

- [54] **POWER DEMAND CONTROL APPARATUS**
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- [51] Int. Cl. **H02j 1/10**
- [58] Field of Search **235/151.21; 307/52, 53, 54, 307/55, 85, 86, 87, 58, 59, 60, 56, 57; 13/12**

- [56] **References Cited**
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[57] **ABSTRACT**

A control apparatus for controlling the electrical power demand of a load during a predetermined time period so that the power demand is limited to a preselected peak level during the

time period. The control apparatus is connected to a demand meter which provides a synchronization signal indicating the start and end of the predetermined time period and to a device for providing a count signal indicating the power used per unit time. The control apparatus comprises a counting means which receives the count signals, counts the same and provides an output signal indicating the total of the count signal received. The synchronization signal is supplied to a means for resetting the counting means to its start count position each time a synchronization signal is received. Thus, the counting means starts its counting at the beginning of each predetermined time period. A first limit selecting means is connected to the output of the counting means and provides a first limit signal when the count reaches a first preselected limit which is less than the preselected peak level. This first limit selecting means is connected to a first power demand reducing means which upon receiving the first signal reduces the demand of the load to a first preselected level. The counting means is also connected to a second limit selecting means which provides a second limit signal when the count reaches a second preselected level between the first preselected limit and the preselected peak level. The second limit selecting means is connected to a second power demand reducing means which, upon receiving the second limit signal, reduces the demand of the load to a second preselected level. A third limit selecting means is connected to the counting means and provides a third limit signal if the count should reach the preselected peak level. The third limit signal is applied to a third reducing means which reduced the demand of the load to zero.

