Aug. 7, 1928. 1,679,506

A. STORM

CYLINDER RENEWING MACHINE

Filed Oct. 17, 1925 3 Sheets-Sheet 1

Fig. 1

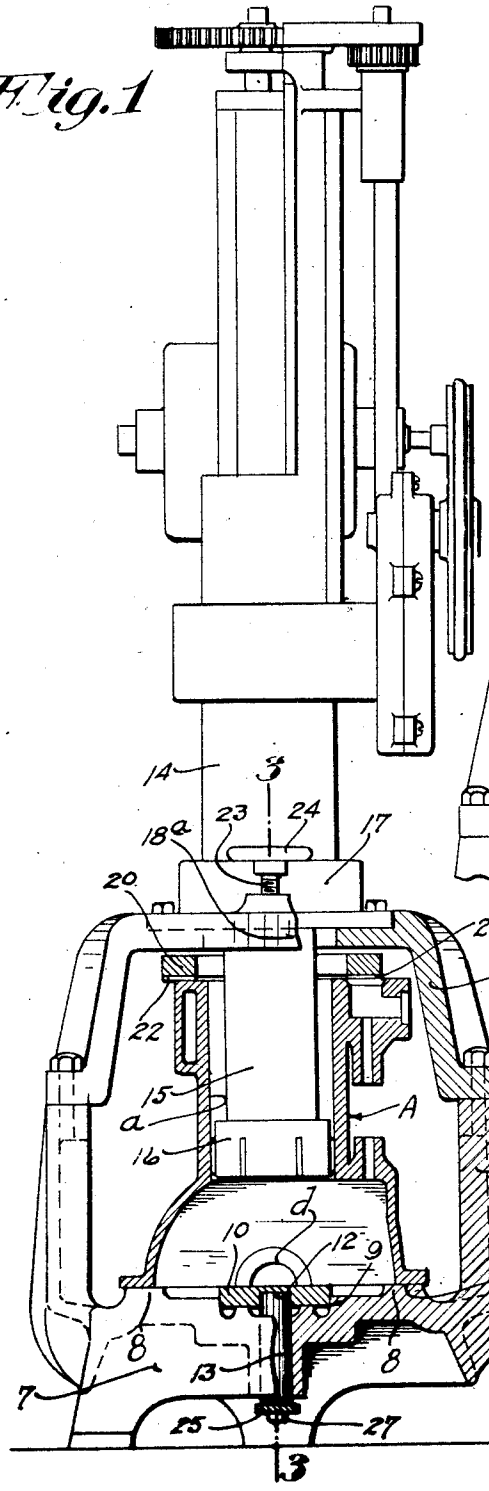
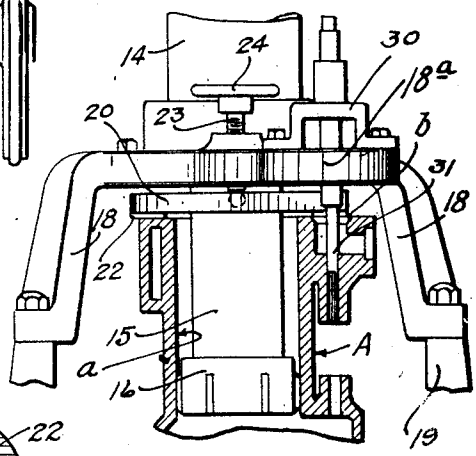


