May 9, 1933. C. H. DAVIS, JR 1,907,513

IGNITION APPARATUS

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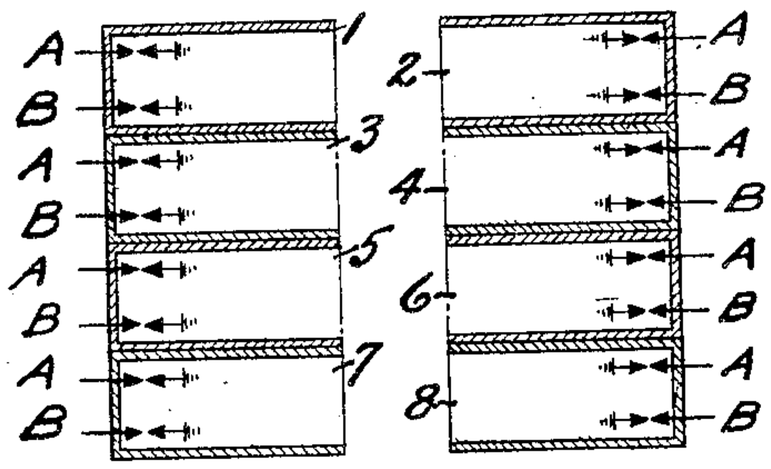