9 Claims, 4 Drawing Figures

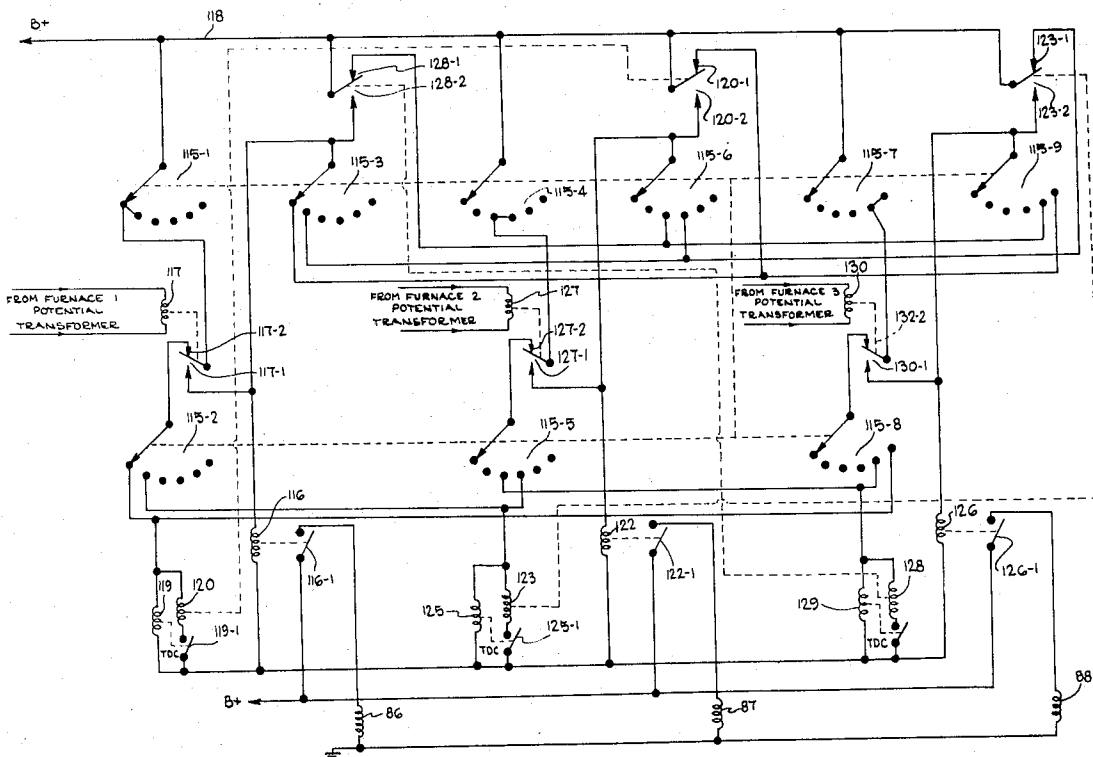
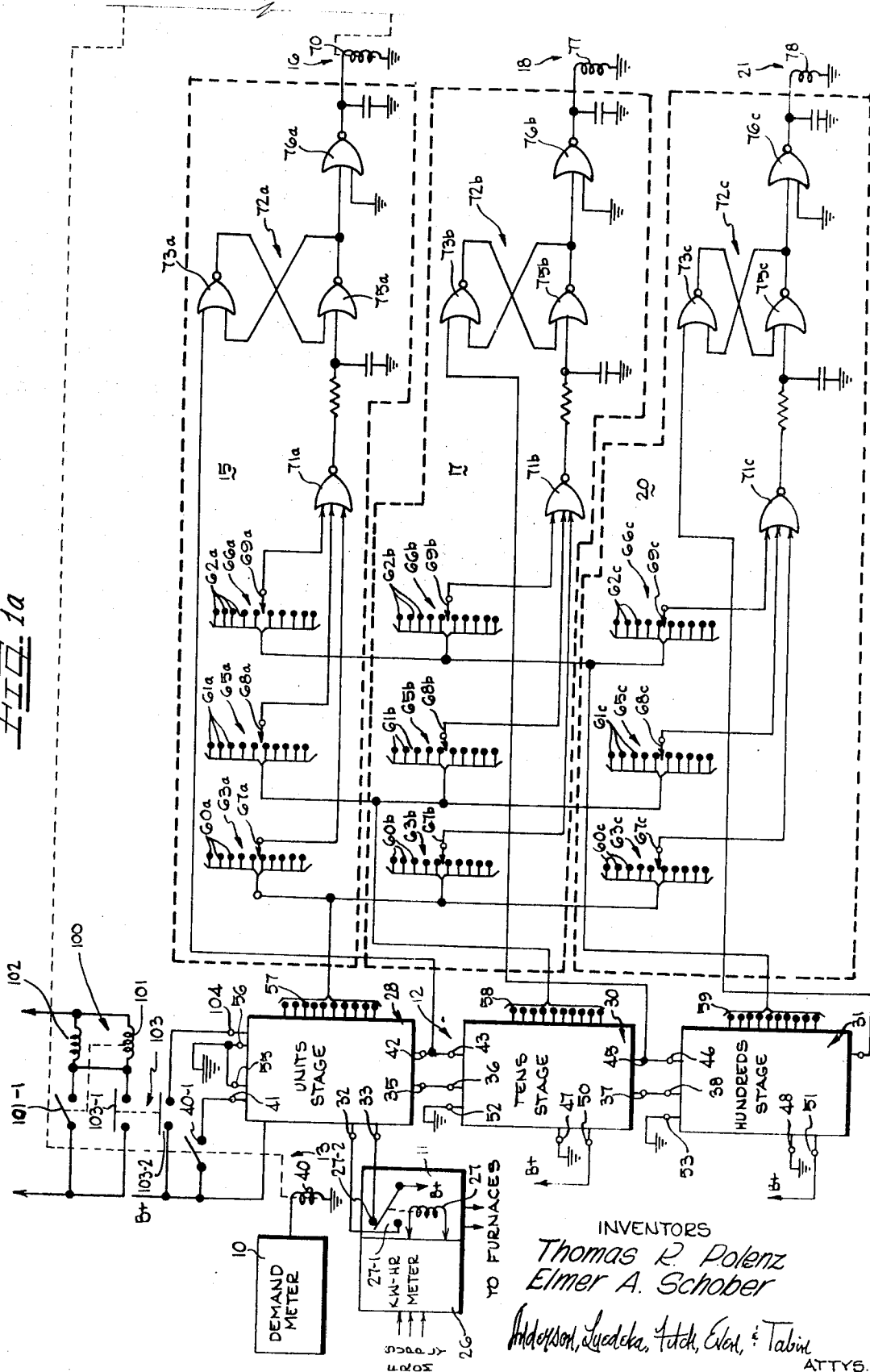
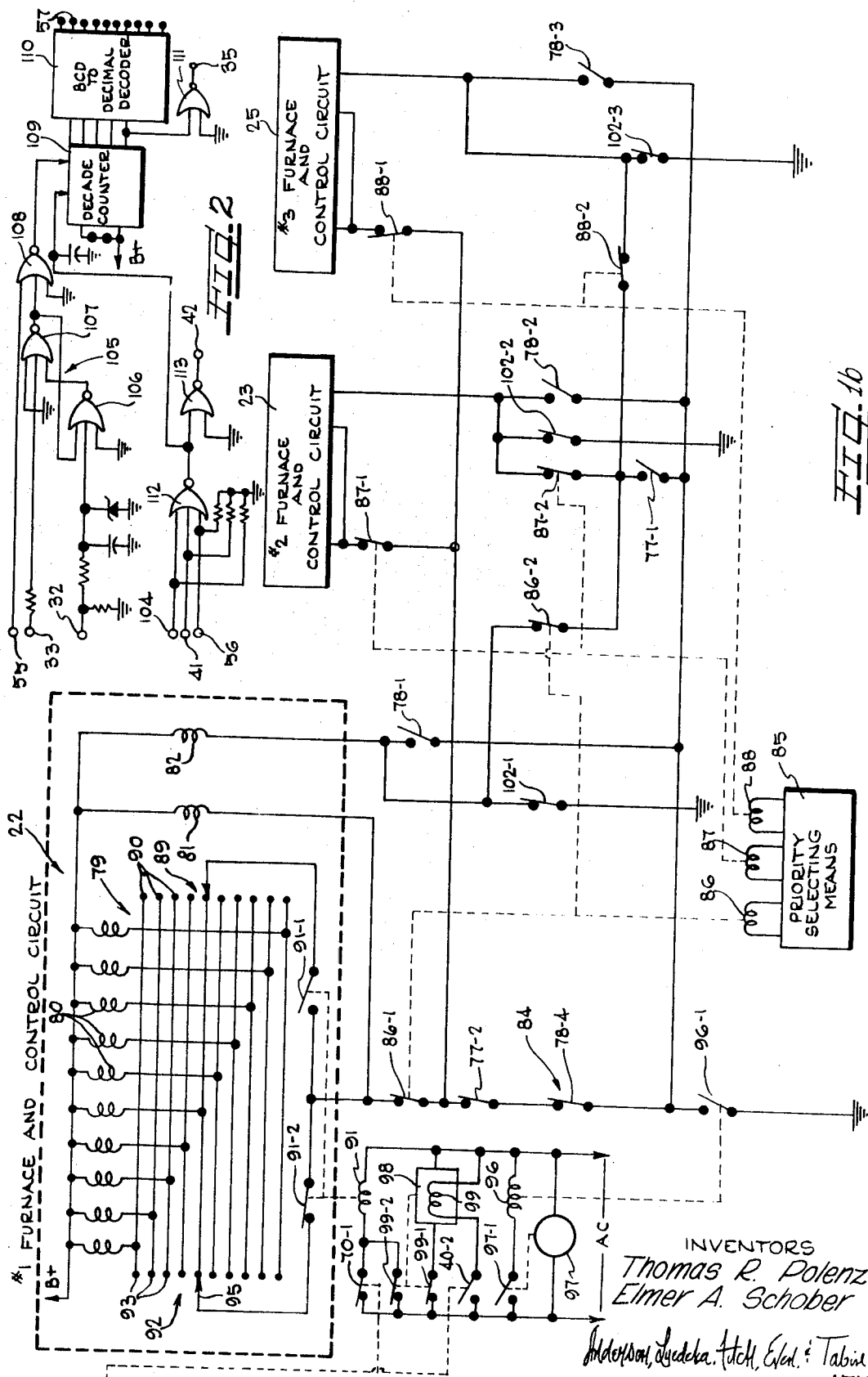