Fig. 2



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Fig. 3

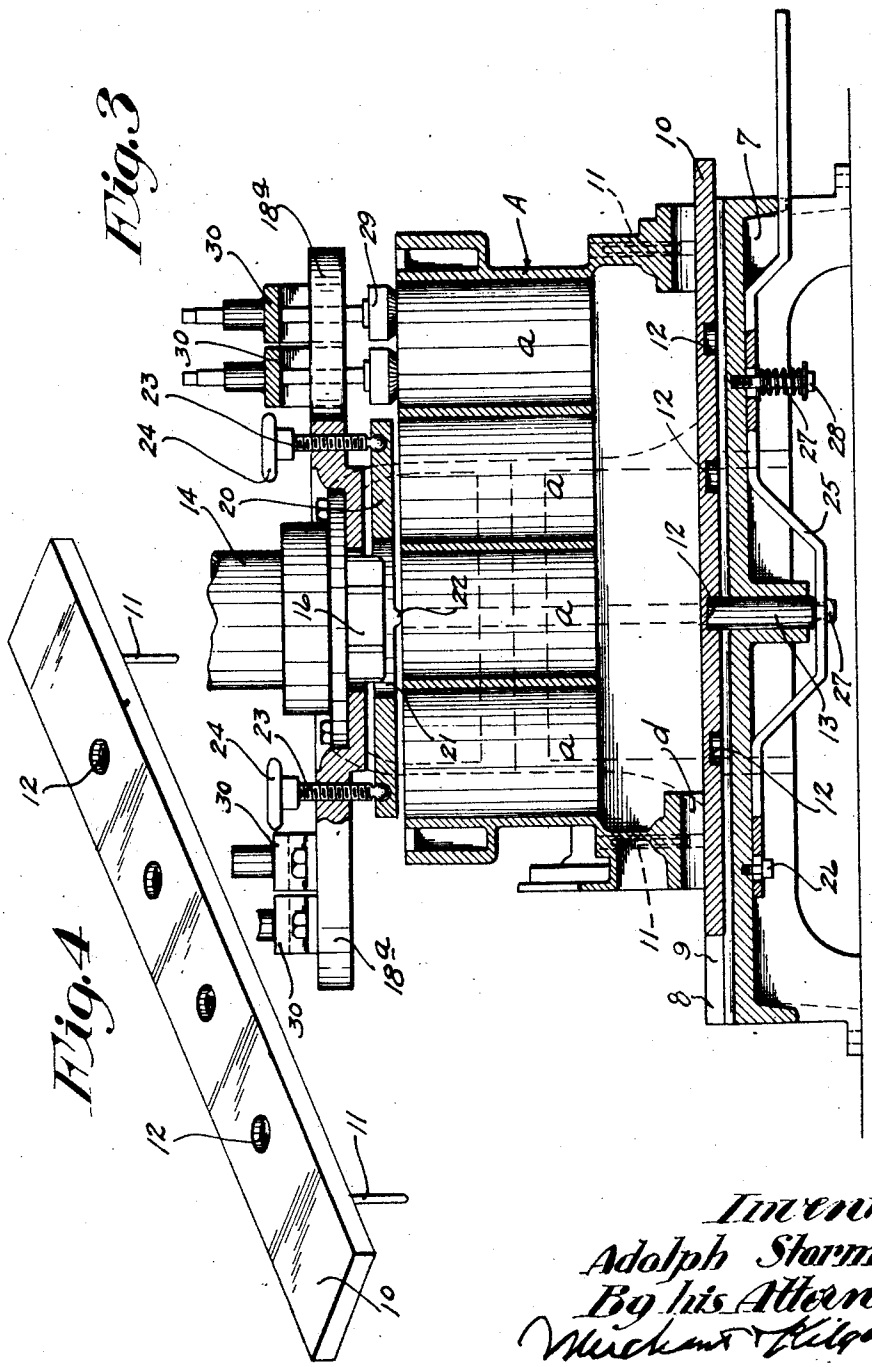


Fig. 4

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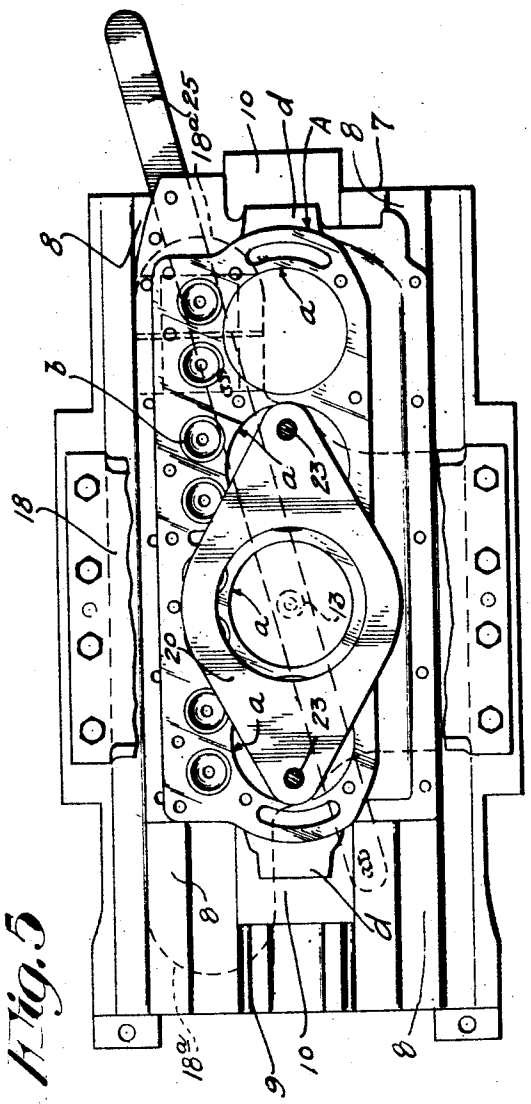