Fig. 1

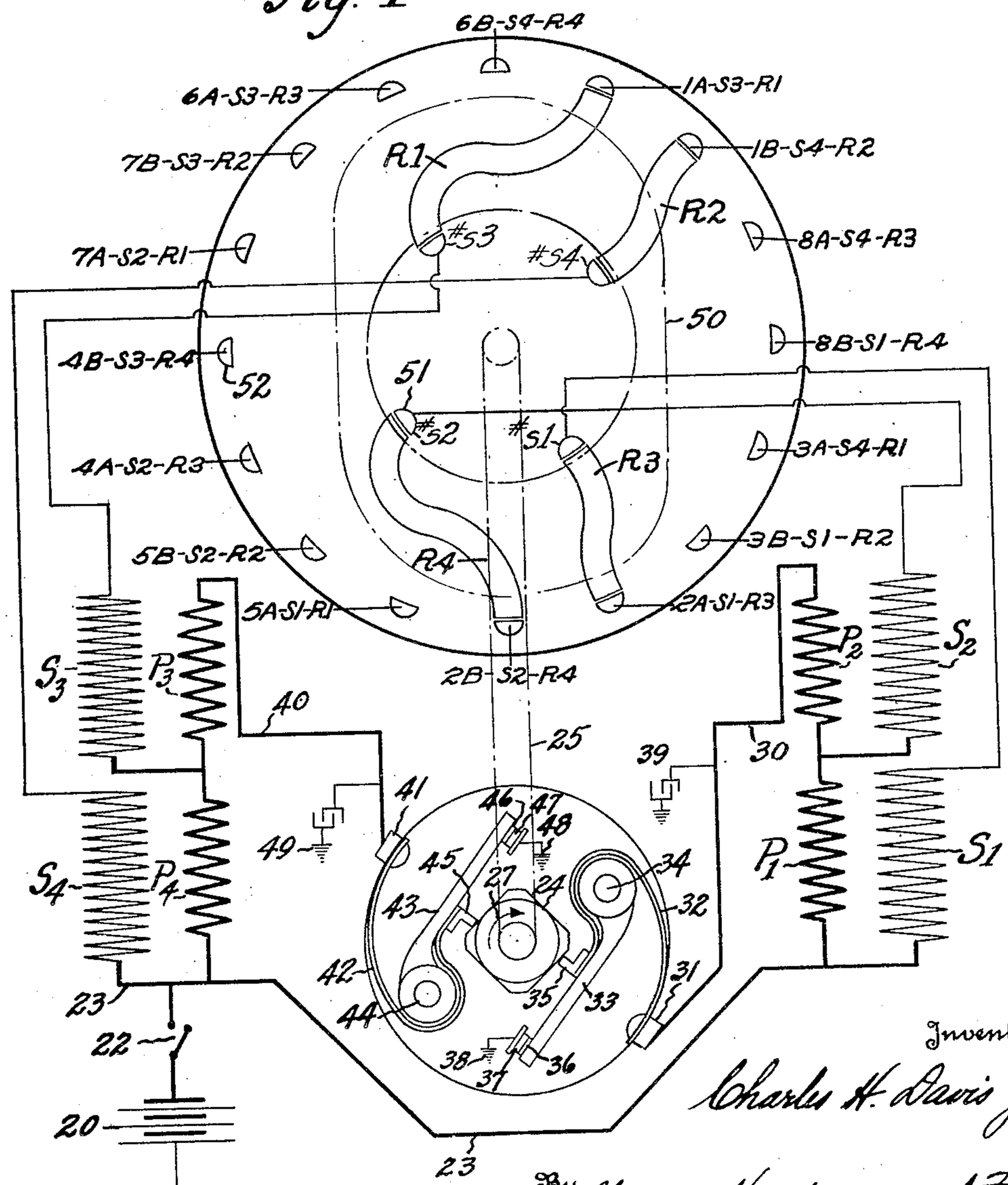

Fig. 2

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UNITED STATES PATENT OFFICE

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IGNITION APPARATUS

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This invention relates to ignition apparatus for internal combustion engines and more particularly for engines having a relative large number of spark gaps to be fired during each explosion period as compared with the number of explosion periods during each engine cycle. One example of an internal combustion engine to which the present invention may be applied is an engine having four explosion periods and requiring that four spark gaps be fired during each explosion period. Such an engine might be a four cylinder engine having four spark gaps in each cylinder or an eight cylinder engine having two spark gaps in each cylinder, the cylinders of the eight cylinder engine being arranged to fire in pairs at the same instant. In either example four spark gaps would be fired during each one of the four spark periods which occur during a cycle of operation of the engine.

It is particularly an object of the present invention to provide an ignition timer and distributor unit for engines of the type referred to, said unit being operated by a single shaft which drives a single timer cam and a single distributor rotor cooperating with a single distributor head. The disclosed embodiment of the present invention comprises a distributor head having an outer and inner row of concentric posts the outer row of distributing posts being equal in number to the product of the number of explosion periods during an engine cycle and the number of spark gaps to be fired at each explosion period of the engine, the inner row of posts being equal in number to the number of spark gaps fired during each explosion period. The distributor head cooperates with a rotor carrying distributor conductors equal in number to the number of spark gaps fired during each explosion period, these distributing conductors bridging gaps between the inner row of posts and certain posts of the outer row of posts at each explosion period of the engine. This distributor cooperates with spark generating means having sparking impulse terminals equal in number to the number of spark gaps to be fired at each explosion period, said sparking impulse terminals being connected respectively with the inner row of distributor posts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawing:

Figs. 1 and 2 constitute a wiring diagram of the present invention.

Referring to Fig. 1 the cylinders of an eight cylinder engine are designated by numbers 1 to 8 respectively, and these cylinders are arranged in two blocks, the left hand block containing cylinders 1, 3, 5 and 7 and the right hand block, cylinders 2, 4, 6 and 8. Each engine cylinder has two spark gaps A and B. The blocks are arranged so that the opposed cylinders will fire in pairs at the same instant. If the engine is a two cycle, eight cylinder dual ignition engine four spark plugs will be required each 90° of engine shaft revolution; and if the engine is a four cycle, eight cylinder dual ignition engine, four sparks will be required each 180° of engine shaft revolution. The timer distributor unit is the same for both types of engines, the distributor shaft operating at engine speed for a two cycle engine or one-half engine speed for a four cycle engine.

The distributor shaft is designated by the parallel dot-dash lines 25 in Fig. 2 and drives a rotor block 50 and a cam 24, the cam controlling the primary circuits comprising storage battery 20 grounded at 21 and connected by a switch 22 with a wire 23 which is connected with pairs of ignition coil primaries P1, P2 and P3, P4. These primaries P1 to P4 cooperate respectively with secondaries S1 to S4. The pair of primary coils P1, P2 is connected by wire 30 connected with terminal 31 connected by leaf spring conductor 32 with circuit breaker lever 33 pivoted at 34 having a rubbing block 35 cooperating with cam 24 and having a contact 36 cooperating with a stationary contact 37 grounded at 38. The contacts 36 and 37 are shunted by a condenser

39. Similarly the pair of primary coils P3, P4 is connected by wire 40 with terminal 41 connected by leaf spring conductor 42 with circuit breaker lever 43 pivoted at 44 having a rubbing block 45 cooperating with cam 24 and having a contact 46 cooperating with a stationary contact 47 grounded at 48. The contacts 46 and 47 are shunted by a condenser 49.

