No. 709,520. Patented Sept. 23, 1902.

E. J. ST. CROIX.

AIR COMPRESSING APPARATUS.

(Application filed Dec. 23, 1901.)

(No Model.)

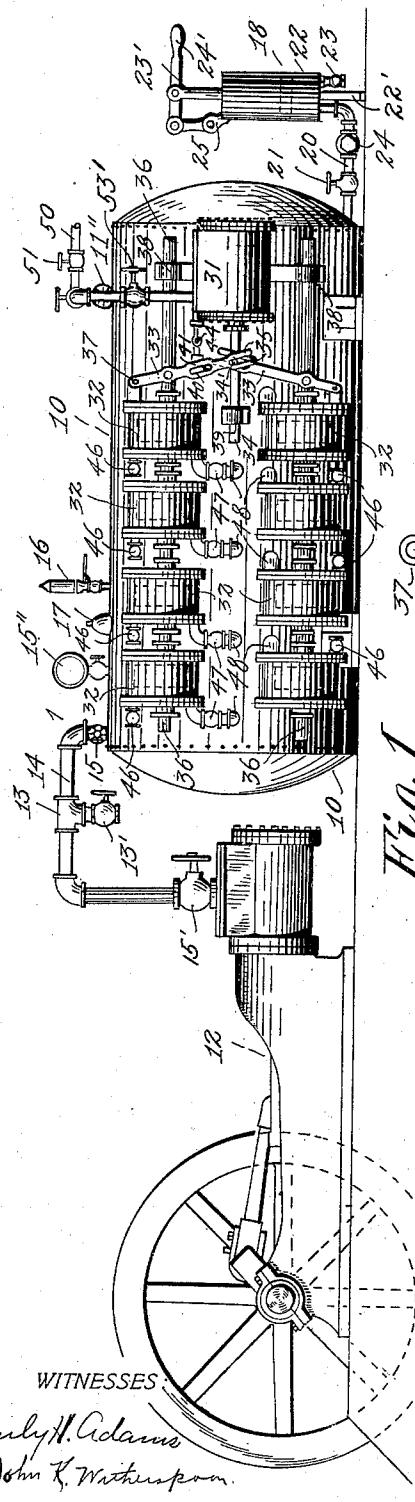


Fig. 1

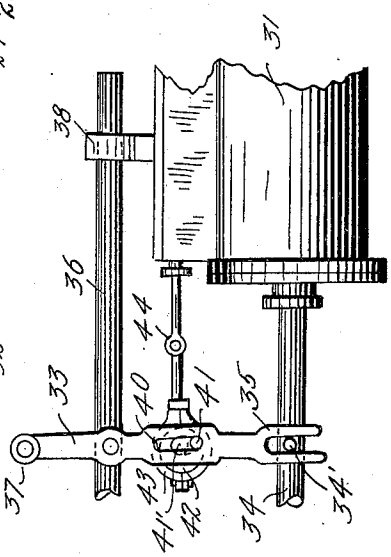


Fig. 3

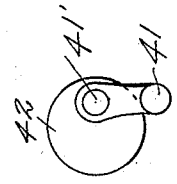


Fig. 4

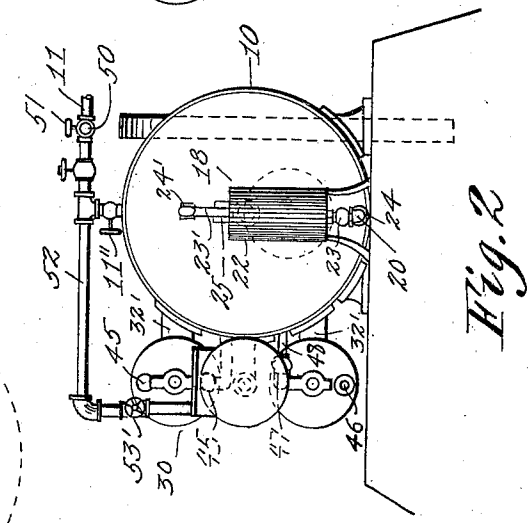


Fig. 2

WITNESSES

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AIR-COMPRESSING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 709,520, dated September 23, 1902.

Application filed December 23, 1901. Serial No. 86,979. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. ST. CROIX, a citizen of the United States of America, and a resident of Madrone, in the county of Kitsap and State of Washington, have invented certain new and useful Improvements in Air-Compressing Apparatus, of which the following is a specification.

My invention relates to improvements in apparatus for compressing and storing air, and has especial reference to a device of this class which is adapted for use as auxiliary to a compressed-air power plant at a substation.