FIG. 1a



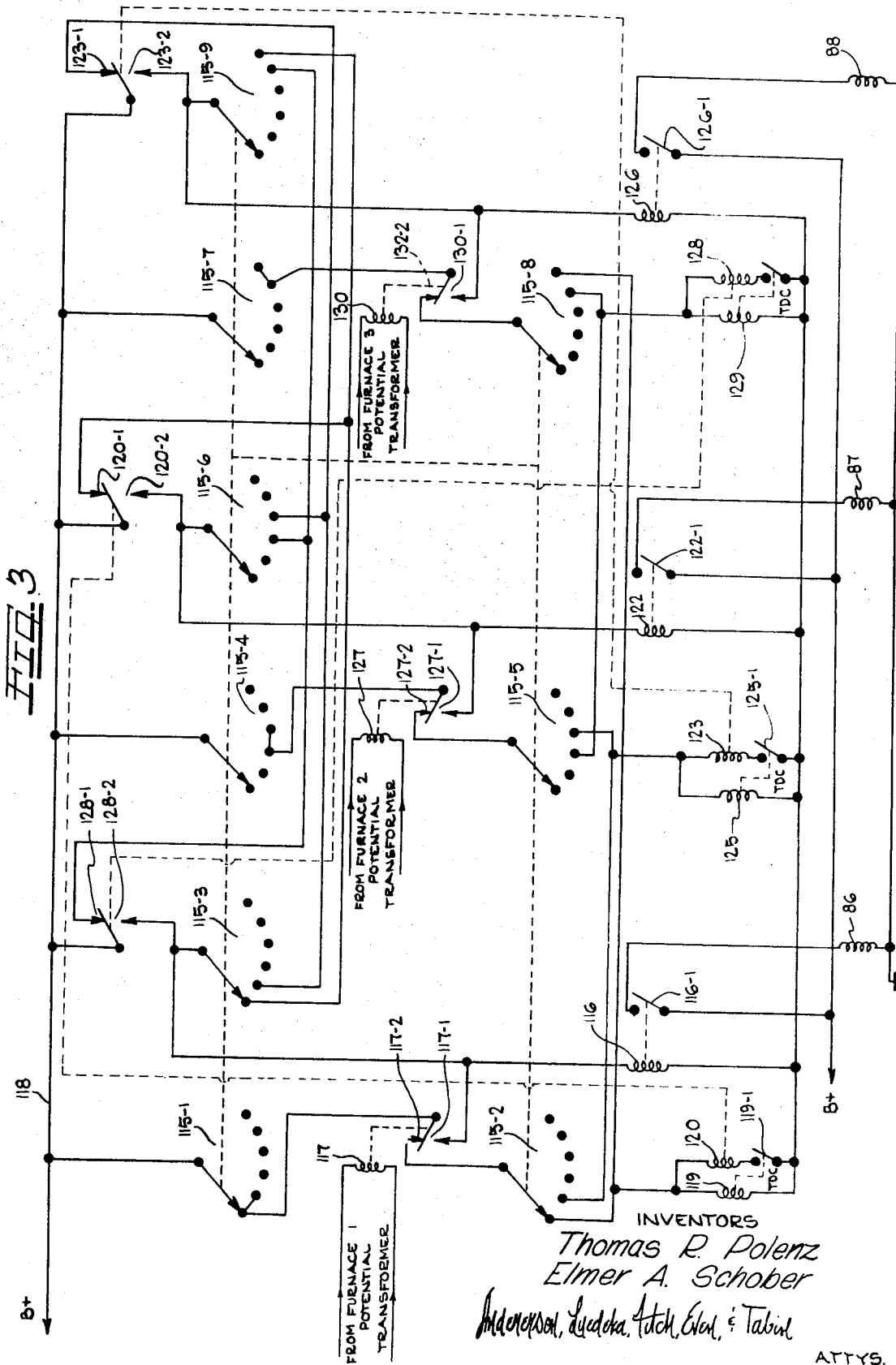
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POWER DEMAND CONTROL APPARATUS

The present invention relates to an apparatus for controlling the electrical power demand of a load during a predetermined time period so that the power demand is limited to a preselected level during that time period.