The rotor block 50 carries rotor conductors R1, R2, R3 and R4 which move in a circular path between two concentric rows of distributor posts, the inner row being designated at 51 and the outer row being designated at 52. Each post 51 of the inner row has a special indicia to indicate to which secondary coil it is connected. It is apparent that posts 51 numbered *s*1 to *s*4 respectively are connected respectively with secondary coils S1 to S4. The outer row of posts 52 are each designated by a special indicia which indicates to which spark plug that post is connected and how that post is supplied with a sparking impulse. Assuming for example, that the spark gaps A and B of cylinders #1 and spark gaps A and B of cylinder #2 are to be fired at the same instant, and that the cam 24 rotates clockwise as indicated by arrow 27, the circuit breaker rubbing blocks 35 and 45 will be operated upon simultaneously by diametrically opposite lobes of cam 24 to effect the separation of pairs of contacts 36, 37 and 46, 47 thereby causing four sparking impulses to be generated substantially simultaneously in the four secondaries S1 to S4. At that instant, the rotors R1, R2, R3 and R4 will be located as shown in the drawing respectively opposite posts 51 #*s*3, 51 #*s*4, 51 #*s*1 and 51 #*s*2. These members R1, R2, R3 and R4 will therefore conduct sparking impulses to four distributor posts 52 which are marked, respectively, 1A—S3—R1, 1B—S4—R2, 2A—S1—R3 and 2B—S2—R4. Indicia 1A—S3—R1 indicates that that post is connected to spark plug 1A that a sparking impulse 1A is generated in secondary S3 and is conducted by rotor conductor R1. Indicia 1B—S4—R2 similarly indicates that that post is to be connected with spark plug 1B and that a sparking impulse for that spark plug is generated in secondary S4 and is connected by rotor R2. With this explanation, the meanings of other indicia applied to posts 52 should be entirely clear.

It is thereby apparent that the present invention contemplates that the number of distributor posts 51 be equal to the number of spark gaps to be fired during each explosion period, that the number of distributor posts 52 be equal to the total number of spark gaps to be fired during an engine cycle, that the rotor carry as many distributing conductor arms as there are posts 51, and that at each explosion period these distributing conductor arms bridge gaps between all of the posts 51 and certain groups of posts 52. It will be noted that the sparking impulse terminal posts 51 #*s*1, 51 #*s*2, 51 #*s*3, 51 #*s*4 and the distributing arms R1, R2, R3 and R4 are so arranged that, coincidentally with the discharge of consecutive sparking impulses, each arm is presented to the sparking impulse terminal posts in succession.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Ignition apparatus for internal combustion engines having E explosion periods during a cycle and comprising in combination, means for distributing sparking impulses to S (a plurality of) spark gaps at each explosion period of the engine, said means including a distributor head having outer and inner concentric rows of distributor posts, the outer row of posts numbering E x S and each connected to a spark gap, the inner row of posts numbering S, and including a rotor rotating one revolution during each engine cycle and having S distributing conductors all of which bridge gaps between all of the posts of the inner row of posts and certain posts of the outer row at each explosion period of the engine; and engine controlled spark generating means having S terminals connected respectively with the posts of the inner row.

2. Ignition apparatus for internal combustion engines having E explosion periods during a cycle and comprising in combination, means for distributing sparking impulses to S (a plurality of) spark gaps at each explosion period of the engine, said means including a distributor head having outer and inner concentric rows of distributor posts, the outer row of posts numbering E x S and each connected to a spark gap, the inner row of posts numbering S, and including a rotor rotating one revolution during each engine cycle and having S distributing conductors all of which bridge gaps between all of the posts of the inner row of posts and certain posts of the outer row at each explosion period of the engine, and engine controlled spark generating means comprising G (a plurality of) groups of ignition coils, each group having $\frac{S}{G}$ sparking impulse terminals, G circuit interrupters for controlling respectively the groups of coils, and a cam having E lobes and rotating one revolution during each engine cycle for operating the interrupters simultaneously.