Fig. 5

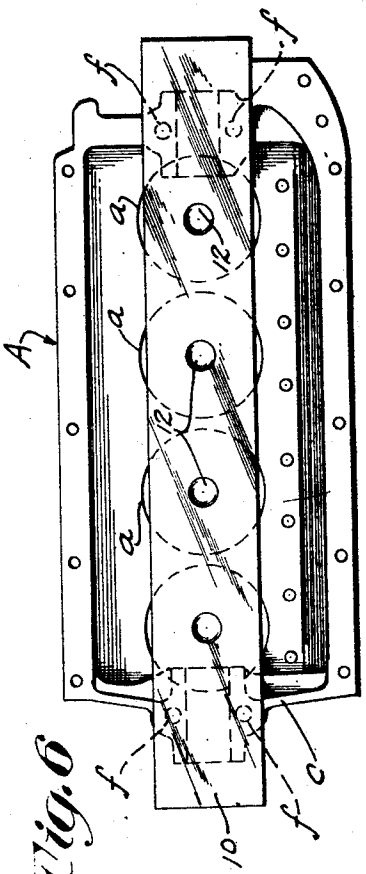


Fig. 6

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UNITED STATES PATENT OFFICE.

ADOLPH STORM, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO STORM MANUFACTURING COMPANY, INCORPORATED, OF MINNEAPOLIS, MINNESOTA, A CORPORATION.

CYLINDER-RENEWING MACHINE.

Application filed October 17, 1925. Serial No. 62,991.

My invention provides a simple and highly efficient machine especially adapted for use in reboring, grinding, honing and finishing, or, generally stated, restoring to original condition the cylinders and cylinder blocks of internal combustion engines. This machine I generically designate as a "cylinder renewing" machine, but it is capable of use in performing the initial operations above indicated. However, the machine has been especially designed and particularly adapted for use in renewing the cylinder blocks of Ford engines and the drawings of this application illustrate a machine especially designed for that particular purpose.

By the use of this improved machine, the cylinders may be very quickly and accurately bored and refinished and restored to as good or better condition than when turned out by the factory. The reboring and finishing of the cylinders is performed in such a manner that the cylinders must of necessity be absolutely parallel and perpendicular to the base of the block and the individual cylinders will be given perfect cylindrical surfaces. The device also includes means for refinishing the valve seats and the valve stem seats and provides an arrangement whereby such operations may be carried out simultaneously with the reboring or refinishing operations. Generally stated, the invention consists of the novel devices, combinations of devices and arrangement of parts hereinafter described and defined in the claims.

In the accompanying drawings, wherein like characters indicate like parts throughout the several views,

Fig. 1 is a view partly in elevation and partly in transverse vertical section showing the complete machine;

Fig. 2 is a fragmentary view corresponding to Fig. 1, showing in position a reamer for reboring a valve stem seat;

Fig. 3 is a longitudinal vertical section taken on the line 3—3 of Fig. 1;

Fig. 4 is a perspective showing an aligning slide used in conjunction with other devices for accurately locating the cylinder block in its several different positions for reboring or refinishing, said gauge bar being turned upside down;

Fig. 5 is a plan view of that portion of the machine shown in Fig. 3, some parts being broken away and some parts being removed; and

Fig. 6 is a bottom plan view of the cylinder block, showing the aligning slide applied thereto.

