

C. HARTER & J. W. SMALL.
STAY BOLT BREAKER.

APPLICATION FILED FEB. 11, 1910.

Patented Oct. 18, 1910.

4 SHEETS-SHEET 1.

972,856.

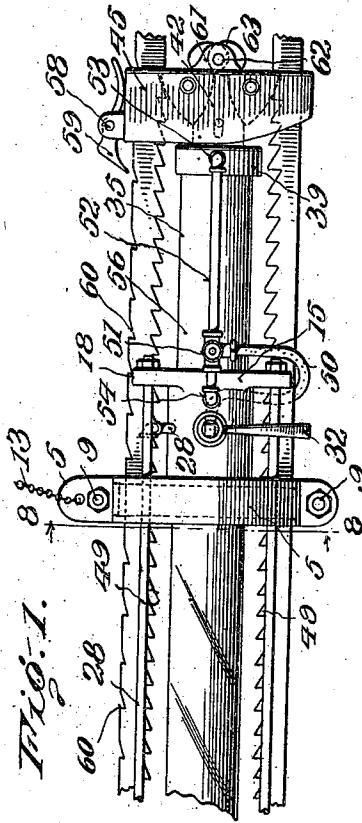


Fig. 1.

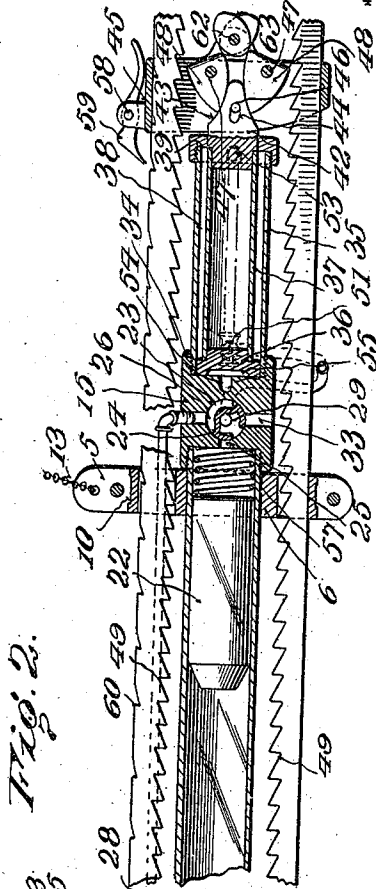


Fig. 2.

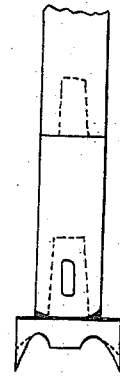
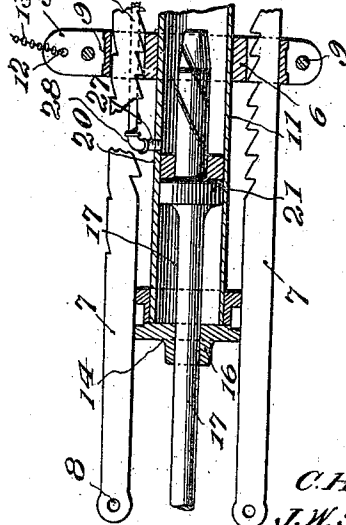
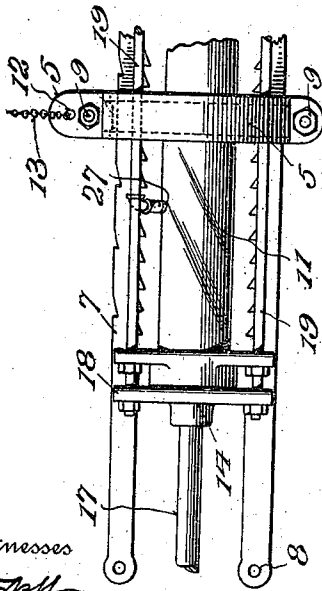


Fig. 13.