Among numerous objects attained by this invention and readily understood from the following specification and accompanying drawings, included as a part thereof, is the production of an efficient air compressing and storing apparatus embodying essential features of adaptibility and utility, which render it especially useful to maintain constantly at a subpower station a supply of compressed air for distribution as required.

The above-mentioned and numerous other desirable objects are attained by the constructions, combinations, and arrangement of parts as disclosed by the drawings, set forth in this specification, and succinctly pointed out in the claim.

With reference to the drawings filed herewith and bearing similar reference characters for corresponding parts throughout, Figure 1 is a view in side elevation of my improved apparatus with an engine indicated in like view and connected to the apparatus to receive motive fluid therefrom. Fig. 2 is an end elevation of the apparatus looking from the right of Fig. 1. Fig. 3 is a side view, on enlarged scale, of the mechanism employed to operate the valve of the motive cylinder of the auxiliary compressor; and Fig. 4 is a side view of the crank and eccentric disk of said mechanism.

This apparatus includes a suitable reservoir for compressed air, as a cylindrical body 10, preferably made of plate metal and rendered of sufficient strength to withstand a predetermined internal pressure. This reservoir is intended for use at subpower-stations operated by compressed air and is connected to a main supply-conduit, as 11, leading from the main power-station, where a suitable air-compressor is maintained to normally supply air to said reservoir through said conduit, and the admission of air to said reservoir is controlled by a gate-valve 11″, arranged in said conduit closely adjacent the reservoir.

The air compressed in reservoir 10 is distributed through suitable conduits to drive the mechanism controlled from the substation and in the present instance passes to an engine, as 12, through a distributing-conduit 14, which is connected to the reservoir and controlled by a gate-valve 15 embodied in its line. This conduit is suitably provided with a blow-off, as a T-fitting 13, placed in the line at a suitable point beyond the gate-valve 15 and controlled by a suitable gate-valve, as 13′, connected to the stem of said fitting, whereby the pressure of the air in the reservoir can be conveniently reduced by opening both of said valves or the air directed to the engine 12 by closing the latter and opening the former. As now considered, a gate-valve, as 15′, is placed in this conduit closely adjacent the cylinder of engine 12 to control the admission of air thereto, and this valve is closed when said blow-off is to be opened.

As now considered, the reservoir 10 is supplied with a suitable gage, as 15″, which is connected thereto and adapted to indicate the pressure of the contained air, and said reservoir is connected to a suitable whistle, as 16, and also has a safety-valve 17 of any desired construction, adapted to prevent accident by excessive pressure. The reservoir 10 can also be supplied with compressed air from a manually-operative air-pump, as 18, positioned in close proximity thereto and suitably constructed for operation by manpower and arranged to deliver air to said reservoir through an auxiliary supply-conduit 20, which is arranged with a gate-valve 21 intermediate the pump and reservoir, whereby said conduit may be disconnected at the outer side of the body of the valve and any water which may have accumulated in said reservoir be then blown out by opening said valve. As now considered, this pump comprises a cylinder 22, closed only at the lower end and having in said end a suitable port of ingress and a port of egress, controlled, re-

spectively, by an inwardly-opening check-valve 23 and an outwardly-opening check-valve 24, the latter valve being located in conduit 20, between the pump-cylinder and gate-valve 21. Within cylinder 22 is fitted a suitable piston, which is attached to a reciprocative rod 23′, operated by a lever 24′, pivotally mounted on a lug 25, formed on said cylinder at the upper or open end. This pump is mounted on suitable legs 22′ and is adapted as means to charge reservoir 10 independently of the main power plant and is especially useful when the reservoir is employed to store air for operating very light appliances, which require but a limited pressure for operation.

As now considered an auxiliary air-compressor, as 30, is combined with the reservoir 10 for the purpose of charging same should the main plant be laid up for repairs or in case of accident thereto, and this auxiliary compressor includes a fluid-operative driving-cylinder 31, having a piston, steam-chest, and valves, arranged as in a steam-engine of ordinary construction. This cylinder is preferably mounted at one side of the reservoir in a horizontal position and supported therefrom by a bracket of any suitable construction and is adapted to operate compound air-compressing mechanism, consisting of oppositely-disposed series of cylinders, as 32, each series being arranged horizontally in tandem and disposed at a respective side of the horizontal center-line of driving-cylinder 31, so that the pistons can be conveniently operated by levers, as 33, which are operably connected to the piston-rod 34 of the driving-cylinder by means of a transversely-disposed pin 34′, fixed in said rod and arranged with suitable projections from each side of the rod to engage between the bifurcations 35, formed at the ends of these levers, which are oppositely disposed and each pivoted to a respective piston-rod 36 of the complex compressing apparatus and fulcrumed at a point, as 37, on the head cylinder of a respective series.