Customers of electrical utility companies that use large amounts of electricity are billed by the electric company on the basis of the amount of electricity used and also by the peak power demands of the customer during daylight hours. The higher the peak power demands, the higher the electric bill. At present, it is common for the electric company to measure the peak power demand of the customer during each 15 minutes of the daylight hours. The electric company averages the two highest demands during the week and this weekly average is averaged over 4 weeks to obtain a factor which is used to compute the charge for electric power; the higher the factor, the higher the charge. Therefore, to economically use electricity, substantially the same amount of electricity should be used for each 15 minute time period and high peaks in the power demand should be eliminated.

In the operation of high power demand loads, the high peaks in power demand only occur occasionally during the week. While these high swings can be eliminated by turning off the power to the load when these occasions arise, there are certain loads which, for efficient operation, require a substantially continuous supply of power. For example, normally in foundries at least two electric furnaces are used; one of which is primarily used for the melt and is manually controlled by an operator. It is desirable for continuous power to be available to this primary or high priority furnace. If the power is turned off to this primary furnace, it should only be turned off for short periods of time and the occasions of these turn off periods should be at a minimum. Also, to utilize the same amount of electricity every 15 minutes, the other furnace should be controlled to utilize the portion of power level not utilized by the primary furnace.

Accordingly, a principal object of the present invention is the provision of an apparatus for controlling the electrical power demand of a load during a predetermined time period so that the power demand is limited to a preselected level during the time period.

Another object is the provision of an apparatus for controlling the electrical power demand of a plurality of electric furnaces during a predetermined time period so that the power demand is limited to a preselected level during the time period.

Still another object is the provision of an apparatus for controlling the electrical power demand of a plurality of electric furnaces so that the electrical power is utilized economically.

Other objects and advantages of the present invention will become apparent by reference to the accompanying drawings.

In the drawings:

FIGS. 1a and 1b are two parts of a schematic circuit diagram of a power demand control apparatus constructed in accordance with the present invention;

FIG. 2 is a schematic circuit diagram of one of the counters shown in FIG. 1; and

FIG. 3 is a schematic circuit diagram of the priority selecting means shown in FIG. 1.

Briefly, in accordance with the present invention, a control apparatus is provided for controlling the electrical power demand of a load during a predetermined time period so that the power demand is limited to a preselected peak level during the time period. The control apparatus is connected to a demand meter 10 which provides a synchronization signal indicating the start and end of the predetermined time period and to a device 11 for providing a count signal indicating the power used per unit time. The control apparatus comprises a counting means 12 which receives the count signals, counts the same and provides an output signal indicating the total of the count signals received. The synchronization signal is supplied to a means 13 for resetting the counting means 12 to its start count position each time a synchronization signal is received.

Thus, the counting means 12 starts its counting at the beginning of each predetermined time period. A first limit selecting means 15 is connected to the output of the counting means 12 and provides a first limit signal when the count reaches a first preselected limit which is less than the preselected peak level. This first limit selecting means 15 is connected to a first power demand reducing means 16 which upon receiving the first signal reduces the demand of the load to a first preselected level. The counting means 12 is also connected to a second limit selecting means 17 which provides a second limit signal when the count reaches a second preselected level between the first preselected limit and the preselected peak level. The second limit selecting means 17 is connected to a second power demand reducing means 18 which, upon receiving the second limit signal, reduces the demand of the load to a second preselected level. A third limit selecting means 20 is connected to the counting means 12 and provides a third limit signal if the count should reach the preselected peak level. The third limit signal is applied to a third reducing means 21 which reduced the demand of the load to zero.

While the control apparatus of the present invention may be used for controlling the demand of various high demand loads, it has particular application in a foundry utilizing electric furnaces. For purposes of explanation, the control apparatus will be described hereinafter as it is utilized in such a foundry.

The illustrated control apparatus is utilized to control the power demand of three electric furnaces 22, 23, and 25. In operation, one of the furnaces (hereinafter referred to as the high priority furnace) is selected to be the primary source of molten steel, while the other two furnaces (hereinafter referred to as low priority furnaces) are utilized as secondary sources of molten steel. The control apparatus of the present invention is arranged to allow manual operation of the high priority furnace and automatic operation of each low priority furnace at a first preselected percentage of full power until the first limit is reached. The power levels of the low priority furnaces are then reduced to a second preselected percentage of full power. When the second limit is reached, the control apparatus turns off the power to the low priority furnaces by raising their electrodes. The power to the high priority furnace is not turned off unless the third limit is reached. If this should occur, the electrode of the high priority furnace is raised.