Witnesses

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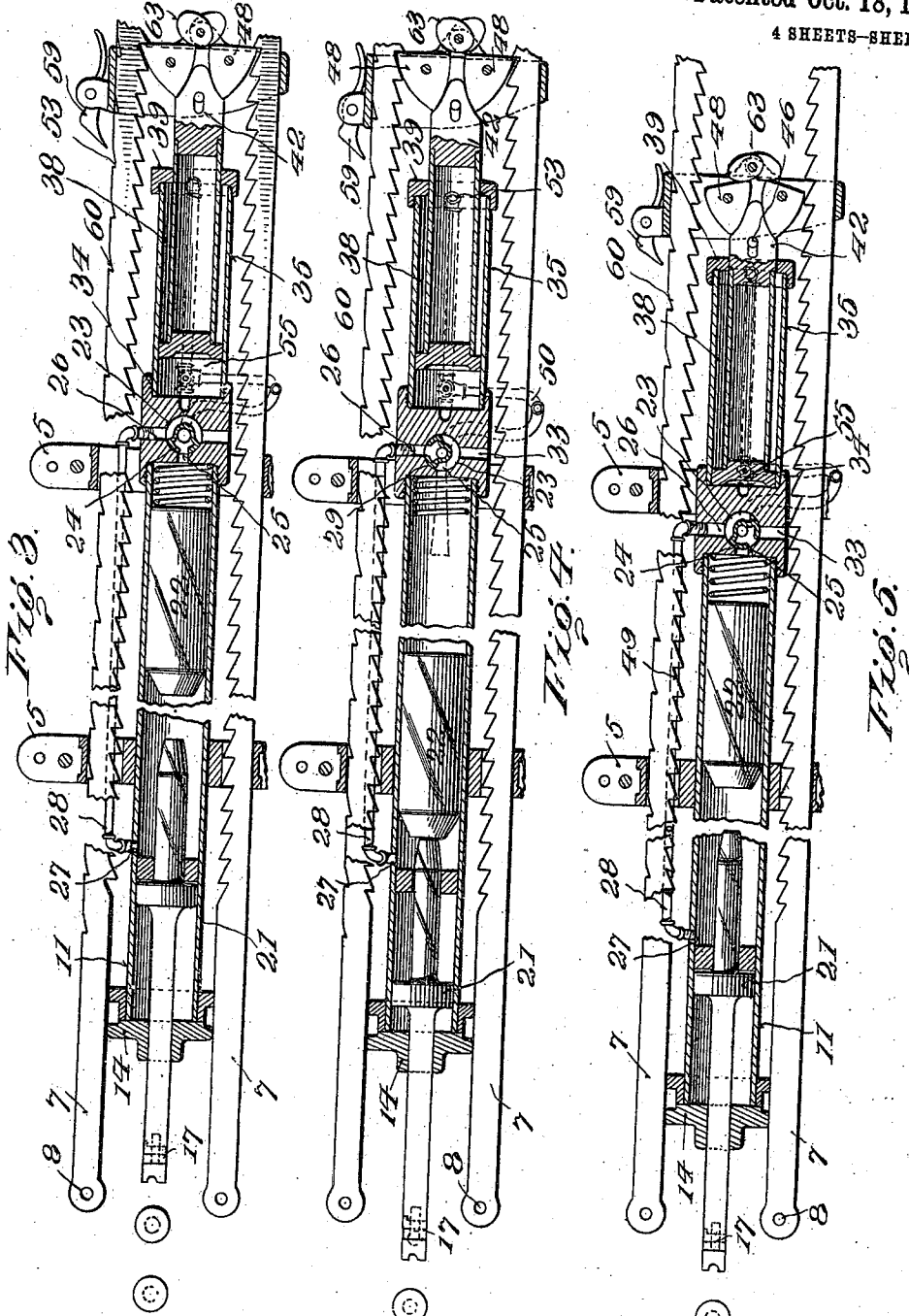
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4 SHEETS—SHEET 2.



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4 SHEETS-SHEET 3.

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Fig. 6.

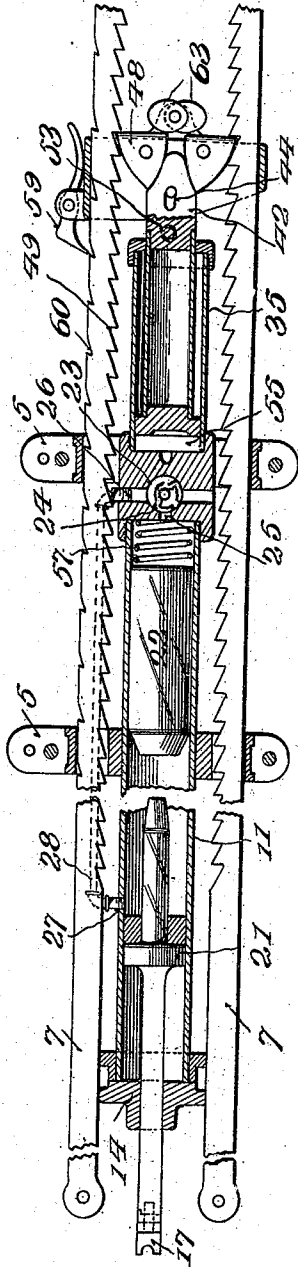
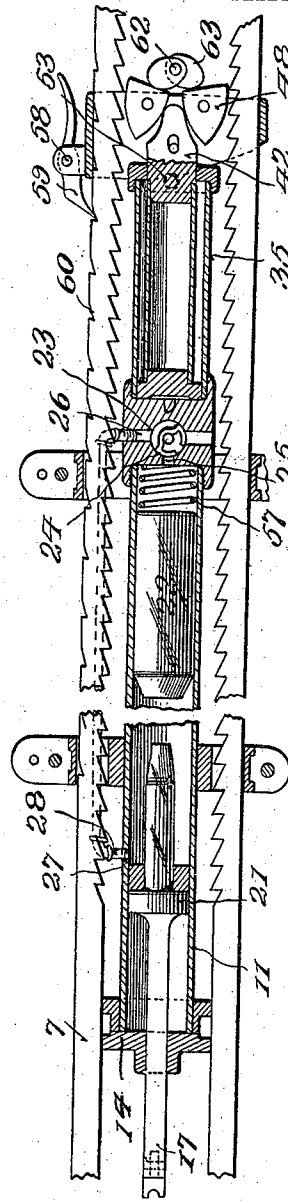


