

1,154,034.

C. J. LAKE.
ENGINE.

APPLICATION FILED MAR. 26, 1912.

Patented Sept. 21, 1915.
2 SHEETS—SHEET 1.

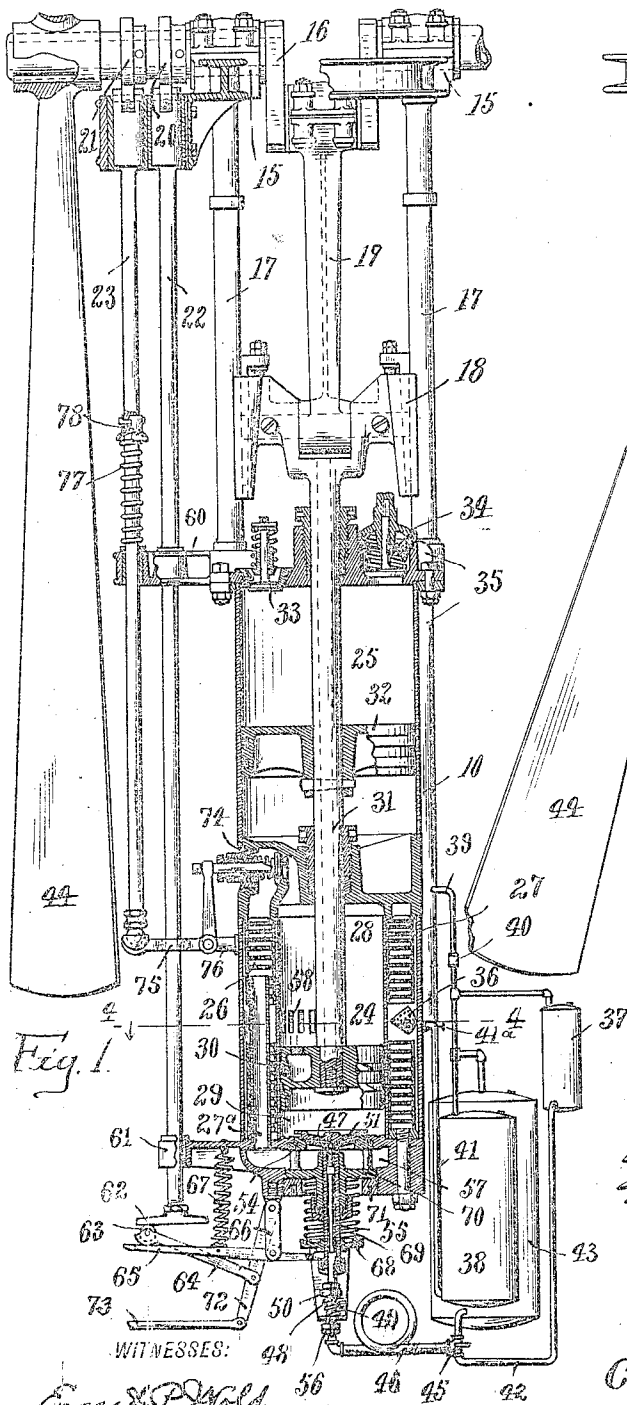


Fig. 1.