The first, second and third limits and preselected percentage of full power are selected based upon past experience and experimentation. If the demand meter only measures the power used by the furnaces, the third limit should be selected at the desired peak level. However, in most installations, the demand meter measures the total power used by the foundry including in addition to the power used by the furnaces, the power used by, for example, the lights, cranes, fans, etc. In such installations, the third limit should be selected somewhat below the desired peak power level, the amount below that limit being dependent upon the rate at which the foundry uses power independently of the furnaces. The first and second limits and the operating levels of the low priority furnaces are selected so that the low priority furnaces are heated efficiently and are not turned off for a period of time each 15 minutes such that melt cools down a substantial amount.

Now referring to the drawings, the electric company normally attaches to its lines the demand meter 10 which measures the total power demand of the customer for each 15 minutes during daylight hours. A clock in the demand meter 10 provides a reset pulse every 15 minutes for resetting the demand meter. This pulse is used as a synchronization pulse for the control apparatus.

The electric company also attaches to its lines a kilowatt hour meter 26 which measures the power used by the customer. There is also a commercially available device 11 which, when connected to the kilowatt hour meter, provides pulses indicating the kilowatt hours used by the load connected to the electric lines. More particularly, this commercially available device 11 includes a photoelectric cell (not

shown) which provides a pulse for each rotation of the disc (not shown) in the kilowatt hour meter 26. This photoelectric cell operates a relay 27 having a normally open and a normally closed contact 27-1 and 27-2, respectively.

The signal provided by the count providing device 11 is applied to the counting means 12 which is a three stage decimal counter, the first stage 28 counting the units, the second stage 30 counting tens, and the third stage 31 counting hundreds. The circuit for each stage is shown in FIG. 2 and is described more fully hereinafter. The normally open contact 27-1 of the count providing relay 27 is connected in series with a d.c. voltage and a count-in-terminal 32 of the units stage 28 and the normally closed contact 27-2 is connected in series with the d.c. voltage and a count-in-terminal 33. A carry out signal of the units stage 28 is utilized to operate the tens stage 30, a carry out terminal 35 being connected to a carry in terminal 36 of the tens stage 30. Likewise, a carry out terminal 37 of the tens stage 30 is connected to a carry in terminal 38 of the hundreds stage 31.

The three stages 28, 30 and 31 are reset to their zero count positions by the synchronization signal provided by the power demand meter 10. In this connection, the sync signal is applied to a sync relay 40, a normally open contact 40-1 of which connects a d.c. voltage to a sync input terminal 41 of the units stage 28. A logical 1 (i.e., a high level) on this sync input resets the units stage 28 to its zero position and causes a logical 1 to appear on a reset-out terminal 42 of the units stage 28 which is connected to a reset-in terminal 43 of the tens stage 30. A logical 1 on the reset-in terminal 43 of the tens stage 30 resets the tens stage and causes a logical 1 to appear on a reset-out terminal 45 of the tens stage 30 which is connected to a reset-in terminal 46 of the hundreds stage 31 to thereby reset the hundreds stage.

Count-in terminals 47 and 48 of the tens and hundred stages 30 and 31 are grounded and count-in-not terminals 50 and 51 of these stages are connected to B+. The sync-in terminals 52 and 53 of the tens and hundreds stages are also grounded. A carry out terminal 55 and a reset in terminal 56 of the units stage 28 are grounded.

Each of the counting stages 28, 30 and 31 is provided with ten output terminals 57, 58 and 59 to indicate each count on the respective counting stage. The first, second and third limits are each selected by selecting one output in each of the sets of output terminals 57, 58 and 59. The three outputs for the first limit are selected by the first limit selecting means 15, the three outputs for the second limit are selected by the second limit selecting means 17, and the three outputs for the third limit are selected by the third limit selecting means 20. The first, second and third limit selecting means 15, 17 and 20 have similar circuits. Only the first limit selecting means is described hereinafter, similar parts in the first, second and third limit selecting means being indicated with the same reference numeral with the subscripts "a", "b", and "c", respectively.

The first limit is selected by coupling the three sets of output terminals 57, 58, and 59, respectively to the sets of individual terminals 60a, 61a, and 62a of three 10 position selector switches 63a, 65a and 66a, respectively. The individual outputs of the counting means 12 are selected by manually positioning the respective movable contacts 67a, 68a, and 69a of the selector switches 61a, 62a and 63a. When the positions of the three selector switches 63a, 65a and 66a match the count (i.e., binary 0) on the output terminals of the three counting stages 28, 30, and 31, a first priority relay 70, included in the first power demand reducing means 16, is energized. In this connection, each of the movable contacts 63a, 65a and 66a will have a binary 0 thereon and these are coupled to the three inputs of a Nor gate 71a, thereby causing its output to be binary 1. The output of the NOR gate 71a is coupled to the set input of a latch circuit 72a formed by two cross-coupled Nor gates 73a and 75a. The output of the latch circuit 72a is coupled through an inverter 76a to the relay 70. The latch 72a is reset when the counting stages 28, 30 and 31 are reset by

coupling the reset-out terminal 42 reset the set of the latch 72a.

