechanism, a called subscriber's line, a selector switch and a connector switch adapted to perform successive switching operations in connecting said subscribers' lines, electromagnets for said switches respectively, adapted to effect primary switching movements thereof, responsive to said relay, a second relay adapted to be controlled by said calling mechanism and electromagnets for said switches respectively, adapted to permit secondary switching movements thereof, responsive to said relay.

37. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a calling subscriber's line connecting the substation with the exchange, of calling mechanism for said line at the substation, a central source of current for operating purposes, a relay at the exchange adapted to be controlled by said mechanism, a called subscriber's line, a selector switch and a connector switch adapted to perform successive switching operations in connecting said subscribers' lines, electromagnets for said switches respectively, adapted to effect primary switching movements thereof, responsive to said relay, a second relay adapted to be controlled by said calling mechanism, electromagnets for said switches respectively, adapted to permit secondary switching movements thereof, responsive to said relay and bridges adapted to supply current from a central source to subscribers' lines for purposes of conversation.

38. In a telephone exchange system provided with calling mechanisms at subscribers' stations and automatic switches at the central office for connecting subscribers' lines for conversation, the combination with a calling subscriber's line connecting the substation with the exchange, of calling mechanism for said line at the substation, a central source of current for operating purposes, a relay at the exchange adapted to be controlled by said mechanism, a called subscriber's line, a selector switch and a connector switch adapted to perform successive switching operations in connecting said subscribers' lines, electromagnets for said switches respectively, adapted to effect primary switching movements thereof, responsive to said relay, a second relay adapted to be controlled by said calling mechanism, electromagnets for said switches respectively, adapted to permit secondary switching movements thereof, responsive to said relay, bridges adapted to supply current from a central source to subscribers' lines for purposes of conversation and release

magnets for said switches adapted to be controlled from the substations.

39. In a telephone exchange system, the combination of a first selector, a second selector, a repeater interposed between the first and second selectors, a connector, a calling subscriber's line, a called subscriber's line, a calling subscriber's impulse transmitter for operating the said selectors and connector, and for operating said repeater, means in the connector for closing a trunk release circuit through the second selector, means in the repeater for closing a trunk release circuit back through the first selector, and means for supplying electrical current for operating the said selectors and connector and repeater.

40. In a telephone exchange system, the combination of a first selector, a second selector, a repeater interposed between the first and second selectors, a connector, a calling subscriber's line, a called subscriber's line, a calling subscriber's impulse transmitter for operating the said selectors and connector, and for operating said repeater, means in the connector for closing a trunk connector, and for operating said repeater, means in the repeater for closing a trunk release circuit back through the first selector, a battery for operating the first selector and the repeater, and another battery for operating the second selector and the connector.

41. In a telephone exchange system, the combination of a calling subscriber's line, an automatic switch individual thereto, other automatic switches, a called subscriber's line, bridged relays for all of said automatic switches, means for cutting off the relay bridges of one or more of said switches, a repeater interposed between two of said automatic switches, line relays for said repeater, adapted to remain bridged across the circuit, and release devices for said automatic switches controlled by the relays of said remaining bridges.

42. In a telephone exchange system, the combination of a telephone line circuit extending between calling and called substations, an automatic switch provided with relay means temporarily disconnected from said circuit, a repeater, means in said repeater for repeating or relaying electrical impulses from one portion of said circuit to another, a trunk release circuit extending between the automatic switch and the repeater, and means in said repeater for closing said trunk release circuit.

43. In a telephone exchange system, the combination of a plurality of automatic switches, a repeater provided with line relays for successively controlling said automatic switches, a subscriber's individual switch, a release circuit extending between the individual switch and the repeater,

adapted when closed to release the individual switch, and means in said repeater for controlling said release circuit.

44. In a telephone exchange system, the combination of a subscriber's individual switch, a repeater, a three conductor trunk line connecting the individual switch with the repeater, a selector, a two conductor trunk line connecting the repeater with the selector, a connector, a three conductor trunk line connecting the selector with the connector, means for supplying current over both sides of said two conductor trunk line to initiate the release of the connector, and means for supplying current over the third conductors of said other trunk line to initiate the release of the individual switch and the selector.

45. In a telephone exchange system, the combination of subscribers' telephone lines, individual trunking switches for said telephone lines, repeaters less in number than said telephone lines, a trunk line for each repeater, each repeater provided with inductive connections in its trunk line, means for repeating or relaying electrical impulses from one side to the other of said inductive connections, and automatic switches in which said trunk lines terminate, adapted to receive electrical impulses from the repeater, together with subscribers' calling devices for sending electrical impulses to the repeater, and means controlled by the repeaters for releasing the individual switches.

46. In a telephone exchange system, a combination of release mechanism, a trunk release circuit, a repeater, a trunk circuit, a subscriber's calling device for transmitting electrical impulses to said repeater, means in said repeater for repeating or relaying said impulses from one portion to another of said trunk circuit, inductive voice current connections in said repeater, and means in said repeater for controlling said release circuit.

47. In a telephone exchange system, the combination of a repeater, a trunk release circuit, and means in said repeater for controlling said circuit.