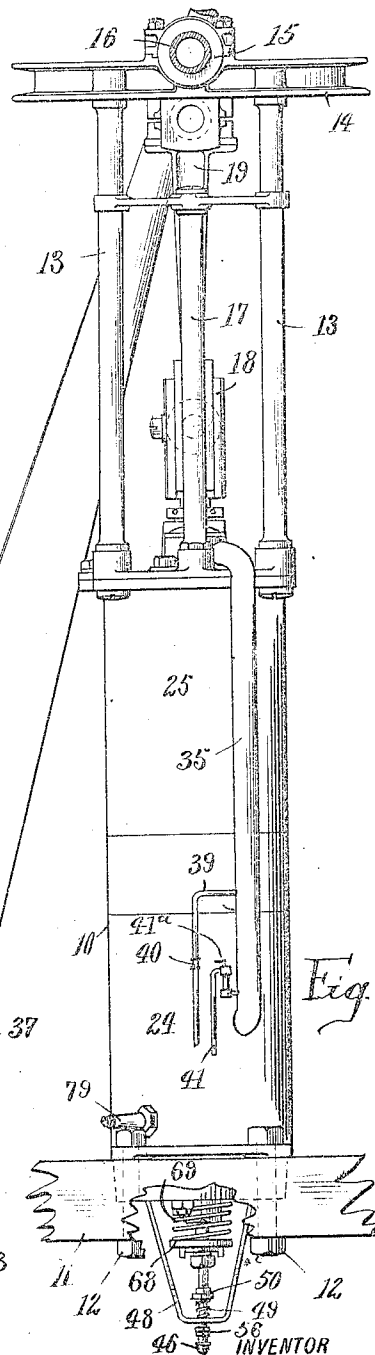


Fig. 2.