As previously indicated, the second and third selecting means 17 and 20 are similar in construction to the first limit selecting means 15. The second limit selecting means 17 operates a second priority relay 77 included in the second power demand reducing means 18 and the third limit selecting means 20 operates a third priority relay 78 included in the third power reducing means 21.

The operation of the first priority relay 70 indicates that the first priority count has been reached and demands of the low priority furnaces are to be reduced. The low priority furnaces are operated at a no limit percentage until the first priority count is reached. In this connection, each of the furnaces 22, 23 and 25 is provided with a control circuit 79, only one of which is shown in FIG. 1b, including 10 percentage relays 80 which select the percentage of the available power to be automatically applied to the furnace. An eleventh or automatic relay 81 selects whether the power demand of the furnace is controlled by the percentage relays 80 or is under manual control. A 12th or raise relay 82 raises the electrode (not shown) of the furnace thereby turning off the furnace. The relays 80, 81 and 82 in the control circuit 79 are all connected by one side to a common d.c. bus 83. The percentage and the automatic relays 80 and 81 are energized by connecting their other sides by means of relay contacts in a grounding circuit 84, described hereinafter, to ground.

One of the furnaces is selected by a high priority selecting means 85, described hereinafter, to be the high priority furnace, the remaining two furnaces operating as low priority furnaces. The priority selecting means 85 energizes only one of three furnace priority relays 86, 87 and 88 associated respectively with the No. 1, No. 2, and No. 3 furnaces 22, 23 and 25. Each furnace priority relay 86, 87 and 88 has a normally closed contact 86-1, 87-1 and 88-1 which is connected in the grounding circuit 84 of the automatic relay 81 of the associated furnace control to thereby de-energize and associated automatic relay 81 when the furnace priority relay is energized. The selected high priority furnace thus operates in the manual mode of operation.

Until the first limit count is reached, each low priority furnace operates at a power level determined by the position of a no limit selector switch 89. In this connection, the 10 percentage relays 80 are connected to the 10 contacts 90 of the selector switch 89. A selector contact 90 of the switch 89 is connected through a normally open contact 91-1 of a limit percent relay 91 to the grounding circuit 84. The limit percent relay 91 is in an energized condition until the first count is reached. This is accomplished by connecting the limit percent relay 91 to a power source through a normally closed contact 70-1 of the first priority relay 70.

After the first priority count is reached, each low priority furnace operates at a power level determined by the position of a first percentage switch 92. The 10 percentage relays 80 are connected to respective individual contacts 93 of the first percentage switch 92 and the selector contact 95 is connected through the normally closed contact 91-2 of the limit percent relay to the grounding circuit 84.

When the second limit count is reached, the electrode (not shown) of each low priority furnace is raised. More particularly, the second limit count is selected by positioning the second set of three selector switches 63b, 65b and 66b. When the signal on the counter stages 28, 30 and 31 matches the position of the selector switches, the second priority relay 77 is energized. A normally open contact 77-1 of the second priority relay 77 connects the raise relays 82 of both low priority furnaces to ground through a normally open contact 96-1 of a clock relay 96, described hereinafter. The energization of the raise relay 82 causes a normally open contact (not shown) to close which is connected to actuate the raise mechanism (not shown) of the electrode. Normally closed contacts 86-2, 87-2 and 88-2 of the furnace priority relays 86, 87 and 88 are connected in series with the raise relays 82 of the respective fur-

naces to prevent the raise relay of the high priority furnace from being energized. A normally closed contact 77-2 of the second priority relay 77 is serially connected in the grounding circuit 84 to disconnect the percentage relays 80 and the automatic relay 81 of the low priority furnaces.

The counting means 12 continues to count the count pulses and should a third limit count be reached, the electrode of the high priority furnace is raised to turn off power thereto. More particularly, the third limit is selected by positioning the third set of three selector switches 63c, 65c and 66c. When the count on the counter stages 28, 30 and 31 matches this setting, the third priority relay 78 is actuated. Three normally open contacts 78-1, 78-2 and 78-3 of the third priority relay 78 are connected to the respective raise relays 82, so that, when they close, the raise relays are connected to ground. The electrode of the high priority furnace is thus raised.

The electric utility company normally only measures the peak power demands during certain hours of the day. Therefore, it is desirable to deactivate the control circuits 79 for the furnaces during times when the demand is not being measured. For this purpose, a 24 hour clock 97 is provided which can be set so as to close a normally open contact 97-1 during certain selected time periods. The closing of the normally closed contact 97-1 energizes the clock relay 96, the normally open contact 96-1 of which is connected in series with all of the grounding circuits 84 of the furnace control circuits 79 to thereby prevent the grounding circuits from being completed.

It is also important to prevent the operation of the first power reducing means 16 for a certain selected time period at the beginning of the 15 minute period. The reason for this is that, if heat is not supplied to the low priority furnaces for a certain length of time each 15 minutes, the melt in the low priority furnace will cool down. For this purpose, an override circuit is provided which includes a timer 98 which can be adjusted to select a time period of up to 15 minutes. A clutch 99 on the timer is energized by a normally open contact 40-2 of the synchronization relay 40. The energization of the clutch 99 causes the timer to begin running and when the timer reaches its preset time, it opens a first normally closed contact 99-1 stopping the timer and opens a second normally closed contact 99-2 which parallels the normally open contact 70-1 of the first priority relay 70. Until this normally closed contact 99-2 is opened, the limit percent relay 91 cannot be energized, and therefore, the low priority furnace operates at its no limit control position.