In Figs. 1, 2, 3 and 5, there is shown a cylinder block A of a Ford engine, such as used in Ford cars, and which block has the customary four cylinders *a*, eight valve seats *b*, and depending marginal base flange *c*. As is well known, the base flanges of these cylinder blocks, at the ends, are formed with the upper portions of shaft bearings *d*, and on opposite sides of said bearings are formed with bolt holes *f*. Also, the base flange *c* is provided with other bolt holes for attachment thereof to the crank casing, but only the holes *f* are important in the use of the machine presently to be described. The holes *f* are, on all Ford engines, very accurately bored and uniformly spaced so that they always bear a definite relation to the axes of the cylinders. The manner in which these holes *f* are utilized will hereinafter appear.

The machine bed is an elongated casting 7 shown as provided with short legs and having on its upper surface laterally spaced parallel rails or guideways 8, the upper surfaces of which are shown as flat and horizontal. Between the rails 8, the bed 7 is provided with a longitudinal guide channel 9 in which is seated a bar-like aligning slide 10, the upper surface of which, as shown, is on the level of the flat upper surfaces of the rails 8. This aligning slide is provided at each end with at least one upstanding dowel pin 11 that is insertable into one of the bolt holes *f* at the corresponding end of the cylinder block. Preferably, these dowel pins 11, at all but their base portions, are made considerably smaller than the bolt holes *f* but close to their bases they are made to very closely fit said bolt holes, so that when the dowel pins are inserted as stated, the cylinder block will be given a very definite and accurate location in respect to the slide and, hence, in respect to boring devices and other finishing tools presently to be described.

In its under side, the aligning slide 10 is formed with four aligning pin seats 12 that are spaced exactly to correspond to the spacing of the cylinders *a* and are so disposed on

the aligning slide 10 that when the pins 11 are inserted in the bolt holes *f*, one seat 12 will be located in perfect alignment with the corresponding one of the cylinders *a*.

Mounted for true vertical movements in a depending sleeve of the bed 7 is an aligning pin or plunger 13, the upper end of which is arranged to closely fit in any one of the overlying aligning seats 12. This aligning pin is so located in the base 7 that when engaged with one of the aligning seats 12 of the aligning bar 10, the corresponding cylinder *a* will be located exactly concentric to the projected axis of said aligning pin.

So far as this invention is concerned, the device for reboring the cylinders may be of any suitable type, in which a boring tool is arranged to rotate and move axially, but in the drawings I have illustrated for such use a machine manufactured and sold by the Storm Manufacturing Company, of Minneapolis, Minnesota, under the trade name of a "Stormizing" machine.

Of the parts of this reboring device, it is only desirable to particularly note the tubular column 14 and the rotary and axially movable boring bar 15, which latter is provided at its lower end with a multiple cutter head 16. For application of this reboring device in proper position on the base 7, the column 14 is shown as rigidly secured to a flanged base collar 17 bolted or otherwise rigidly secured to a U-shaped yoke 18, which, in turn, is rigidly bolted to the upper ends of laterally spaced upstanding flanges 19 shown as cast integral with the sides of the bed 7. By the means just described, the column 14 and boring bar 15 are very accurately located in true axial alignment with the projected axis of the underlying aligning pin 13, so that when one of the cylinders *a* is located by means already described, in axial alignment with the said aligning pin 13, the boring tool will be very accurately positioned for reboring of that particular cylinder.

The above described arrangement of the aligning pin 13 in axial alignment with the boring bar 15 is the best, but not the only possible arrangement, for it is possible to locate the aligning pin elsewhere, but the relative arrangement would necessarily be such that engagement of the aligning pin with the aligning slide will position one or the other of the cylinders in true axial alignment with the boring bar.

For clamping the cylinder block tightly on the upper surfaces of the guide rails 8 and on the aligning slide 10, there is provided a clamping bar 20 extended immediately over the cylinder block and immediately under the transverse upper portion of the base-forming yoke 18. This clamping bar is formed with a large central opening 21 that permits the boring tool 16 to freely pass therethrough. At the sides of its central portion, the clamping bar 20 is shown as provided with depending laterally spaced bearing lugs 22 that are engageable with the sides of the cylinder block adjacent to the cylinder positioned to be bored. At its ends, the clamping bar 20 is subject to clamping screws 23, which, as shown, are swiveled with the ends thereof, have threaded engagement with extended arms 18^a of the base yoke 18 and are provided at their upper ends with hand grips 24 by means of which they may be readily operated with considerable power.