48. In a telephone exchange system, the combination of an automatic switch provided with bridging relay means, bridge cut-off devices for opening up or disconnecting the bridge, another automatic switch, a repeater having relay means for controlling the said other automatic switch, a trunk line connecting the repeater with the said other automatic switch, and means controlled by the repeater for releasing said first-mentioned automatic switch.

49. In a telephone exchange system, the combination of an automatic switch provided with bridging line relay means, instrumentalities for disconnecting or cutting off the bridge, a repeater, means in said re-

peater for controlling the energizing of said bridge before the latter is cut off.

50. An automatic telephone system comprising a talking circuit provided with a pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one bridge, and another battery for energizing the other bridge.

51. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together and included in a complete metallic talking circuit, two separate batteries for supplying current to the said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for connecting the said batteries in bridge across the talking circuit, whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is supplied to the talking circuit at two points in the latter's length.

52. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality of batteries for independently supplying talking current to the different sections of the circuit, means under the control of only the called subscriber for bridging one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the said battery which is bridged across the called subscriber's line for bridging the other battery across the calling subscriber's line.

53. An automatic telephone system comprising an automatic switching machine provided with "line relays" adapted to respond to any electrical impulses produced in their circuits, a subscriber's device for producing or generating suitable electrical impulses, means including a pair of "line relays" having switch contacts controlling the circuits for the said "line relays" of the switching machine, whereby the electrical impulses produced by the calling subscriber are repeated by said second pair of relays in the circuits of said "line relays" of the switching machine.

54. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine

being provided with a pair of "line relays", together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line relays" having circuits controlled by the calling subscriber and provided with switch contacts for controlling the circuits of the said "line relays" of the switching machine.

55. An automatic telephone system comprising a calling subscriber's line, a switching machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of "line relays", means for inductively connecting a subscriber's line with the said machine, a second pair of "line relays", said pairs of relays being bridged across the circuit at opposite sides of said inductive connections, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitutes the means whereby the calling subscriber also controls the operation of said "line relays" of the switching machine, said second pair of relays thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the line "circuit" at the other side of said inductive connections.

56. An automatic telephone system comprising a calling subscriber's line, an electrically propelled and step-by-step actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line relay", means for inductively separating the said "line relay" from the calling subscriber's line, a second "line relay" connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating the second relay and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line relay" of the switching machine.

57. An automatic telephone system comprising a suitable number of electrically propelled and step-by-step actuated switching machines divided into separate exchanges or divisions, trunk lines connecting the two exchanges or divisions, as many repeaters as there are trunk lines, each trunk line terminating at one end in a switching machine and at the other end in a repeater, together with a centralized source of current supply at each exchange or division, said sources, being adapted and connected for

supplying current to the subscriber's lines for both talking and switching purposes.

58. An automatic telephone system comprising a plurality of electrically-propelled and step-by-step actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk lines, each trunk line terminating at one end in a switching machine and at the other end in a repeater.

59. An automatic telephone system comprising a repeater provided with a pair of condensers, an automatic electrically-propelled and step-by-step actuated switching machine provided with a pair of movable switch contacts, and a pair of trunk line conductors, each trunk line conductor terminating at one end in one of said movable switch contacts, and at the other end in one of said condensers.

60. An automatic telephone system comprising an electrically-propelled and step-by-step actuated switching machine provided with a pair of "line relays", a trunk line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater.

61. An automatic telephone system comprising a trunk line, a pair of "line relays" normally bridged across one end of said line, means for automatically cutting off said bridge when the line is used for talking purposes, a third relay normally bridged across the other end of said trunk line and adapted to remain so during the use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the said third relay when the use of said line is to be discontinued.

62. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step actuated switching machines, a suitable number of repeaters, and "release circuits" for said switching machines, some of said "release circuits" being controlled by certain of the switching machines, and other "release circuits" being controlled by said repeaters.

63. An automatic telephone system comprising a talking circuit divided into inductively united end and intermediate sections, a repeater relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of the said repeater relay, and another battery connected in series with said second relay,

together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit.

5 64. An automatic telephone system comprising a temporarily established talking circuit, a repeater apparatus, a suitable "connector", said repeater apparatus and "connector" both having relay coils, to-  
10 gether with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector".

65. An automatic telephone system com-  
15 prising an established talking circuit, a suitable "connector," a repeater apparatus, the said "connector" having a relay provided with differential windings, said repeater apparatus having a plurality of relays, and  
20 there being a battery temporarily connected in series in a charged or closed circuit including said differential windings and one of said relays.

66. An automatic telephone system com-  
25 prising an established talking circuit, a calling subscriber's line included in said talking circuit, a repeater apparatus provided with a relay having differential windings and provided also with a second relay bridged  
30 across the talking circuit, said bridge having normally closed switch contacts included in the structure of said relay with the differential windings, there being a battery temporarily connected in series in a charged  
35 or closed circuit including said differential windings and said calling subscriber's line.

67. An automatic telephone system comprising an established talking circuit composed of inductively united end and inter-  
40 mediate sections, a battery and a plurality of relay coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking circuit, and whereof another includes an  
45 end section of the circuit, and there being another battery and a plurality of relay coils temporarily connected in a charged or closed circuit including the other end section of the talking circuit.

50 68. An automatic telephone system comprising a talking circuit provided with a pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay  
55 coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one bridge, and another battery for energizing the other  
60 bridge, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called sub-

scriber's line and thereby producing an audi- 65 ble signal at the latter's station.

69. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together and includes in a complete me-  
70 tallic talking circuit, two separate batteries for supplying current to the said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for connecting  
75 the said batteries in bridge across the talking circuit, whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is supplied  
80 to the talking circuit at two points in the latter's length, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called  
85 subscriber's line and thereby producing an audible signal at the latter's station.

70. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected  
90 together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality of batteries for independently supplying talking current to the different sections of the  
95 circuit, means under the control of only the called subscriber for bridging one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the  
100 said battery which is bridged across the called subscriber's line for bridging the other battery across the calling subscriber's line, said system also comprising means operated by battery current and under the control  
105 of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

71. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line, and means under the control of the calling subscriber for establishing connection between the two lines,  
110 said means comprising inductively united circuit sections, and comprising also a repeater connected and operative to repeat electrical impulses from one circuit section to the other, said system also comprising  
115 means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

72. An automatic telephone system comprising an automatic switching machine provided with "line relays" adapted to respond  
125 to any electrical impulses produced in their



circuits, a subscriber's device for producing or generating suitable electrical impulses, means including a pair of "line relays" having switch contacts controlling the circuits for the said "line relays" of the switching machine, whereby electrical impulses produced by the calling subscriber are repeated by said second pair of relays in the circuits of said "line relays" of the switching machine, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

73. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine being provided with a pair of "line relays," together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line relays" having circuits controlled by the calling subscriber and provided with switch contacts for controlling the circuits of the said "line relays" of the switching machine, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

74. An automatic telephone system comprising a calling subscriber's line, a switching machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of "line relays," means for inductively connecting a subscriber's line with the said machine, a second pair of "line relays," said pairs of relays being bridged across the circuit at opposite sides of said inductive connections, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitute the means whereby the calling subscriber also controls the operation of said "line relays" of the switching machine, said second pair of relays thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the "line circuit" at the other side of said inductive connections, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current

onto any called subscriber's line and thereby producing an audible signal at the latter's station.

75. An automatic telephone system comprising a calling subscriber's line, an electrically propelled and step-by-step actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line relay," means for inductively separating the said "line relay" from the calling subscriber's line, a second "line relay" connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating said second relay, and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line relay" of the switching machine, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

76. An automatic telephone system comprising a suitable number of electrically propelled and step-by-step actuated switching machines divided into separate exchanges or divisions, trunk lines connecting the two exchanges or divisions, as many repeaters as there are trunk lines, each trunk line terminating at one end in a switching machine and at the other end in a repeater, together with a centralized source of current supply at each exchange or division, said sources being adapted and connected for supplying current to the subscribers' lines for both talking and switching purposes, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

77. An automatic telephone system comprising a plurality of electrically propelled and step-by-step actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk lines, each trunk line terminating at one end in a switching machine and at the other end in a repeater, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

78. An automatic telephone system com-



prising a repeater provided with a pair of condensers, an automatic electrically propelled step-by-step actuated switching machine provided with a pair of movable switch contacts, and a pair of trunk line conductors, each trunk line conductor terminating at one end in one of said movable switch contacts, and at the other end in one of said condensers, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

79. An automatic telephone system comprising an electrically propelled and step-by-step actuated switching machine provided with a pair of "line relays", a trunk line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

80. An automatic telephone system comprising a trunk line, a pair of "line relays" normally bridged across one end of said line, means for automatically cutting off said bridge when the line is used for talking purposes, a third relay normally bridged across the other end of said trunk line and adapted to remain so during use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the said third relay when the use of said line is to be discontinued, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

81. An automatic telephone system comprising a suitable number of electrically propelled and step-by-step actuated switching machines, a suitable number of repeaters, and "release circuits" for said switching machines, some of said "release circuits" being controlled by certain of the switching machines, and other "release circuits" being controlled by said repeaters, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

82. An automatic telephone system comprising a talking circuit divided into inductively united end and intermediate sections, a repeater relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of said repeater relay, and another battery connected in series with said second relay, together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

83. An automatic telephone system comprising a temporarily established talking circuit, a repeater apparatus, a suitable "connector", said repeater apparatus and "connector" both having relay coils, together with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector", said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

84. An automatic telephone system comprising an established talking circuit, a suitable "connector", a repeater apparatus, the said "connector" having a relay provided with differential windings, said repeater apparatus having a plurality of relays, and there being a battery temporarily connected in series in a charged or closed circuit including said differential windings and one of said relays, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

85. An automatic telephone system comprising an established talking circuit, a called subscriber's line included in said talking circuit, a repeater apparatus provided with a relay having differential windings and provided also with a second relay bridged across the talking circuit, said bridge having normally closed switch contacts included in the structure of said relay with the differential windings, there being a battery temporarily connected in series in a charged or closed circuit including said differential windings and said calling subscriber's line, said system also comprising means operated by battery current and under the control of the calling subscriber for admitting alternating current onto any

called subscriber's line and thereby producing an audible signal at the latter's station.