Also, a circuit 100 is provided in the apparatus to insure that the unit is manually reset after a power failure. In the illustrated embodiment, this reset circuit 100 includes a pair of relays 101 and 102 connected in parallel and the parallel combination is connected in series with a normally open contact 103-1 of a manually operated reset pushbutton 103 and a power supply. Connected in parallel with the pushbutton contact 103-1 is a normally open contact 101-1 of one of the relays 101 and 102 which normally open contact 102-1 serves as a holding contact for the relays 101 and 102. Three normally closed contacts 102-1, 102-2 and 102-3 of the relay 102 are respectively connected between the raise relays 82 and ground. This arrangement causes the electrodes of all of the furnaces to be raised after power is restored and until the reset pushbutton 103 is depressed. A second normally open contact 103-2 of the reset pushbutton 103 is connected between B+ and a pushbutton input terminal 104 of the units stage 28. Closing this second contact 103-2 resets the counter stages 28, 30 and 31.

In the illustrated embodiment, each of the counter stages 28, 30 and 31 is of similar construction, the circuit of one of the units stage being shown in FIG. 2. As shown in FIG. 2, the count-in-terminal 32 is connected to the set input of a latch circuit 105 and the count in not terminal 33 is connected to the reset input of the latch circuit 105. The latch circuit 105 is formed by two cross coupled Nor gates 106 and 107. The output of the latch circuit 105 is applied to one input of a third Nor gate 108, another input of the third Nor gate being con-

nected to the carry in terminal. The output of this third Nor gate 108 is connected to the count input of a decade counter 108 which may be a monolithic ripple counter such as the MDTL MC938P sold by Motorola. The outputs of the decade counter are connected to a BCD to decimal decoder 110, such as the N8251B sold by Signetics. The outputs of the decoder 110 form the outputs 57 of the units stage 28 counter. The carry out signal to the ten stage 30 is provided by coupling the 1 output of the decade counter 109 through an inverter 111 to the carry out terminal 35.

The decade counter 109 is reset by a binary 1 at the pushbutton terminal 104, a binary 1 at the sync input terminal 41, or, in the case of the tens and hundreds stages 30 and 31, a binary 1 at the reset in terminal 56. The decade counter reset circuit includes a fourth Nor gate 112, the inputs of which are connected to the sync input terminal 41, the reset in terminal 56, and the pushbutton terminal 104. The output of this Nor gate 112 provides the reset for the decade counter 109 and is also connected through an inverter 113 to the reset input of the latch circuit 72a in the selecting means 15.

The circuit for the furnace priority selecting means 85 is shown in FIG. 3. The priority selecting means 85 is arranged to select one of the three furnaces as a high priority furnace, but if that furnace is turned off by the operator, a second furnace is automatically selected to become the high priority furnace. The circuit includes a nine tier selector switch 115 which has six positions. In position one, the circuit selects furnace 1 as the high priority furnace, and furnace 2 as the alternate. In position two, the circuit selects furnace 1 as the high priority furnace and furnace 3 as the alternate. In position three, the circuit selects furnace 2 as the high priority furnace and furnace 1 as the alternate. In position four, the circuit selects furnace 2 as the high priority furnace and furnace 3 as the alternate. In position five, the circuit selects furnace 3 as the high priority furnace and furnace 1 as the alternate. In position six, the switch selects furnace 3 as the high priority furnace and furnace 2 as the alternate.

More particularly, assume that the nine tier switch 115 is turned to position one and that furnace 1 is on. The furnace priority relay 86 associated with furnace 1 is energized by the closing of a normally open contact 116-1 connecting the relay 86 to power. The normally open contact 116-1 is actuated by a furnace 1 relay 116, one side of which is connected to ground and the other side of which is connected through a normally open contact 117-1 of a furnace power on relay 117 to the first individual contact on the first tier 115-1 of the selector switch. The selector contact of the first tier 115-1 is connected to B+ bus 118. The normally open contact is closed by the energization of the power on relay 117 which is connected across the potential transformer (not shown) of furnace 1. Assuming now that furnace 1 is turned off, then a normally closed contact 117-2 of the power on relay 117 connects the first contact of the first tier 115-1 to the selector contact of a second tier 115-2 of the selector switch. The first contact of the second tier 115-2 is connected to a time delay relay 119, which closes causing its normally open contact 119-1 to close thereby energizing a relay 120. The energization of the relay 120 opens its normally open contact 120-1 thereby opening a holding circuit for the furnace 1 relay 116. The holding circuit includes the normally closed contact 120-1 and the first contact of the third tier 115-3 of the selector switch. A normally open contact 120-2 of the relay 120 is connected in series with the bus 118 and a furnace 2 relay 122, whereby its normally open contact 122-1 is closed energizing the furnace priority relay 87 associated with furnace 2.