Fig. 7.



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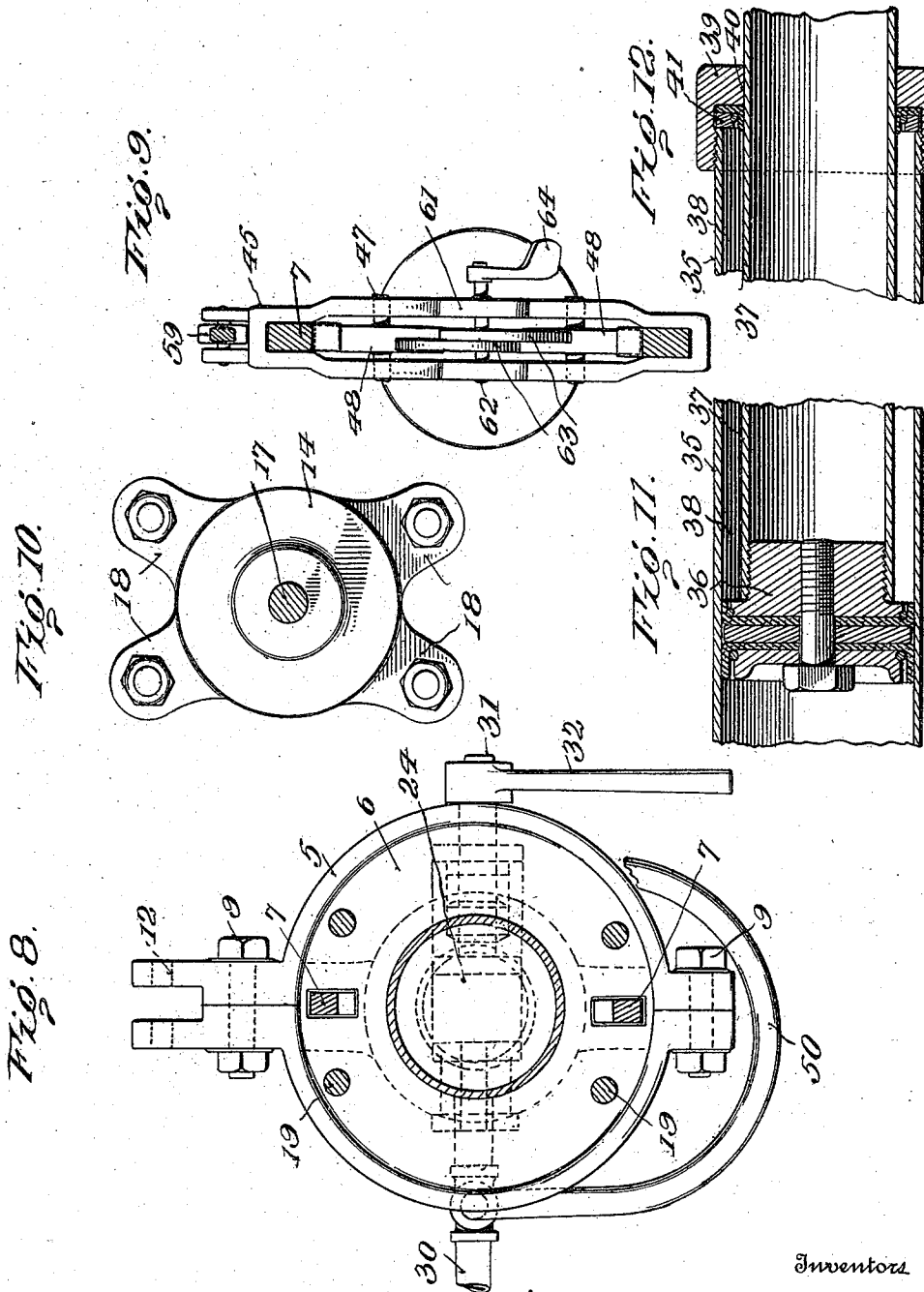
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

CHARLES HARTER, OF BARBERTON, OHIO, AND JOHN W. SMALL, OF LOS ANGELES, CALIFORNIA.