The cylinders 32 are preferably single-acting and arranged in two series, and the pistons in these cylinders are suitably operated so that when the cylinders of one series are taking air those of the other series are operating to compress air. These cylinders are each formed with a head at both ends, arranged with suitable stuffing-boxes, and are preferably supported from the reservoir 10 by suitable brackets, as 32′, and are preferably placed to form a series above and a series below the driving-cylinder to render the apparatus more compact. As now considered, four cylinders 32 are included in each series, and the piston-rods 36 thereof are extended beyond each end of respective series for support at the head end and for attachment of an extra length of rod to the tail end, if desired to include another cylinder in the series and to expedite the removal of the cylinders from the tail ends by simply disconnecting same from the reservoir and shifting them along the respective piston-rod. In the present instance the head ends of piston-rods 36 are supported in brackets 38, which are mounted on driving-cylinder 31, and the piston-rod of said driving-cylinder is supported at the outer end by a bracket 39, which is secured to the wall of reservoir 10. To conveniently operate the valve of driving-cylinder 31, one of the levers 33 is formed with a longitudinally-extending slot 40 adjacent the power end and adapted to receive a suitable pin of an operative crank, as 41, which is thereby made to revolve as the lever is reciprocated. This crank is suitably mounted on a short shaft 41′, which has bearing in a suitable bracket fixed to the reservoir 10, and on this shaft a suitable eccentric disk, as 42, is fixed, having a suitable strap 43 thereabout and which is connected to the said valve by a suitable rod having a knuckle-joint 44.

Each head of each of the cylinders 32 is formed with two openings, as 45, adapted as ports for ingress and egress of air, and these openings in one of the heads of each cylinder are controlled by check-valves 46 and 47, of which the former has direct opening to the atmosphere and opens by external pressure and the latter is embodied in a suitable conduit 48, which leads to reservoir 10 and opens upon the working stroke of the piston in a respective cylinder to admit air to the reservoir from said cylinder.

The valves 46 and 47 are placed at the same head of each cylinder of a series, but at the opposite heads of the cylinders of the other series, so that the said series will act alternately for suction and compression, and thereby render the driving-cylinder operative to compress air throughout each stroke.

It will be understood that the cylinders 32 are rendered as much shorter in proportion to cylinder 31 as the difference in the length of travel of the respective piston-rods, which is in proportion to the separation of said rods and the placing of the fulcrums of the levers 33.

To conveniently operate the piston of driving-cylinder 31 a conduit 50 is connected to the main supply-conduit 11 and extended to a source of fluid-supply, as a boiler or the like adapted to generate steam, and a gate-valve 51 is embodied in said line of conduit to normally keep same closed. From conduit 11 a branch conduit 52 is arranged to lead to the cylinder 31 to conduct motive fluid thereto from either the main conduit 11 or auxiliary conduit 50, and a gate-valve 53′ is placed in the line of said branch to control the passage of fluid to said cylinder. In this manner the driving-cylinder 31 is rendered operative by passing fluid from either main conduit 11 or auxiliary conduit 50, as may be desired, and the reservoir 10 can thus be charged to a pressure exceeding that of the fluid passing through said conduits and

as due to the increase of power obtainable by the use of levers 33.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States of America, is—

In an apparatus for compressing and storing air; a reservoir, a main conduit adapted to convey air under pressure to said reservoir, a gate-valve to control said conduit and a second gate-valve in the conduit closely adjacent said reservoir, an auxiliary conduit adapted to convey steam to the main conduit and a gate-valve to control same, a driving-cylinder, a branch conduit leading from the main conduit to said cylinder and having a gate-valve therein, a double series of air-compressing cylinders each of less length of bore than said driving-cylinder said series arranged within the cylinders in tandem and disposed at opposite sides of the center line of the driving-cylinder, a conduit leading from one head of each compression-cylinder to the reservoir and a port of ingress in said end, a check-valve in last said conduit, and a check-valve arranged to control said port, a piston-rod for each series of cylinders and a like rod for the driving-cylinder, oppositely-disposed levers operably connected to the rod of the driving-cylinder and arranged to drive the piston-rods of the compression-cylinders, valve-operating mechanism for the valve of the driving-cylinder operably connected to one of said levers, and a manually-operative air-pump connected to said reservoir.

Signed at Seattle, Washington, this 9th day of December, 1901.

EDWARD J. ST. CROIX.

Witnesses:
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