3. Ignition apparatus for an internal combustion engine having four explosion periods during a cycle comprising in combination, means for distributing sparking impulses to four spark gaps during each explosion period, said means including an outer row of sixteen posts each connected with a spark gap, and a concentric inner row of four equi-distant posts and including a rotor having four conductors for bridging between all of the inner row of posts respectively and certain posts of the outer row at each explosion period; two groups of two ignition coils; a current source; two interrupters each controlling connections between the current source and two coils; a timer cam having four lobes; and a shaft rotating once during each engine cycle for driving the cam and rotor.

4. Ignition apparatus for internal combustion engines having a plurality of spark gaps to be supplied with sparking impulses at each explosion period comprising, in combination, means for generating sparking impulses and having a plurality of terminals, engine operated circuit breaker means for controlling the sparking impulse generators, a distributor head carrying a circular row of posts connected respectively with spark gaps, a plurality of posts of substantially the same width as the spark gap posts of the head, and arranged concentrically therewith, and connected respectively with terminals of the spark generating means, a plurality of distributing arms arranged to pass between the first and second mentioned posts but out of contact therewith in order to distribute sparking impulses from the second mentioned posts to certain of the spark gap posts, said arms and said second mentioned posts being so arranged that, coincidentally with the discharge of consecutive sparking impulses, each arm is presented to said second mentioned posts in succession.

5. Ignition apparatus for internal combustion engines comprising, in combination, a distributor for distributing sparking impulses to a plurality of spark gaps to be fired in groups simultaneously at each explosion period, said distributor comprising concentric rows of distributor posts, one row of posts being connected respectively with spark gaps of the engine, sparking impulse generating means having terminals connected with another row of distributor posts, and said distributor including a plurality of distributing conductor arms so arranged with respect to the posts that, at each explosion period, the arms cooperate with adjacent posts connected with spark gaps and with adjacent posts connected with sparking impulse generator terminals.

6. Ignition apparatus for internal combustion engines comprising, in combination, a distributor for distributing sparking impulses to a plurality of spark gaps to be fired in groups simultaneously at each explosion period, said distributor comprising concentric rows of distributor posts, one row of posts being connected respectively with spark gaps of the engine, sparking impulse generating means having terminals connected with another row of distributor posts, and said distributor including a plurality of distributing conductor arms so arranged with respect to the posts that, at each explosion period, the arms cooperate with adjacent posts connected with spark gaps and with adjacent posts connected with sparking impulse generator terminals and that said arms each cooperate with the sparking impulse generator terminal posts in succession at successive explosion periods.

7. Ignition apparatus for internal combustion engines comprising, in combination, a distributor for distributing sparking impulses to a plurality of spark gaps to be fired in groups simultaneously at each explosion period, said distributor comprising concentric rows of distributor posts, one row of posts being connected respectively with spark gaps of the engine, sparking impulse generating means having terminals connected with another row of distributor posts, and said distributor including a plurality of groups of distributing conductor arms each group including a plurality of arms which cooperate with groups of adjacent distributor posts, and each arm of each group of arms cooperating with the sparking impulse generator terminal posts in succession at explosive periods.

8. Ignition apparatus for internal combustion engines comprising, in combination, a distributor for distributing sparking impulses to a plurality of spark gaps to be fired in groups simultaneously at each explosion period, said distributor comprising concentric rows of distributor posts, one row of posts being connected respectively with spark gaps of the engine, sparking impulse generating means having terminals connected with another row of distributor posts, and said distributor including a plurality of groups of distributing conductor arms each group including a plurality of arms which cooperate with groups of adjacent distributor posts, the groups of spark gap posts with which a group of arms cooperates alternating with groups of spark gap posts with which another group of arms cooperates, and each arm of each group of arms cooperating with the sparking impulse generator terminal posts in succession at successive explosion periods.

In testimony whereof I hereto affix my signature.

CHARLES HALL DAVIS, JR.