STAY-BOLT BREAKER.

972,856.

Specification of Letters Patent.

Patented Oct. 18, 1910.

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To all whom it may concern:

Be it known that we, CHARLES HARTER and JOHN W. SMALL, citizens of the United States, residing at Barberton and Los Angeles, respectively, in the counties of Summit and Los Angeles, respectively, and States of Ohio and California, respectively, have invented certain new and useful Improvements in Stay-Bolt Breakers, of which the following is a specification.

This invention relates to stay bolt breakers and more particularly to a machine especially designed for cutting or breaking stay bolts between the fire box and outer shell of a locomotive boiler to permit the renewal of said fire box.

The object of the invention is to provide a machine of simple and compact construction by means of which stay bolts may be cut or severed more expeditiously and with less labor on the part of the operator than heretofore.

A further object is to provide a machine including a cylinder having a projectile slidably mounted therein and actuated by fluid pressure to engage a cutting tool and break or sever a stay bolt.

A further object is to provide means for feeding the machine forward with a step by step movement, and means for retracting the machine after the last stay bolt in a row is broken.

A still further object of the invention is generally to improve this class of machines so as to increase their utility, durability and efficiency.

Further objects and advantages will appear in the following description, it being understood that various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

For a full understanding of the invention and the merits thereof and also to acquire a knowledge of the details of construction and the means for effecting the result, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a side elevation of a stay bolt breaker constructed in accordance with our invention; Fig. 2 is a longitudinal sectional view of the same, showing the stop ring or collar on the main cylinder in engagement with the flange of the cutting tool and the air admitted through the three-

way valve to the auxiliary cylinder to actuate the plunger; Fig. 3 is a similar view showing the position of the main valve when the projectile is actuated to engage the cutting tool; Fig. 4 is a longitudinal sectional view showing the main valve in position to retract the projectile; Fig. 5 is a longitudinal sectional view showing the plunger retracted and the main cylinder ready to be fed forward with a step by step movement, the locking pawls being out of engagement with the teeth on the guide rods; Fig. 6 is a similar view showing the locking pawls in engagement with the teeth on the guide rods and the machine ready to be fed forward into engagement with the work; Fig. 7 is a longitudinal sectional view showing the position of the parts when the machine is to be retracted; Fig. 8 is a transverse sectional view taken on the line 8—8 of Fig. 1; Fig. 9 is an end elevation partly in section of Fig. 1; Fig. 10 is a transverse sectional view taken on the line 10—10 of Fig. 1; Fig. 11 is a detail longitudinal sectional view of the plunger head; Fig. 12 is a detail longitudinal sectional view of the packing for the auxiliary cylinder; Fig. 13 is a top plan view of the cutting or breaking tool.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The machine comprises relatively stationary guide yokes 5 having bearing rings 6 journaled therein and provided with alined seating recesses for the reception of spaced longitudinally disposed guide rods or bars 7, the latter being provided with terminal openings 8 for the reception of bolts or similar fastening devices, by means of which the guide rods may be secured to the front end of a locomotive boiler. The stationary guide yokes 5 are each preferably formed in two sections detachably secured in assembled position by bolts or similar fastening devices 9, said guide yokes being formed with annular stop shoulders 10 for engagement with corresponding flanges on the bearing rings, as shown. The bearing rings serve to receive and support a longitudinally movable main cylinder 11. The upper ends of the guide yokes 5 are formed with transverse openings 12 to which may be connected the adjacent ends of suitable cables or

chains 13, the latter being designed for attachment to the locomotive boiler to assist in sustaining the weight of the machine. If desired however, the machine may be supported in operative relation with respect to the boiler by means of a crane or tripod.

The cylinder 11 is provided with oppositely disposed heads 14 and 15, one of which constitutes a valve casing, there being an opening 16 formed in the forward head to permit the passage of the shank of a cutting or breaking tool 17. The heads 14 and 15 are provided with diagonally disposed ears 18 having perforations formed therein for the reception of tie rods 19, which tie rods extend through suitable openings in the bearing rings and serve to reinforce and strengthen the cylinder and retain the heads in engagement therewith.

Disposed within the cylinder 11 is a stop ring or collar 20 adapted to bear against a flange 21 on the shank of the cutting or breaking tool 17 when the active or pointed end of the latter is in engagement with a stay bolt, thus to limit the forward movement of said cylinder. Slidably mounted within the cylinder is a projectile 22 adapted to engage the adjacent end of the tool 17, thus to actuate the latter to cut or break the stay bolt.

The valve casing 15 is provided with a circular seat 23 in which is mounted for rotation a main valve 24 adapted to successively register with the ports 25 and 26 so as to permit the admission of fluid under pressure to either the front or rear end of the projectile 22.