Assuming now that the nine tier switch was in position two when furnace 1 was turned off, the holding circuit for the furnace 1 relay 116 is provided by connecting the second contact of the third tier 115-3 through the normally closed contact 123-1 of a relay 123. The relay 123 is connected to the second contact of the second tier 115-2 whereby, when furnace 1 is turned off this relay 123 is energized after a time delay. The time delay is provided by a time delay relay 125 having its nor-

mally open contact 125-1 connected in series with the relay 123. A normally open contact 123-2 of the relay 123 is connected in series with a furnace 3 relay 126 which has its normally open contact 126-1 in series with the priority relay 88 for furnace 3.

If the nine tier selector switch 115 is turned to position three, and furnace number 2 is turned on, the furnace 2 relay 122 is picked up through a circuit extending from the bus 118 through the third contact of the fourth tier 115-4 through the normally open contact 127-1 of a furnace 2 power on relay 127 to the relay 122 and ground. If furnace 2 is turned off, a relay 128 is picked up after a time delay through a normally closed contact 127-2 of the furnace 2 power on relay 127 and the third contact of the fifth tier 115-5. The time delay is provided by the time delay relay 129 having its normally open contact 129-1 in series with the relay 128. A normally closed contact 128-1 of the relay 128 provides a holding circuit for the furnace 2 relay 122 through the third contact on the sixth tier 115-6. A normally open contact 128-2 of the relay 128 is connected in series with the furnace 1 relay 116 thereby, when it is energized and actuating the furnace 1 relay 116. Thus, furnace 1 priority relay 86 is energized. If the nine tier selector switch 115 is in its fourth position when furnace 2 is turned off, the relay 123 will be actuated through the fourth contact of the fifth tier 115-5. The energization of relay 123 causes the furnace 3 relay 126 to be energized, thus energizing furnace 3 priority relay 88.

Assuming that the selector switch 115 is turned to its fifth position, the furnace 3 relay 126 will be picked up through a circuit which includes a normally open contact 130-1 of a furnace 3 power on relay 130 and the fifth contact of the seventh tier 115-7. If furnace 3 is turned off, the relay 128 will be picked up, after a delay, through a normally closed contact 130-2 of the furnace 3 power on relay 130 and the fifth contact of the eighth tier 115-8. The energization of the relay 128 causes its normally closed contact 128-1 to open de-energizing furnace 3 relay 126, the holding circuit of which extends through the fifth position of the ninth tier 115-9. The closing of the normally open contact 128-2 actuates the furnace 1 relay 116 and thus the furnace 1 priority relay 86.

In the nine tier selector switch 115 is set at its sixth position, and furnace 3 turned off, the relay 120 will be picked up. The closing of the normally open contact 120-2 of the relay 120 picks up furnace 2 relay and thus also furnace 2 priority relay 87.

Various changes and modifications may be made in the above described power demand control circuit without departing from the spirit or scope of the present invention. Various features are set forth in the following claims.

What is claimed is:

1. For use with an electrical power supply, apparatus for controlling the electrical power demand of a load during a predetermined time period so that the power demand is limited to a preselected peak level during the time period, the start and end of said time period being indicated by a synchronization signal and the power used per unit time being indicated by a count signal, said apparatus comprising count-

ing means responsive to said count signal for counting said count signal and providing an output signal indicating the total of said count signals, means responsive to said synchronization signal for resetting said counting means to its start count position, first selecting means coupled to the output of said counting means for providing a first signal when said count reaches a first preselected limit which is less than said preselected level, first reducing means responsive to said first signal for reducing the demand of the load to a first preselected level, second selecting means coupled to the output of said counting means for providing a second signal if said count should reach a second preselected limit equal to said preselected peak level, and second reducing means responsive to said second signal for reducing the demand of the load to substantially zero.

2. Apparatus in accordance with claim 1 in which a third selecting means is provided which is coupled to the output of said counting means and provides a third signal when said count reaches a third preselected limit which is less than said first preselected limit, and means is provided which is responsive to said third signal for reducing the load to a third preselected level which is higher in demand than said first preselected level.

3. Apparatus in accordance with claim 1 in which a first override means is connected to said first reducing means for preventing said first reducing means from reducing the demand of the load during an initial preselected time period after the synchronization signal.

4. Apparatus in accordance with claim 1 in which a second override means is connected to said first and second reducing means for preventing said first and second reducing means from reducing the demand of the load during a preselected time period during the day.

5. Apparatus in accordance with claim 1 in which said load includes at least two furnaces, said first reducing means turns off all but one of the furnaces, and said second reducing means turns off the one furnace.

6. Apparatus in accordance with claim 2 in which said load includes at least two electric furnaces, said third reducing means reduces the demand of all but one of the furnaces, the first reducing means turns off all but the one furnace, and the second reducing means turns off the one furnace.

7. Apparatus in accordance with claim 6 in which a first override means is connected to said first reducing means for preventing said first reducing means from reducing the demand of the load during an initially preselected time period after the synchronization signal.

8. Apparatus in accordance with claim 6 in which a second override means is connected to said first, second and third reducing means for preventing said first, second and third reducing means from reducing the demand of the load during a preselected time period during the day.

9. Apparatus in accordance with claim 6 in which switching means is provided for automatically disconnecting one of the other furnaces from said first and third reducing means and connecting it to said second reducing means if said one furnace is not in operation.

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