86. An automatic telephone system comprising an established talking circuit composed of inductively united end and intermediate sections, a battery and a plurality of relay coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking circuit, and whereof another includes an end section of the circuit, and there being another battery and a plurality of relay coils temporarily connected in a charged or closed circuit including the other end section of the talking circuit, said system also comprising means operated by battery current and under the control of any calling subscriber for admitting alternating current onto any called subscriber's line and thereby producing an audible signal at the latter's station.

87. An automatic telephone system comprising a talking circuit provided with a pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one bridge, and another battery for energizing the other bridge, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground circuits necessary in calling the number of another subscriber.

88. An automatic telephone system comprising a calling subscriber's line, a called subscriber's line temporarily connected together and included in a complete metallic talking circuit, two separate batteries for supplying current to said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for connecting the said batteries in bridge across the talking circuit, whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is supplied to the talking circuit at two points in the latter's length, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground circuits necessary in calling the number of another subscriber.

89. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality of batteries for independently supplying talk-

ing current to the different sections of the circuit, means under the control of only the called subscriber for bringing one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the said battery which is bridged across the called subscriber's line for bridging the other battery across the calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground circuits necessary in calling the number of another subscriber.

90. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line, and means under the control of the calling subscriber for establishing connection between the two lines, said means comprising inductively united circuit sections, and comprising also a repeater connected and operative to repeat electrical impulses from one circuit section to the other, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

91. An automatic telephone system comprising an automatic switching machine provided with "line relays" adapted to respond to any electrical impulses produced in their circuits, a subscriber's device for producing or generating suitable electrical impulses, means including a pair of "line relays" having switch contacts controlling the circuits for the said "line relays" of the switching machine, whereby electrical impulses produced by the calling subscriber are repeated by said second pair of relays in the circuits of said "line relays" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

92. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine being provided with a pair of "line relays", together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line relays" having circuits controlled by the calling subscriber and provided with switch contacts for controlling the circuits of the said "line relays" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the

live or charged ground-circuits necessary in calling the number of another subscriber.

93. An automatic telephone system comprising a calling subscriber's line, a switching machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of "line relays," means for inductively connecting a subscriber's line with the said machine, a second pair of "line relays," said pair of relays being bridged across the circuit at opposite side of said inductive connections, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitutes the means whereby the calling subscriber also controls the operation of said "line relays" of the switching machine, said second pair of relays thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the "line-circuit" at the other side of said inductive connections, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

94. An automatic telephone system comprising a calling subscriber's line, an electrically propelled and step-by-step actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line relay," means for inductively separating the said "line relay" from the calling subscriber's line, a second "line relay" connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating said second relay, and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line relay" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

95. An automatic telephone system comprising a suitable number of electrically propelled and step-by-step actuated switching machines divided into separate exchanges or divisions, trunk-lines connecting the two exchanges or divisions, as many repeaters as

there are trunk-lines, each trunk-line terminating at one end in a switching machine and at the other end in a repeater, together with a centralized source of current supply at each exchange or division, said sources being adapted and connected for supplying current to the subscribers' lines for both talking and switching purposes, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charge ground-circuit necessary in calling the number of another subscriber.

96. An automatic telephone system comprising a plurality of electrically propelled and step-by-step actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk-lines, each trunk-line terminating at one end in a switching machine and at the other end in a repeater, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

97. An automatic telephone system comprising a repeater provided with a pair of condensers, an automatic electrically propelled and step-by-step actuated switching machine provided with a pair of movable switch contacts, and a pair of trunk-line-conductors, each trunk-line-conductor terminating at one end in one of said movable switch contacts, and at the other end in one of said condensers, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

98. An automatic telephone system comprising an electrically propelled and step-by-step actuated switching machine provided with a pair of "line relays," a trunk-line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk-line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charge ground-circuits necessary in calling the number of another subscriber.

99. An automatic telephone system comprising a trunk-line, a pair of "line relays" normally bridged across one end of said line, means for automatically cutting off said

bridge when the line is used for talking purposes, a third relay normally bridged across the other end of said trunk-line and adapted to remain so during the use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the third relay when the use of said line is to be discontinued, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

100. An automatic telephone system comprising a suitable number of electrically propelled and step-by-step actuated switching machines, a suitable number of repeaters, and "release circuits" for said switching machines, some of said "release circuits" being controlled by certain of the switching machines, and other "release circuits" being controlled by said repeaters, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

101. An automatic telephone system comprising a talking circuit divided into inductively united end and intermediate sections, a repeater relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of the said repeater relay, and another battery connected in series with said second relay, together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

102. An automatic telephone system comprising a temporarily established talking circuit, a repeater apparatus, a suitable "connector," said repeater apparatus and "connector" both having "relay-coils," together with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector," the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

103. An automatic telephone system comprising an established talking circuit, a

suitable "connector," a repeater apparatus, the said "connector" having a relay provided with differential windings, said repeater apparatus having a plurality of relays, and there being a battery temporarily connected in series in a charged or closed circuit including said differential windings and one of said relays, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

104. An automatic telephone system comprising an established talking circuit, a calling subscriber's line included in said talking circuit, a repeater apparatus provided with a relay having differential windings and provided also with a second relay bridged across the talking circuit, said bridge having normally closed switch-contacts included in the structure of said relay with the differential windings, there being a battery temporarily connected in series in a charged or closed circuit including said differential windings and said calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

105. An automatic telephone system comprising an established talking circuit composed of inductively united end and intermediate sections, a battery and a plurality of relay coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking circuit, and whereof another includes an end section of the circuit, and there being another battery and a plurality of relay coils temporarily connected in a charged or closed circuit including the other end section of the talking circuit, the said telephone system as a whole comprising also suitable connections and means whereby a subscriber may momentarily establish the live or charged ground-circuits necessary in calling the number of another subscriber.