For readily operating the aligning pin 13, there is shown a lever 25 loosely pivoted at one end to the bottom of the bed 7 at 26. The intermediate portion of this lever 25 is loosely pivoted to the lower end of the aligning pin 13 at 27. The free end of the lever 25 projects beyond the bed so that it may be easily reached. The lever 25 is yieldingly pressed upward so as to render the aligning pin 13 normally operative, by a light coiled spring 27 shown as anchored to the bed 7 by a screw 28 passed freely through a perforation in said lever.

In Fig. 3, the numeral 29 indicates valve seat reamers, the stems of which are mounted for rotary and axial movements in the extended arms 18^a of the yoke 18 and in bearings 30 secured to said arms. These valve seat reamers are thus so located that when any cylinder is located for reboring or refinishing, as already described, the said reamers will stand in position to properly recut valve seats of one or the other of the other cylinders. The two reamers at the one side will serve to recut valve seats of two of the cylinders, and the two reamers at the other side will serve to recut the valve seats of the other cylinders. These reamers are thus positioned so that, in recutting the valve seats, they will restore the same to exactly the original and proper relation to the cylinders. Moreover, these reamers can be used while the boring device is reboring or machining the cylinders.

In Fig. 2, the numeral 31 indicates a reamer for recutting the valve stem seats. These reamers 31 can be readily substituted for the reamers 29 in the arms 18^a and bearings 30, and they too may be used while the cylinders are being rebored.

The operation and use of the machine are probably obvious from the foregoing, but may be briefly summarized as follows:

The aligning bar 10 will be applied with its dowel pins 11 in the end bolt holes *f* of the base flange of the cylinder block, as already described. The base flange of the cylinder block will be placed on the flat upper surfaces of the guide rails 8 with the dowel pins 11 of the aligning slide 10 inserted through the end bolt holes *f*, as already de-

scribed. This being done, the cylinder block will be positioned with its cylinders truly horizontal and parallel to the axis of the boring tool and, moreover, the cylinders will be located one ahead of the other with their axes in a plane that is parallel to the line of movement of the aligning slide 10. When the aligning pin 13 is depressed, the aligning slide 10 with the cylinder block anchored thereto may be quite freely slid longitudinally of the bed 7 so as to align the axes of the several cylinders one after the other with the axis of the boring bar. When the aligning pin 13 is engaged with the first seat 12, (directions being taken from the left toward the right in respect to Fig. 3), the first or left-hand cylinder will be accurately aligned with the boring tool. In Fig. 3, the aligning pin 13 is engaged with the second seat 12 and, hence, the second cylinder is then aligned with the boring bar. Obviously, when the aligning pin 13 is engaged with the third seat 12, the third cylinder will be aligned with the boring bar, and when said aligning pin is engaged with the fourth seat 12, the fourth cylinder will be aligned with the boring bar.

The above noted sliding movements of the cylinder block on the rails, together with the slide 10, must of course be accomplished while the clamping bar 20 is raised or released. When a cylinder is properly aligned for boring or finishing, the clamping bar 20 should be screwed down tight so that the cylinder block will be clamped tightly against the rails and held in very true alignment and against vibratory movements while it is being bored or refinished. In practice, it has been found that reboring and refinishing of the cylinders may, by the use of this machine, be very quickly accomplished, the boring of a cylinder usually requiring fifteen minutes or less. It will also be remembered that the valve seats may be recut while the boring operations are taking place. A finishing tool, such as a hone or a grinding tool, may be substituted on the boring bar 15 for the boring tool 16, or, if desired, any other suitable form of hone or finishing tool may be used. In the use of the boring tool or any type of renewing or finishing tool, the proper alignment of the cylinders therewith and accurate setting thereof will be accomplished by the means above described.

From the statements made, it is obvious that many modifications may be made within the scope of the invention as herein disclosed and claimed.

What I claim is:

1. A machine of the kind described comprising a bed, an aligning slide mounted on said bed and having aligning devices engageable with a cylinder block to connect the same thereto for common movement therewith to locate the cylinders of the cylinder block with their axes spaced longitudinally of the line of movement of said slide and perpendicular to said slide, a rotary renewing tool capable of axial movements and having its axis in a plane common to the axes of said cylinders and parallel to the said cylinder axes, and an aligning device operative to secure said aligning slide in positions to hold said cylinder block with the axis of the one or the other of the cylinders in alignment with the axis of said renewing tool.