WITNESSES:
C. J. Lake

Attest M. W. Holden

Christopher J. Lake

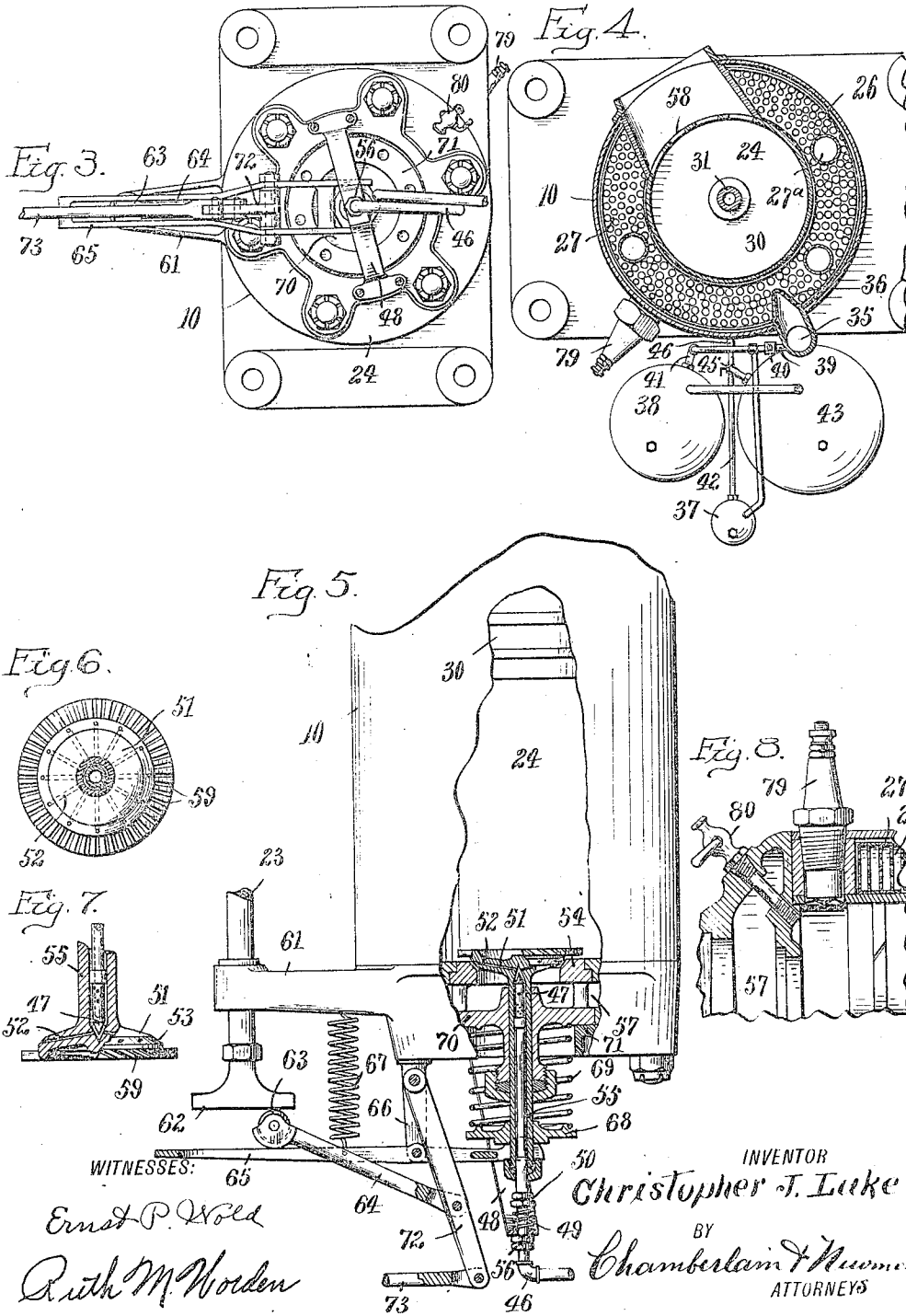
BY
Chamberlain & Newman
ATTORNEYS

C. J. LAKE.
ENGINE.

APPLICATION FILED MAR. 26, 1912.

Patented Sept. 21, 1915.
2 SHEETS—SHEET 2.

1,154,034.



WITNESSES:
Ernest P. Wold
Ruth M. Worden

INVENTOR
Christopher J. Lake

BY
Chamberlain & Muirhead
ATTORNEYS

UNITED STATES PATENT OFFICE.

CHRISTOPHER J. LAKE, OF BRIDGEPORT, CONNECTICUT.

ENGINE.

1,154,034.

Specification of Letters Patent. Patented Sept. 21, 1915.

Application filed March 26, 1912. Serial No. 686,361.

To all whom it may concern:

Be it known that I, CHRISTOPHER J. LAKE, citizen of the United States, and resident of Bridgeport in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Engines, of which the following is a specification.

This invention relates to a combined gas explosion and steam pressure engine, and is an improvement on that class of engine shown and described in my patent dated October 4, 1910, #971,760.

The purpose of my present device is to utilize a portion of the power of the explosion stroke to drive an air compressor to force an elastic fluid under pressure into a radiating chamber surrounding the piston cylinder, and whereby the heat radiating from the explosions is utilized to increase the temperature and pressure of such fluid for use to drive the piston in the opposite direction, and for other useful purposes as will be hereinafter more fully set forth.

Another object is to provide for the employment of a portion of the air from the compressor to force a spray of water into the heat absorbing chamber, to be turned into steam by the heat radiating from the explosions; further to provide for the commingled injectment of a portion of the superheated elastic fluid and a regulatable proper proportion of fuel for the explosion charge.

I also provide means to preheat, disintegrate, and volatilize the heavier grades of fuel or crude oils at the point of commingled elastic fluid injectment into the combustion cylinder; provision is also made for the employment of a portion of the superheated fluid to scavenge the cylinder of dead or spent gases near the end of the piston stroke before the fuel is admitted and to recharge the cylinder with new explosive mixture under pressure with subsequent compression before ignition.

Another object is to provide a common means to vary the volume of the explosive charge and at the same time maintain the proper proportion of fuel and air, viz: as the fuel is increased or decreased the elastic fluid will be relatively increased or decreased by the same operation so as to maintain the efficient explosive mixture at any load or speed desired, and finally to so design the engine that its power generating cylinder is placed on its foundation bed or

lower portion, with its initial explosive stroke thrusting upward and its crank shaft arranged upon the upper extremity of the engine.

In present forms of upright engines the power shaft is located in the lower extremity of the engine bed or crank case with the power or driving cylinder arranged above the driven shaft. This is conducive to vibration and presents serious transmission difficulties, especially in flying machines and aerial propelled vessels on either land or water. After extensive experimenting to obtain a stable flying machine I find that the supporting surface should be above the weight moment, and the propelling or thrust moment should be between the sustaining surfaces and weight moments. To obtain these results from an engine with a low driving shaft, some form of power transmission must be resorted to which is undesirable and inefficient. In my aerial propelled boat I experience the same difficulty, as the propeller must be located high to clear the water. To make direct connection with the present type of low shaft engine would make the boat top heavy and dangerous, and serious transmission difficulties are encountered. This division of the prime explosive stroke with the intermediate elastic pressure stroke alleviates vibration and makes it possible to employ a lighter construction and fly wheel, evens the application of power, insures steadier running, and produces in combination a complete one cycle engine.