A port 27 is formed in the forward end of the cylinder 11 and connected through the medium of a conductor 28 with the port 26.

The main valve 24 is provided with a central chamber 29 which communicates with a supply pipe 30, the latter being connected with any suitable source of fluid pressure, preferably compressed air. The valve 24 is provided with a stem 31 which projects through one side of the valve casing 15 and is provided with an operating handle 32 by means of which the valve may be rotated so as to admit fluid under pressure to the front or the rear of the projectile 22, as before stated.

When the valve 24 is in the position shown in Fig. 3 of the drawings, air under pressure is admitted to the cylinder 11 at the rear of the projectile and when the valve is in the position shown in Fig. 4 of the drawings, the air in the cylinder 11 at the rear of the projectile is permitted to discharge through an exhaust port 33.

Threaded in the valve casing 15 at 34, is an auxiliary cylinder 35 in which is mounted for sliding movement a plunger 36. The plunger 36 is provided with a tubular ex-

tension 37, which latter is spaced from the interior walls of the auxiliary cylinder 35 to form circumferential fluid chamber 38. The auxiliary cylinder 35 is closed by a head 39 having an opening 40 formed therein to permit free sliding movement of the tubular extension 37 therethrough, there being a packing 41 carried by the head 39 and bearing against the tubular extension 37 to prevent leakage of fluid at this point.

Threaded on or otherwise rigidly secured to the tubular extension 37 of the plunger is a cap piece or head 42 having its free end tapered to produce converging side walls 43 and provided with a transverse slot 44.

Slidably mounted on the guide rods 7 at the cap piece or head of the plunger, is a movable guide yoke 45, preferably of the construction shown in Fig. 9 of the drawings, said yoke being operatively connected with the head or cap piece 42 by means of a bolt 46 secured to the walls of the guide yoke 45 and extending through the slot 44.

Pivotally mounted at 47 between the side walls of the movable yoke 45, are locking pawls 48 adapted to engage suitable teeth 49 formed on the inner longitudinal edges of the guide rods 7 for the purpose of locking the plunger against longitudinal movement under certain conditions.

The construction of the cap piece or head 42 is such that when the plunger 36 is moved outwardly, the inclined faces 43 of said cap piece or head will bear against the pawls 48 and tilt the latter so as to cause said pawls to engage the teeth 49 and prevent further outward movement of the plunger, the slot 44 permitting a slight lost motion of the head or cap piece 42 on the rearward stroke of the plunger 36, thus to permit the pawls 48 to drop by gravity out of engagement with the teeth 49.

Communicating with the air supply pipe 30, is a branch pipe 50 leading to a three-way valve 51 disposed on one side of the machine near the operating lever 32, there being a conductor 52 connected with the three-way valve and having one end thereof communicating with the chamber 38 through a port 53 and its other end communicating through a port 54 with a chamber 55 formed at the rear of the plunger 36 so that by operating the handle 56 of the three-way valve, air may be admitted from the main supply pipe 30 to either the chamber 38 or chamber 55.

A coil spring 57 is disposed within the cylinder 11 at the rear of the projectile 22 for the purpose of receiving the impact of said projectile on its rearward stroke.

Pivotally mounted at 58 on the movable yoke 45, is a pawl 59 adapted to engage suitable notches or teeth 60 formed in the upper longitudinal edge of one of the guide rods 7 when it is desired to retract the machine

after a row of stay bolts have been broken. The side walls of the movable yoke 45 are provided with spaced ears 61 between which is pivotally mounted at 62 a pair of eccen-
 5 trics 63 so disposed that by rotating the operating handle 64 in one direction, the eccentrics 63 will engage the adjacent ends of the locking pawls 48 and disengage the latter from the teeth 49 for the purpose
 10 hereinafter referred to.