106. An automatic telephone system comprising calling and called subscribers' lines temporarily maintained in connection with each other through the medium of the switch-contacts of a plurality of step-by-step switching machines, a repeater bridged across the talking circuit at a point between two of said switching machines, and means for supplying talking current through the said repeater to the calling subscriber's line, and through one of said switching machines to the called subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a

calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

107. An automatic telephone system comprising a talking circuit provided with a pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one bridge, and another battery for energizing the other bridge, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

108. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together and included in a complete metallic talking circuit, two separate batteries for supplying current to the said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for connecting the said batteries in bridge across the talking circuit whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is supplied to the talking circuit at two points in the latter's length, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

109. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality of batteries for independently supplying talking current to the different sections of the circuit, means under the control of only the called subscriber for bridging one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the said battery which is bridged across the called subscriber's line for bridging the other battery across the calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means

whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

110. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line, and means under the control of the calling subscriber for establishing connection between the two lines, said means comprising inductively united circuit sections, and comprising also a repeater connected and operative to repeat electrical impulses from one circuit section to the other, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

111. An automatic telephone system comprising an automatic switching machine provided with "line relays" adapted to respond to any electrical impulses produced in their circuits, a subscriber's device for producing or generating suitable electrical impulses, means including a pair of "line relays" having switch contacts controlling the circuits for the said "line relays" of the switching machine, whereby electrical impulses produced by the calling subscriber are repeated by said second pair of relays in the circuits of said "line relays" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

112. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine being provided with a pair of "line relays", together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line relays" having circuits controlled by the calling subscriber and provided with switch contacts for controlling the circuits of the said "line relays" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

113. An automatic telephone system comprising a calling subscriber's line, a switch-

ing machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of "line-relays", means for inductively connecting a subscriber's line with the said machine, a second pair of "line-relays", said pairs of relays being bridged across the circuit at opposite sides of said inductive connection, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitute the means whereby the calling subscriber also controls the operation of said "line-relays" of the switching machine, said second pair of relays thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the "line-circuit" at the other side of said inductive connections, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' station after the conversation is terminated.

114. An automatic telephone system comprising a calling subscriber's line, an electrically-propelled and step-by-step actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line-relay", means for inductively separating the said "line-relay" from the calling subscriber's line, a second "line-relay", connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating said second relay, and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line-relay" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between the subscribers' stations after the conversation is terminated.

115. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines divided into separate exchanges or divisions, trunk-lines connecting the two exchanges or divisions, as many re-

peaters as there are trunk-lines and each trunk-line terminating at one end in a switching machine and at the other end in a repeater, together with a centralized source of current supply at each exchange or division, said sources being adapted and connected for supplying current to the subscribers' lines for both talking and switching purposes, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

116. An automatic telephone system comprising a plurality of electrically-propelled and step-by-step actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk-lines, each trunk-line terminating at one end in a switching machine and at the other end in a repeater, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

117. An automatic telephone system comprising a repeater provided with a pair of condensers, an automatic electrically-propelled and step-by-step-actuated switching machine provided with a pair of movable switch-contacts, and a pair of trunk-line-conductors, each trunk-line-conductor terminating at one end in one of said movable switch-contacts, and at the other end in one of said condensers, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

118. An automatic telephone system comprising an electrically-propelled and step-by-step-actuated switching machine provided with a pair of "line-relays", a trunk-line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk-line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in au-

tomatically effecting a disconnection between subscribers' stations after the conversation is terminated.

119. An automatic telephone system comprising a trunk-line, a pair of "line-relays" normally bridged across one end of said line, means for automatically cutting off said bridge when the line is used for talking purposes, a third relay normally bridged across the other end of said trunk-line and adapted to remain so during the use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the said third relay when the use of said line is to be discontinued, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

120. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines, a suitable number of repeaters, and "release-circuits" for said switching machines, some of said "release-circuits" being controlled by certain of the switching machines, and other "release-circuits" being controlled by said repeaters, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

121. An automatic telephone system comprising a talking-circuit divided into inductively-united end and intermediate sections, a repeater relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of the said repeater relay, and another battery connected in series with said second relay, together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

122. An automatic telephone system comprising a temporarily established talking-circuit, a repeater apparatus, a suitable "connector," said repeater apparatus and "connector" both having relay-coils, to-

gether with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector," the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

123. An automatic telephone system comprising an established talking-circuit, a suitable "connector," a repeater apparatus, the said "connector" having a relay provided with differential windings, said repeater apparatus having a plurality of relays, and there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings and one of said relays, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

124. An automatic telephone system comprising an established talking-circuit, a calling subscriber's line included in said talking-circuit, a repeater apparatus provided with a relay having differential-windings and provided also with a second relay bridged across the talking-circuit, said bridge having normally-closed switch-contacts included in the structure of said relay with the differential-windings, there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings and said calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

125. An automatic telephone system comprising an established talking-circuit composed of inductively-united end and intermediate sections, a battery and a plurality of relay-coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking-circuit, and whereof another includes an end section of the circuit, and there being another battery and a plurality of relay-coils temporarily connected in a charged or closed circuit including the other end section of the talking-circuit, the said telephone system as a whole comprising also suitable connections and means whereby a calling subscriber may momentarily estab-



lish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' stations after the conversation is terminated.