The invention further consists in certain novel features of construction and arrangement of parts through which the above objects are obtained, as will be more fully understood from the accompanying drawings, forming a part of this specification, upon which similar characters of reference will be found to designate like or corresponding parts throughout the several figures and of which,

Figure 1, shows a central longitudinal section through my improved combined gas and steam engine. Fig. 2, is a side view of same, the gas, air and oil tanks being removed. Fig. 3, is a bottom plan view of the said engine. Fig. 4, is a sectional plan through the main cylinder of the engine and taken on line 4—4 of Fig. 1. Fig. 5, is an enlarged sectional elevation of the lower portion of the cylinders illustrating the

valve mechanism on an enlarged scale. Fig. 6, is a detached inverted plan view of the valve shown in Fig. 5. Fig. 7, is a further detached central vertical sectional view of the said valve, and, Fig. 8, is an enlarged detail vertical sectional view of a portion of the cylinder showing the ignition plug and drain cock.

As before mentioned the engine as a whole is arranged in an upright position, the base or cylinder casing 10 being supported upon a sill 11 and secured thereto by means of bolts 12. Four standards 13 are secured to a flange on the upper end of the casing and thus support a connected frame 14. Journal bearings 15 are formed on this frame and serve to accommodate the crank shaft 16 arranged crosswise therein. A pair of guide-rods 17 are also secured to the frame and casing flange and intermediate of the said standards. A piston rod slide 18 is reciprocatingly mounted between these guide rods and has one end of a link 19 pivotally connected thereto and whose other end is similarly connected to the crank of the shaft 16 and whereby the reciprocating motion of the piston rod is converted into a rotary movement. Common forms of eccentric cams 20 and 21 are also mounted upon this crank shaft and are connected with the slide rods 22 and 23 for operating the intake valves for the cylinders as will later be more fully explained. A propeller wheel 44 is indicated upon the end of the shaft 16 and suggests the adoption of the engine for air ship purposes.

A casing 10 serves to inclose and in part forms the two cylinders 24 and 25. The lower and main cylinder 24 is employed as the power cylinder, while the upper one serves as a compressor to force the heat absorbent agent into the radiating chamber 26 surrounding the cylinder 24. The heat radiating chamber is formed between the outer casing 10 and the jacket proper of the cylinder 24 and contains a series of annular perforated flanges 27 which are directly connected with the cylinder walls and are heated therefrom by the explosions in the cylinder. The heat absorbent agent is forced through the chamber, between these heating flanges, so that the heat radiating from the explosion in the cylinder may be used to increase the temperature and pressure of said agent, preparatory to being used in the upper end 28 of the cylinder 24 to force the piston down. When the main explosion of gas takes place in the lower part 29 of the cylinder it naturally drives the piston 30 upward which in turn carries the piston rod 31 and compressor piston 32 in the compressor cylinder 25. 33 represents an air intake valve whereby successive charges of air are admitted to the upper cylinder from time to time, to be compressed, and in turn

are forced out through the check valve 34 into the pipe 35 that leads down and has its outlet in the radiating chamber 26. A perforated cone 36 is employed over the outlet end of the pipe within the said chamber and whereby the absorbent agent introduced therethrough is broken up and better distributed. The fuel tanks 37 and 43 as well as the water tank 38 are connected with the before mentioned pipe 35 by means of a smaller pipe 39 having in it a check valve 40. A small quantity of water is fed into the radiating chamber through a pipe 41 and its valve 41^a, while the fuel is fed into the cylinder 24 through a pipe 46.