In operation, the machine is secured to the front end of the boiler, in the manner before stated, with the active end of the cutting or
 15 breaking tool 17 bearing against the first stay bolt in a row. The handle 56 of the three-way valve is then rotated so as to admit air under pressure from the main line 30 through the branch pipe 50 and port 54 to the chamber 55, thus forcing the plunger 36
 20 longitudinally of the auxiliary cylinder 37 and causing the inclined walls 43 of the cap piece or head 42 to move the pawls 48 outwardly into engagement with the teeth of the adjacent racks so as to lock the plunger
 25 against outward movement. As soon as the pawls 48 engage the teeth 49, the fluid pressure within the chamber 55 will force the cylinder 11 longitudinally until the stop ring 20 bears against the flange 21 of the
 30 cutting tool 17, the active end of the latter having previously been positioned against a stay bolt. The main valve 24 is then rotated so as to admit fluid under pressure through the port 25 to the rear of the projectile 22,
 35 thus forcing the latter into engagement with the adjacent end of the tool 17 and causing the active end of said tool to cut or break the stay bolt. The main valve 24 is then rotated until the same registers with the port 26,
 40 thus allowing the air from the main line to flow through the by-pass or conductor 28 to the front of the projectile 22 for the purpose of retracting the same, the air at the rear of the projectile being exhausted through the
 45 port 33 during the retraction of the projectile 22, as best shown in Fig. 4 of the drawings. In order to feed the cylinder and its associated parts forward in the direction of the work with a step by step movement, the
 50 three-way valve 51 is rotated so as to discharge the air from the chamber 55 through the by-pass or conductor 52 and port 53 into the chamber 38 at the front of the plunger 36. As soon as the plunger 36 moves, rear-
 55 wardly, the locking pawls 48 are disengaged from the teeth 49, in the manner before stated so that when the three-way valve 51 is again rotated to admit air to the chamber 55, the locking pawls 48 will again engage the
 60 teeth 49 and lock the head 42 against further movement, while the cylinder 11 is forced forward toward the work by the pressure in the chamber 55 at the rear of the plunger, this operation being repeated after each stay
 65 bolt has been cut or broken. In order to

effect the retraction of the cylinder and its associated parts after all of the stay bolts in a row have been cut or severed, the pawls 59 are tilted downwardly into engagement with the adjacent teeth 60 so as to lock the mov-
 70 able yoke 45 against forward movement, after which the handle 64 is rotated to move the eccentrics 63 in contact with the adjacent ends of the pawls 48 and thus disengage the latter from the teeth 49. Air is then admit-
 75 ted through the port 54 to the chamber 55 which moves the plunger 36 forward carrying with it the yoke 45, the pawl 59 riding loosely over the teeth 60 of the rack during the rearward movement of the yoke. The
 80 eccentrics 33 are then released and the air exhausted out of the chamber 55 and admitted into the chamber 38, which brings the pressure against the cylinder head 39 and plunger 36 with a tendency to pull the plun-
 85 ger back into the cylinder 35, but as the pawl 59 engages the adjacent notch or tooth 60, the plunger 36 is held against movement and the cylinder 11 is retracted a distance equal to the length of the auxiliary cylin-
 90 der 35.

It will here be noted that as soon as one stay bolt breaks, the cylinder 11 is moved automatically into engagement with the next stay bolt by the pressure behind the plunger
 95 36. It will also be noted that by having the guide yokes provided with bearing rings for the reception of the main cylinder, said cylinder and its associated parts may be rotated within the yokes while said yokes
 100 remain relatively stationary.

While it is preferred to operate the machine by compressed air, it will of course be understood that steam or other fluid may be utilized for this purpose without departing
 105 from the spirit of the invention.

The term, cutting tool, as used in the specification and claims, is intended to cover any form of tool capable of cutting, breaking or otherwise severing a bolt on the head thereof.
 110 It will also be understood that the term "yoke", applied to the members 5 and 45, is intended to include hangers, brackets or equivalent elements, capable of performing a similar function.
 115

Having thus described the invention, what is claimed as new is:

1. A stay bolt breaker including a cylinder, a cutting or breaking tool, a fluid actuated projectile for operating said tool,
 120 means including pawl and ratchet mechanism for feeding the machine forward, and means for retracting the machine.

2. A stay bolt breaker including a cylinder, a cutting or breaking tool, a fluid actuated projectile for operating said tool,
 125 means including pawl and ratchet mechanism for feeding the machine forward with a step by step movement, and means for retracting the machine.
 130