2. A machine of the kind described comprising a bed, an aligning slide mounted on said bed and having aligning devices engageable with a cylinder block to connect the same thereto for common movement therewith to locate the cylinders of the cylinder block with their axes spaced longitudinally of the line of movement of said slide and perpendicular to said slide, a rotary renewing tool capable of axial movements and having its axis in a plane common to the axes of said cylinders and parallel to the said cylinder axes, an aligning device operative to secure said aligning slide in positions to hold said cylinder block with the axis of the one or the other of the cylinders in alignment with the axis of said renewing tool, and means for rigidly clamping the cylinder block to said bed.

3. A machine of the kind described comprising a bed, an aligning slide mounted on said bed and having aligning devices engageable with a cylinder block to locate the cylinders of the cylinder block with their axes spaced longitudinally of the line of movement of said slide and perpendicular to said slide, a rotary renewing tool capable of axial movements and having its axis in a plane common to the axes of said cylinders and parallel to the said cylinder axes, an aligning device operative to secure said aligning slide in positions to hold said cylinder block with the axis of the one or the other of the cylinders in alignment with the axis of said renewing tool, and a valve-seating tool definitely associated with said renewing tool and operative at will to renew valve seats while the said renewing tool is in action.

4. In a machine of the kind described, the combination with a bed having parallel horizontal rails, an aligning slide mounted on said bed for movements parallel to said rails, aligning devices on said slide engageable with the end base portions of the cylinder block to position the cylinders with their axes spaced longitudinally of the line of movement of said slide and perpendicular to the plane of said rails and slide, a base frame anchored to said bed and extended clear of but above the cylinder casting mounted thereon, a renewing tool rotatively mounted with its axis in the plane of the

axis of the cylinders and perpendicular to the horizontal plane of said rails, a support for said renewing tool mounted on said base frame, and an aligning device applied to said bed and engageable with said aligning slide to definitely hold said slide in positions in which the cylinders of the block will be axially aligned with the axis of said renewing tool.

5. The structure defined in claim 4 in further combination with a clamping bar arranged to engage the top of the cylinder block, and clamping devices applied to the top of said base frame and operative on said clamping bar to force the same downward.

6. The structure defined in claim 4 in further combination with a clamping bar arranged to engage the top of the cylinder block and having a large opening through which the renewing tool works freely, and clamping screws applied to the top of said base frame and to the end portions of said clamping bar.

7. The combination with a bed having parallel horizontal rails or cylinder block guides, a yoke-like frame rigidly connected to said bed and adapted to extend over a cylinder block applied on said rails, a bearing pedestal rigidly secured to and rising from said yoke-like frame, a renewing tool mounted for rotary movements in said bearing pedestal and having its axes in the plane of the cylinder mounted on said rails, the axis of said tool being perpendicular to the horizontal plane of said rails, an aligning slide mounted on said bed for movements parallel to the rails thereof, dowel pins on the ends of said slide engageable with bolt holes in the ends of the base flange of the cylinder block to hold said cylinder block with its cylinders positioned as indicated, said slide having aligning seats spaced to correspond to the spacing of the cylinders of the block, and an aligning pin mounted in said bed and engageable with the aligning seats of said aligning slide, said aligning pins being so located that when engaged with one of said seats, the corresponding cylinder of the block will be aligned with the axis of said renewing tool.

8. The structure defined in claim 7 in further combination with a clamping bar located immediately over the cylinder block and engageable therewith, said bar having a large opening through which said renewing tool freely works, and clamping devices applied to the upper portion of said yoke-like frame and operative on the ends of said clamping bar.

9. In a machine of the kind described, the combination with a base, and a renewing tool mounted above said base in a definite relation thereto for rotary and vertical axial movements, and means for removing the cylinder block on said base from one predetermined position to the other to positively position the cylinders thereof successively in alignment with the axis of said renewing tool.

10. The structure defined in claim 1 in further combination with a spring-retracted lever connected to and tending to hold said aligning device operative but movable to release the same.

In testimony whereof I affix my signature.

ADOLPH STORM.