The feed pipe 42 connects the bottom of the oil tank 43 and the gas tank 37, and is provided with a three way cock 45 which in turn is connected with another pipe 46 that leads to the needle valve 47. A bracket 48 secured to the bottom of the cylinder casing serves to support the vertically disposed portion of the feed pipe 46. A spring 49 is coiled about the pipe and is seated between the said bracket 48 and a nut 50 upon the said pipe 46 in a manner to hold the needle valve 47 of the pipe 46 up in its normal position. This needle valve is normally seated in the main valve 51 in a way to close the radial ports 52 thereof when the said main valve is seated against the annular beveled seat 53 formed in the cap 54 in the bottom of the cylinder 24. When the main valve head is raised as shown in Fig. 5, by the action of the cam 20 the said needle valve is freed thereby allowing the fuel to enter the recess within the head and pass out through the ports 52 into the cylinder. The needle valve end of the pipe 46 is somewhat smaller than the lower portion and is perforated as shown, to allow the fuel to come through into the surrounding chamber. This needle and pipe are thus obviously fitted and guided in the hollow stem 55 of the main valve 51 which has a vertical movement thereon and with relation thereto. The nuts 56 upon this pipe 46 serve to limit the upward movement of the needle and its pipe within the main valve stem, that is, when the said main valve is raised as shown in Fig. 5, thus insuring the opening of both valves with each upward stroke of the piston. The stop nuts 56 upon the pipe 46 are made adjustable with relation to the bracket 48 so as to regulate the movement of the needle valve within and with relation to the main valve. In this connection it will be noted that the main valve opens slightly in advance of the needle valve which is for the purpose of admitting a charge of air from the compartment 57 in advance of the fuel supply, which serves to scavenge the cylinder of spent gases that are forced out through ports 58. The charge of fuel is introduced during the return stroke of the piston and the instant the said ports

58 are closed by the piston. The fuel is thus forced in along with the continued supply of heated air which air is drawn down from the top of chamber through the vertical pipes 27^a within the heat radiating chamber 26 and whereby the driest of the steam contained therein may be supplied beneath the main valve, and there proportioned with the fuel to provide a proper mixture. The under side of the top flange of the main valve is provided with a series of radial grooves 59 that serve to insure a more thorough distribution and mixture of the fuel and air.

The main valve is operated by the cam 20 upon the crank shaft 16 through the medium of the slide rod 22 mounted in brackets 60 and 61 secured to the main frame of the machine. Upon the lower end of the rod is mounted a shoe 62 that engages a roll 63 mounted upon the free end of a link 64 and interposed between said shoe and a lever 65 hung from a link 66 pivotally connected to the cylinder head. A spring 67 is connected from the lower bracket 61 to the said lever 65 and serves to normally hold the outer end of the said lever up against the roll and likewise the roll up against the shoe. The inner forked end of the lever straddles the stem 55 of the main valve and engages the collar 68 secured to said stem. A spring 69 is seated between this collar and the end of the cylinder for the purpose of normally holding the collar, stem, and valve down to close the valve. The valve is thus opened by the cam and closed when released by the cam, by the action of the spring 69. The cap 54 for the main valve seat 53 as well as the connected cap 70 for the lower end of the cylinder jacket are removably held in place by a nut 71 as shown in Fig. 1.

The before mentioned connection of shoe, roll and lever are for the purpose of varying the amount of opening movement of the main valve so as to regulate the charge thereby in effect operating as a throttle. This variation is accomplished by shifting the position of the contacting roll 63 with relation to the shoe and lever thereby bringing the contact nearer to or farther from the fulcrum or pivotal point of the lever with link 64. The opposite end of this link bearing the roll, is pivotally connected to a vertically hung lever 72 to which the operating rod 73 is connected and adapted to throw the lever, link and roll back and forth to shift the roll in the manner and for the purpose before mentioned.

The heated fluid from within the radiating chamber 26 is introduced into the upper end 28 of the cylinder 24 through a valve 74, while the piston 30 is in an upper position. This valve is operated by the cam 21 through the rod 23 and a bell crank lever 75. This bell crank lever is pivoted to a bracket 76 mounted upon the jacket of the cylinder.

One arm of the lever 75 is connected with the valve stem and the other end is connected with the lower end of the slide rod. A spring 77 is mounted upon this rod between the bracket 60 and a collar 78 secured to the rod, so as to normally hold the rod up against its cam.

79 represents a spark plug located in the lower end of the cylinder 24 and which would obviously be connected with batteries not shown, in the usual manner, whereby the charge in the lower part of the cylinder could be fired at the proper instant to operate the piston.

80 represents a relief cock that is located in the lower end of the cylinder 24 to release the pressure therein.