3. A stay bolt breaker having means for attachment to a boiler and including a cylinder having spaced ports, a cutting tool, a fluid actuated projectile for operating the cutting tool, means including pawl and ratchet mechanism for feeding the machine forward with a step by step movement, and a valve for admitting fluid under pressure to the rear of the projectile when the valve is in one position and to the front of the projectile to retract the latter when the valve is in another position.
4. A stay bolt breaker including spaced guides for attachment to a boiler, a cylinder slidably mounted between the guides, a cutting tool, a fluid actuated projectile slidably mounted within the cylinder for actuating the cutting tool, means including pawl and ratchet mechanism for feeding the cylinder forward with a step by step movement, and means for retracting the cylinder.
5. A stay bolt breaker including a plurality of spaced yokes, guides carried by the yokes and having means for attachment to a boiler, a longitudinally movable cylinder mounted for rotation in the yokes, a cutting tool, a fluid actuated projectile for operating the cutting tool, means including pawl and ratchet mechanism for feeding the cylinder forward in the direction of the work with a step by step movement, and means for retracting the cylinder.
6. A stay bolt breaker including spaced yokes having bearing rings journaled therein, guides carried by the bearing rings and provided with means for attachment to a boiler, a cylinder slidably mounted in said rings, a cutting tool carried by the cylinder, a fluid actuated projectile slidably mounted within the cylinder at the rear of the cutting tool and adapted to engage the latter, a valve for admitting fluid under pressure to the rear of the projectile when said valve is in one position and for admitting fluid to the front of the projectile to retract the latter when the valve is in another position, and yieldable means for receiving the impact of the projectile on its rearward stroke.
7. A stay bolt breaker including spaced guides having means for attachment to a boiler, main and auxiliary cylinders slidably mounted between the guides, a cutting tool carried by the main cylinder, a fluid actuated projectile adapted to engage the cutting tool, and a plunger slidably mounted in the auxiliary cylinder and provided with means for engagement with the guides for feeding both cylinders in the direction of the work with a step by step movement.
8. A stay bolt breaker including spaced guides having teeth and provided with means for attachment to a boiler, main and auxiliary cylinders slidably mounted between the guides, a cutting tool carried by the main cylinder, a fluid actuated projectile adapted to engage the cutting tool, a fluid actuated plunger slidably mounted in the auxiliary cylinder and provided with a slotted head, a pin connecting the head and movable yoke and seated in the main cylinder, a fluid actuated projectile adapted to engage the cutting tool, a plunger slidably mounted in the auxiliary cylinder, and pawls carried by the plunger and adapted to engage the teeth on the guides for feeding both cylinders in the direction of the work with a step by step movement.
9. A stay bolt breaker including spaced guides having teeth, main and auxiliary cylinders slidably mounted between the guides, a cutting tool carried by the main cylinder, a fluid actuated projectile adapted to engage the cutting tool, a fluid actuated plunger slidably mounted in the auxiliary cylinder and provided with a head projecting beyond said cylinder, and pawls pivotally mounted on said head and adapted to engage the teeth on the guides for feeding both cylinders forward with a step by step movement.
10. A stay bolt breaker including relatively stationary yokes, guides supported by the yokes and provided with teeth, main and auxiliary cylinders slidably mounted between the yokes, a cutting tool carried by the main cylinder, a fluid actuated projectile adapted to engage the cutting tool, a movable yoke, a plunger operating within the auxiliary cylinder and connected with the movable yoke, and pawls pivotally mounted on said movable yoke and movable into engagement with the teeth on the guides by contact with the plunger for feeding both cylinders forward with a step by step movement.
11. A stay bolt breaker including relatively stationary yokes, spaced guides supported by said yokes and provided with teeth, main and auxiliary cylinders slidably mounted within the yokes, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in said main cylinder for engagement with the cutting tool, a fluid actuated plunger slidably mounted in the auxiliary cylinder, a head carried by the plunger, a movable yoke having a pin and slot connection with the head, and pawls pivotally mounted on the movable yoke and adapted to engage the teeth on the guides by contact with the head of the plunger for moving both cylinders forward with a step by step movement.
12. A stay bolt breaker including relatively stationary yokes, spaced guides supported by the yokes and provided with teeth, a movable yoke, main and auxiliary cylinders slidably mounted in the yokes, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in the main cylinder and adapted to engage the cutting tool, a fluid actuated plunger slidably mounted in the auxiliary cylinder and provided with a slotted head, a pin connecting the head and movable yoke and seated in

the slot of said head, and locking pawls pivotally mounted on the movable yoke and adapted to engage the teeth on the guides when the plunger is moved in one direction to feed both cylinders forward with a step by step movement and arranged to release said pawls when the plunger is moved in the opposite direction.

13. A stay bolt breaker including a supporting frame having spaced teeth, main and auxiliary cylinders carried by the supporting frame, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in said main cylinder and adapted to engage the cutting tool, a fluid actuated plunger, a yoke slidably mounted on the frame and having a pin and slot connection with the plunger, and pawls pivotally mounted on the yoke and movable into engagement with the teeth by contact with the plunger when the latter is moved in one direction to feed both cylinders in the direction of the work with a step by step movement, said pawls being movable out of engagement with the teeth when the plunger is moved in another direction.

14. A stay bolt breaker including spaced guides having upper and lower sets of teeth, main and auxiliary cylinders slidably mounted between the guides, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in the main cylinder and adapted to engage the cutting tool, a movable yoke, a fluid actuated plunger slidably mounted in the auxiliary cylinder, pawls pivotally mounted on the movable yoke, a head carried by the plunger and adapted to engage and force the pawls against the teeth when the plunger is moved in one direction and to release said pawls when the plunger is moved in another direction, and an auxiliary pawl carried by the movable yoke and adapted to engage the adjacent teeth on one of the guides for preventing movement of said yoke when the cylinders are retracted.