5 126. An automatic telephone system comprising calling and called subscribers' lines temporarily maintained in connection with each other through the medium of the switch contacts of a plurality of step-by-step switching machines, a repeater bridged across the  
10 talking circuit at a point between two of said switching machines, and means for supplying talking current through said repeater to the calling subscriber's line, and through  
15 one of said switching machines to the called subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live  
20 or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

127. An automatic telephone system comprising a calling subscriber's line temporarily connected with a called subscriber's line through the medium of the switch contacts of a step-by-step switching machine, a repeater bridged across the talking circuit at  
25 a point between the said switching machine and the calling subscriber's line, and means for supplying talking current through the said repeater to the calling subscriber's line, and through the said switching machine to  
30 the called subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in  
35 automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

128. An automatic telephone system comprising a talking circuit provided with a  
45 pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one  
50 bridge, and another battery for energizing the other bridge, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is  
55 terminated.

129. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together and included in a complete

metallic talking circuit, two separate batteries for supplying current to the said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for  
70 connecting the said batteries in bridge across the talking circuit, whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is  
75 supplied to the talking circuit at two points in the latter's length, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

130. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality  
85 of batteries for independently supplying talking current to the different sections of the circuit, means under the control of only the called subscriber for bridging one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the said battery which is bridged across the  
90 called subscriber's line for bridging the other battery across the calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

131. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line, and means under the control of the calling subscriber for establishing connection between the two lines, said means comprising inductively united circuit sections and comprising also a repeater connected and operative to repeat  
115 electrical impulses from one circuit section to the other, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

132. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together through the medium of inductively united conductors, and also through



the medium of the switch contacts of automatic step-by-step switching apparatus, together with means for supplying the current necessary for operating the switching apparatus, and a repeater for reproducing or repeating in one conductor the electrical impulses produced by the calling subscriber in another conductor, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

133. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine being provided with a pair of "line relays", together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line relays" having circuits controlled by the calling subscriber and provided with switch contacts for controlling the circuits of the said "line relays" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

134. An automatic telephone system comprising a calling subscriber's line, a switching machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of "line relays", means for inductively connecting a subscriber's line with the said machine, a second pair of "line relays", said pairs of relays being bridged across the circuit at opposite sides of said inductive connections, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitute the means whereby the calling subscriber also controls the operation of said "line relays" of the switching machine, said second pair of relays, thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the "line-circuits" at the other side of said inductive connections, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits nec-

essary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

135. An automatic telephone system comprising a calling subscriber's line, an electrically-propelled and step-by-step-actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line-relay", means for inductively separating the said "line-relay" from the calling subscriber's line, a second "line-relay" connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating said second relay, and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line-relay" of the switching machine, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

136. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines divided into separate exchanges or divisions, trunk-lines connecting the two exchanges or divisions, as many repeaters as there are trunk-lines, each trunk line terminating at one end in a switching machine, and at the other end in a repeater, together with a centralized source of current-supply at each exchange or division, said sources being adapted and connected for supplying current to the subscribers' lines for both talking and switching purposes, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

137. An automatic telephone system comprising a plurality of electrically-propelled and step-by-step-actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk-lines, each trunk line terminating at one end in a switching machine and at the other end in a repeater, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged

ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

138. An automatic telephone system comprising a repeater provided with a pair of condensers, an automatic electrically-propelled and step-by-step-actuated switching machine provided with a pair of movable switch-contacts, and a pair of trunk-line-conductors, each trunk-line-conductor terminating at one end in one of said movable switch-contacts and at the other end in one of said condensers, the said telephone system as a whole comprising also suitable connection and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

139. An automatic telephone system comprising an electrically-propelled and step-by-step-actuated switching machine provided with a pair of "line-relays," a trunk-line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk-line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

140. An automatic telephone system comprising a trunk-line, a pair of "line-relays" normally bridged across one end of said line, means for automatically cutting off said bridge when the line is used for talking purposes, a third relay normally bridged across the other end of said trunk-line and adapted to remain so during the use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the said third relay when the use of said line is to be discontinued, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

141. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines, a suitable number of repeaters, and "release-circuits" for said switching machines, some of said "release-circuits" being controlled by certain of the switching machines, and other "release-circuits" being

controlled by said repeaters, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

142. An automatic telephone system comprising a talking-circuit divided into inductively-united end and intermediate sections, a repeater-relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of said repeater relay, and another battery connected in series with said second relay, together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

143. An automatic telephone system comprising a temporarily established talking-circuit, a repeater apparatus, a suitable "connector," said repeater apparatus and "connector" both having relay-coils, together with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector," the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

144. An automatic telephone system comprising an established talking-circuit, a suitable "connector," a repeater apparatus, the said "connector" having a relay provided with differential-windings, said repeater apparatus having a plurality of relays, and there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings and one of said relays, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