The operation of my engine is substantially as follows: Assuming a compressed charge of fluid to be contained within the end 29 of the cylinder 24 and the same to be ignited and fired through the medium of the spark plug 79 before mentioned, it would obviously force the pistons 30 and 32 and their rod 31 upward until the lower piston passed the exhaust ports 58 through which the burnt gases escape. The air contained within the top end of the cylinder 25 is by this same movement of the piston forced out through the valve 34 and down through the pipe 35 and into the heat radiating chamber, 26. The said air compressed end of the cylinder 25 is replenished with a new supply of air through the check valve 33 when the piston and rod again descend. A small proportion of air is also forced out from the pipe 35 through the pipes 39 to the several tanks 37, 38 and 43 sufficient to insure a pressure upon the fluids contained therein. A small quantity of water is forced up from the tank 38 through the pipe 41 and its valve 41^a in through the nozzle 36 to the heat radiating chamber 26 where it is distributed and heated together with the air by reason of their contact with the several perforated flanges 27 within said space. After a few operations of the piston this radiating chamber obviously becomes compactly filled with a mixture of steam and air which in turn is fed through the check valve 74 and into the upper end 28 of the cylinder 24 at a time and in a manner to force the piston down, thereby producing a double acting cylinder. A small quantity of the heated air and steam in the compartment 26 passes down through the pipes 27^a to the chamber 57 where it is introduced into the explosion cylinder together with the fuel through the valve 51. The fluid is fed into the cylinder from either the tank 37 or 43 through the pipe 46, the needle valve and the main valve. These valves are opened and closed by the movement of the main valve 51 operated through the lever and connections with cams on the crank

shaft. The amount of the opening and closing movement of the said valve when regulated by the operation of the rod 73 and lever 72 is regulated in the manner heretofore described. The fuel or gasolene contained in the tank 37 is used for starting the engine, while the larger tank 43 containing heavier oil, is used for operating the engine after being started.

10 Having thus described my invention what I claim and desire to secure by Letters Patent is:—

1. In an engine of the class described, the combination of an explosive cylinder, a chamber surrounding the same, perforated heat radiating disks mounted therein, vertically arranged pipes extending through the disks, means for feeding both air and water into the chamber to be heated to form steam, a main valve to feed the fuel to the explosion cylinder, a needle valve within the main valve for controlling the supply of fuel to the main valve, means for automatically operating both the main valve and needle valve, an air compressor cylinder in alignment with the main cylinder, connections from the air compressor cylinder to the steam generating cylinder, a single piston rod for both cylinders and having pistons to operate in the two alined cylinders.

2. In an engine of the class described, the combination of a compression cylinder and an explosion cylinder in alinement with each other, a piston rod passing through both cylinders, a piston within each cylinder and mounted upon the rod, means for operating the one piston in one direction by gas explosions, means for operating the same piston in the opposite direction by steam, a steam generating cylinder around the explosion cylinder, valve and pipe connections from the compression cylinder to the steam cylinder

der and explosion cylinder, means for feeding air into the said steam generating cylinder to be heated, a main valve and pipe connection for controlling the supply of fuel and heated air to the explosion cylinder, a needle valve within the main valve for controlling the supply of fuel to the main valve, means for automatically operating both the main valve and needle valve.

3. In an engine of the class described, the combination of a compression cylinder and an explosion cylinder in alinement with each other, a piston rod passing through both cylinders, a piston within each cylinder and mounted upon the rod, means for operating the one piston in one direction by gas explosions, means for operating the same piston in the opposite direction by steam, perforated heat radiating disks mounted therein, vertically arranged pipes extending through the disks, a steam generating cylinder around the explosion cylinder, valve and pipe connections from the compression cylinder to the steam cylinder and explosion cylinder, means for feeding air into said steam cylinder to be heated, means for feeding a small quantity of water into the steam cylinder at the point of intake for compressed air, a main valve and pipe connection for controlling the supply of fuel and heated air to the explosion cylinder, a needle valve within the main valve for controlling the supply of fuel to the main valve, and means for automatically operating both the main valve and needle valve.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut this 20th day of March, A. D. 1912.

CHRISTOPHER J. LAKE.

Witnesses:

C. M. NEWMAN,
RUTH MC. WORDEN.