15. A stay bolt breaker including a supporting frame having spaced sets of teeth, main and auxiliary cylinders slidably mounted on the supporting frame, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in said main cylinder and adapted to engage the cutting tool, a yoke slidably mounted on the frame, a fluid actuated plunger disposed within the auxiliary cylinder, a head carried by the plunger and having a pin and slot connection with the sliding yoke, said head being provided with oppositely disposed inclined walls, pawls pivotally mounted on the sliding yoke and movable into engagement with one set of teeth on the supporting frame by contact with the inclined walls of the head when the plunger is moved in one direction and movable out of engagement with

said teeth when the plunger is moved in another direction, other means for disengaging the pawls from the teeth, and an auxiliary pawl pivotally mounted on the sliding yoke and adapted to engage another set of teeth on the supporting frame, thereby to hold said sliding yoke against movement during the retraction of said cylinders.

16. A stay bolt breaker including a supporting frame having spaced sets of teeth, main and auxiliary cylinders slidably mounted on the supporting frame, a cutting tool carried by the main cylinder, a fluid actuated projectile slidably mounted in said main cylinder and movable into engagement with the cutting tool, a yoke slidably mounted on the supporting frame, a fluid actuated plunger slidably mounted in the auxiliary cylinder and having a pin and slot connection with the sliding yoke, pawls carried by the sliding yoke and movable into engagement with one set of teeth by contact with the plunger, eccentrics pivotally mounted on the yoke and adapted to engage the pawls for holding the latter out of engagement with said teeth, and an auxiliary pawl pivotally mounted on the yoke and adapted to engage another set of teeth on the supporting frame.

17. A stay bolt breaker including a supporting frame, main and auxiliary cylinders slidably mounted in the frame, a valve casing connecting said cylinders and provided with a seat, there being a by-pass forming a connection between the seat and the forward portion of the main cylinder, a cutting tool, a projectile slidably mounted in the main cylinder for engagement with the cutting tool, a valve engaging the seat for admitting fluid under pressure to either the front or rear of the projectile, a plunger operating within the auxiliary cylinder and adapted to engage the frame for feeding both cylinders forward with a step by step movement, and means for admitting fluid to the auxiliary cylinder to actuate said plunger.

18. A stay bolt breaker including a supporting frame, main and auxiliary cylinders slidably mounted in the frame, a valve casing forming a connection between said cylinders and provided with a seat, a by-pass connecting the seat with the forward end of the main cylinder, a cutting tool, a projectile slidably mounted in the main cylinder for engagement with the cutting tool, a main valve having communication with a source of fluid under pressure mounted for rotation in said seat for admitting fluid to either the front or back of the projectile, a plunger operating within the auxiliary cylinder and provided with means adapted to engage the frame for moving both cylinders forward with a step by step movement, a branch pipe having a three-way valve for

controlling the admission of fluid to the front and rear of the plunger, and means for retracting both cylinders after the completion of the work.

5 19. A stay bolt breaker including a supporting frame, main and auxiliary cylinders slidably mounted in the frame, a valve casing connecting the cylinder and provided with a seat, a by-pass forming a connection
10 between the seat and forward end of the main cylinder, a cutting tool, a projectile slidably mounted in the main cylinder and adapted to engage the cutting tool, a fluid supply pipe, a valve connected with the fluid
15 supply pipe and engaging said seat for admitting fluid to both the front and rear of the projectile, a plunger slidably mounted in the auxiliary cylinder and having means for engagement with the supporting frame
20 for moving both cylinders in the direction of the work with a step by step movement, said auxiliary cylinder having ports at the opposite ends thereof, a conductor connecting said ports and provided with a three-
25 way valve, and a branch pipe connecting the three-way valve with the fluid supply pipe.

30 20. A stay bolt breaker including a supporting frame, main and auxiliary cylinders slidably mounted in the supporting frame, a valve casing forming a connection between said cylinders and provided with a seat, a by-pass connecting the seat and the forward portion of the main cylinder, a cut-

ting tool, a projectile slidably mounted in 35 the main cylinder, a fluid supply pipe, a main valve seated in the casing and connected with the fluid supply pipe, a yoke slidably mounted on the supporting frame, a plunger operating within the auxiliary 40 cylinder and provided with a head having a pin and slot connection with the yoke, pawls pivotally mounted on the yoke and adapted to engage the frame for feeding both cylinders forward with a step by step 45 movement, said auxiliary cylinder being provided with oppositely disposed ports, a conductor connecting said ports, a three-way valve carried by the conductor, a branch pipe connecting the three-way valve and 50 fluid supply pipe, means carried by the yoke and adapted to engage the frame for holding said yoke stationary when the cylinders are retracted, and eccentrics pivotally mounted on the movable yoke for disengag- 55 ing the locking pawls from the supporting frame.

In testimony whereof we affix our signatures in presence of two witnesses.

CHARLES HARTER. [L. s.]
JOHN W. SMALL. [L. s.]

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D. A. TAYLOR.

Witnesses for Small:

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A. L. FRANCIS.