145. An automatic telephone system comprising an established talking-circuit, a calling subscriber's line included in said talking-circuit, a repeater apparatus provided with a relay having differential-windings and

provided also with a second relay bridged across the talking-circuit, said bridge having normally-closed switch-contacts included in the structure of said relay with the differential-windings, there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings and said calling subscriber's line, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

146. An automatic telephone system comprising an established talking-circuit composed of inductively-united end and intermediate sections, a battery and a plurality of relay-coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking-circuit, and whereof another includes an end section of the circuit, and there being another battery and a plurality of relay-coils temporarily connected in a charged or closed circuit including the other end section of the talking-circuit, the said telephone system as a whole comprising also suitable connections and means whereby a called subscriber may momentarily establish the live or charged ground-circuits necessary in automatically effecting a disconnection between subscribers' lines after the conversation is terminated.

147. An automatic telephone system comprising calling and called subscribers' lines temporarily maintained in connection with each other through the medium of the switch contacts of a plurality of step-by-step switching machines, a repeater bridged across the talking circuit at a point between two of said switching machines, and means for supplying talking current through the said repeater to the calling subscriber's line, and through one of said switching machines to the called subscriber's line, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

148. An automatic telephone system comprising a calling subscriber's line temporarily connected with a called subscriber's line through the medium of the switch contacts of a step-by-step switching machine, a repeater bridged across the talking circuit at a point between the said switching machine and the calling subscriber's line, and means for supplying talking current through the said repeater to the calling subscriber's line, and through the said switch-

ing machine to the called subscriber's line, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

149. An automatic telephone system comprising a talking circuit provided with a pair of condensers, said condensers being arranged in and at opposite sides of the circuit, a repeater having a pair of "line relay coils" bridged across the circuit at one side of said condensers, and having another relay coil normally bridged across said circuit at the other side of said condensers, together with a battery for energizing one bridge, and another battery for energizing the other bridge, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

150. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together and included in a complete metallic talking circuit, two separate batteries for supplying current to the said circuit for talking purposes, and means including suitable relays under the control of the called subscriber only and adapted for connecting the said batteries in bridge across the talking circuit, whereby the supply of talking current to the said circuit is under the control of the called subscriber exclusively, and whereby the talking current is supplied to the talking circuit at two points in the latter's length, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

151. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line temporarily connected together for conversational purposes, said circuit being divided into a plurality of inductively connected sections, a plurality of batteries for independently supplying talking current to the different sections of the circuit, means under the control of only the called subscriber for bridging one of said batteries across the called subscriber's line, and means controlled only by the called subscriber but operated by current from the said battery which is bridged across the called subscriber's line for bridging the other battery across the calling subscriber's line, the exchange or central station equipment of the system comprising automatic

means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

152. An automatic telephone system comprising a calling subscriber's line and a called subscriber's line and means under the control of the calling subscriber for establishing connection between the two lines, said means comprising inductively united circuit sections, and comprising also a repeater connected and operative to repeat electrical impulses from one circuit section to the other, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking current from the centralized source of supply.

153. An automatic telephone system comprising an automatic switching machine provided with "line-relays" adapted to respond to any electrical impulses produced in their circuits, a subscriber's device for producing or generating suitable electrical impulses, means including a pair of "line-relays" having switch-contacts controlling the circuits for the said "line-relays" of the switching machines, whereby electrical impulses produced by the calling subscriber are repeated by said second pair of relays in the circuit of said "line-relays" of the switching machine, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

154. An automatic telephone system comprising a calling subscriber's line, a step-by-step switching machine to be employed by the calling subscriber in obtaining the desired connection, said switching machine being provided with a pair of "line-relays," together with a battery for furnishing the current necessary for talking and switching purposes, and a second pair of "line-relays" having circuits controlled by the calling subscriber and provided with switch-contacts for controlling the circuits of the said "line-relays" of the switching machine, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

155. An automatic telephone system comprising a calling subscriber's line, a switching machine at the service of the calling subscriber for use in securing the desired connection, said machine having a pair of

"line-relays," means for inductively connecting a subscriber's line with the said machine, a second pair of "line-relays," said pairs of relays being bridged across the circuit at opposite sides of said inductive connections, a battery for energizing one pair of relays, a separate battery for energizing the other pair of relays, means whereby the calling subscriber controls the operation of said second pair of relays, and suitable connections whereby the said second pair of relays constitute the means whereby the calling subscriber also controls the operation of said "line-relays" of the switching machine, said second pair of relays thereby constituting means for repeating in the circuits of the switching machine relays any electrical impulses produced by the calling subscriber in that portion of the "line-circuit" at the other side of said inductive connections, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

156. An automatic telephone system comprising a calling subscriber's line, an electrically-propelled and step-by-step actuated switching machine at the service of the calling subscriber for use in establishing the desired connection, said machine being provided with a "line-relay" means for inductively separating the said "line-relay" from the calling subscriber's line, a second "line-relay" connected with the subscriber's line at the other side of said machine and separated from said first-mentioned relay by the said inductive connection, a battery for energizing one relay, a separate battery for energizing the other relay, a subscriber's calling device for operating said second relay, and suitable connections whereby the electrical impulses produced in the circuit of said second relay are repeated or reproduced in the "line-relay" of the switching machine, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

157. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines divided into separate exchanges or divisions, trunk-lines connecting the two exchanges or divisions, as many repeaters as there are trunk-lines, each trunk-line terminating at one end in a switching machine and at the other end in a repeater, together with a centralized source of current-supply at each exchange or division,

said sources being adapted and connected for supplying current to the subscribers' lines for both talking and switching purposes, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

158. An automatic telephone system comprising a plurality of electrically-propelled and step-by-step-actuated switching machines, as many repeaters as there are switching machines, and a similar number of trunk-lines, each trunk-line terminating at one end in a switching machine and at the other end in a repeater, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

159. An automatic telephone system comprising a repeater provided with a pair of condensers, an automatic electrically-propelled and step-by-step-actuated switching machine provided with a pair of movable switch-contacts, and a pair of trunk-line-conductors, each trunk-line-conductor terminating at one end in one of said movable switch-contacts, and at the other end in one of said condensers, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

160. An automatic telephone system comprising an electrically-propelled and step-by-step-actuated switching machine provided with a pair of "line-relays", a trunk-line across one end of which said relays are normally bridged, a repeater connected with the other end of said trunk-line and provided with a relay normally bridged across the said line, a battery for furnishing the current necessary for energizing all of said relays, and another and separate battery for furnishing the current necessary for operating the repeater, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

161. An automatic telephone system comprising a trunk-line, a pair of "line-relays", normally bridged across one end of said line, means for automatically cutting off said bridge when the line is used for talking purposes, a third relay normally bridged

across the other end of said trunk-line and adapted to remain so during the use of the line for talking purposes, means for supplying all necessary current, together with means for opening the bridge of the said third relay when the use of said line is to be discontinued, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

162. An automatic telephone system comprising a suitable number of electrically-propelled and step-by-step-actuated switching machines, a suitable number of repeaters, and "release-circuits" for said switching machines, some of said "release-circuits" being controlled by certain of the switching machines, and other "release-circuits" being controlled by said repeaters, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

163. An automatic telephone system comprising a talking-circuit divided into inductively-united end and intermediate sections, a repeater-relay and a battery bridged across the calling subscriber's section of the circuit, a relay bridged across an intermediate section of the circuit and provided with contacts for controlling the operation of the said repeater relay, and another battery connected in series with said second relay, together with suitable windings for also connecting said last-mentioned battery in bridge across the called subscriber's section of the circuit, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

164. An automatic telephone system comprising a temporarily established talking-circuit, a repeater apparatus, a suitable "connector," said repeater apparatus and "connector" both having relay coils, together with a battery temporarily connected in series in a charged circuit including relays of both the repeater apparatus and the "connector," the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

165. An automatic telephone system comprising an established talking-circuit, a suit-

able "connector", a repeater apparatus, the said "connector" having a relay provided with differential-windings, said repeater apparatus having a plurality of relays, and there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings, and one of said relays, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

166. An automatic telephone system comprising an established talking-circuit, a calling subscriber's line included in said talking-circuit, a repeater apparatus provided with a relay having differential-windings, and provided also with a second relay bridged across the talking circuit, said bridge having normally-closed switch-contacts included in the structure of said relay with the differential-windings, there being a battery temporarily connected in series in a charged or closed circuit including said differential-windings and said calling subscriber's line, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

167. An automatic telephone system comprising an established talking-circuit composed of inductively-united end and intermediate sections, a battery and a plurality

of relay-coils temporarily connected in two charged or closed circuits whereof one includes an intermediate section of the talking-circuit, and whereof another includes an end section of the circuit, and there being another battery and a plurality of relay-coils temporarily connected in a charged or closed circuit including the other end section of the talking-circuit, the exchange or central station equipment of the system comprising automatic means for preventing any calling subscriber from establishing connection with a line which is busy or already charged with talking-current from the centralized source of supply.

168. In an automatic telephone exchange system, a central station and subscribers' lines leading therefrom, automatic switching apparatus comprising selectors and connectors, and a metallic trunk line extending from a first selector to a second selector or connector, a condenser interposed in each conductor of the trunk line to render the same conductively discontinuous but inductively continuous, a controlling magnet connected to each conductor of the trunk circuit upon one side of its condenser and adapted to control a branch wire for repeating into the opposite conductor on the other side of the condensers, substantially as described.

In witness whereof, I hereunto subscribe my name this 3rd day of February, A. D., 1905.

ALFRED H. DYSON.

Witnesses:

H. G. WEBSTER,  
F. D. KELLOGG.

It is hereby certified that in Letters Patent No. 1,148,665, granted August 3, 1915, upon the application of Alfred H. Dyson, of Chicago, Illinois, for an improvement in "Telephone Systems," errors appear in the printed specification requiring correction as follows: Page 24, line 12, claim 93, for the word "side" read *sides*; same page, line 76, claim 95, for "charge ground-circuit" read *charged ground-circuits*; same page, line 122, claim 98, for the word "charge" read *charged*; page 27, line 30, claim 113, for the word "station" read *stations*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of January, A. D., 1916.

[SEAL.]

Cl. 179—18.

J. T. NEWTON,

*Acting Commissioner of Patents.*