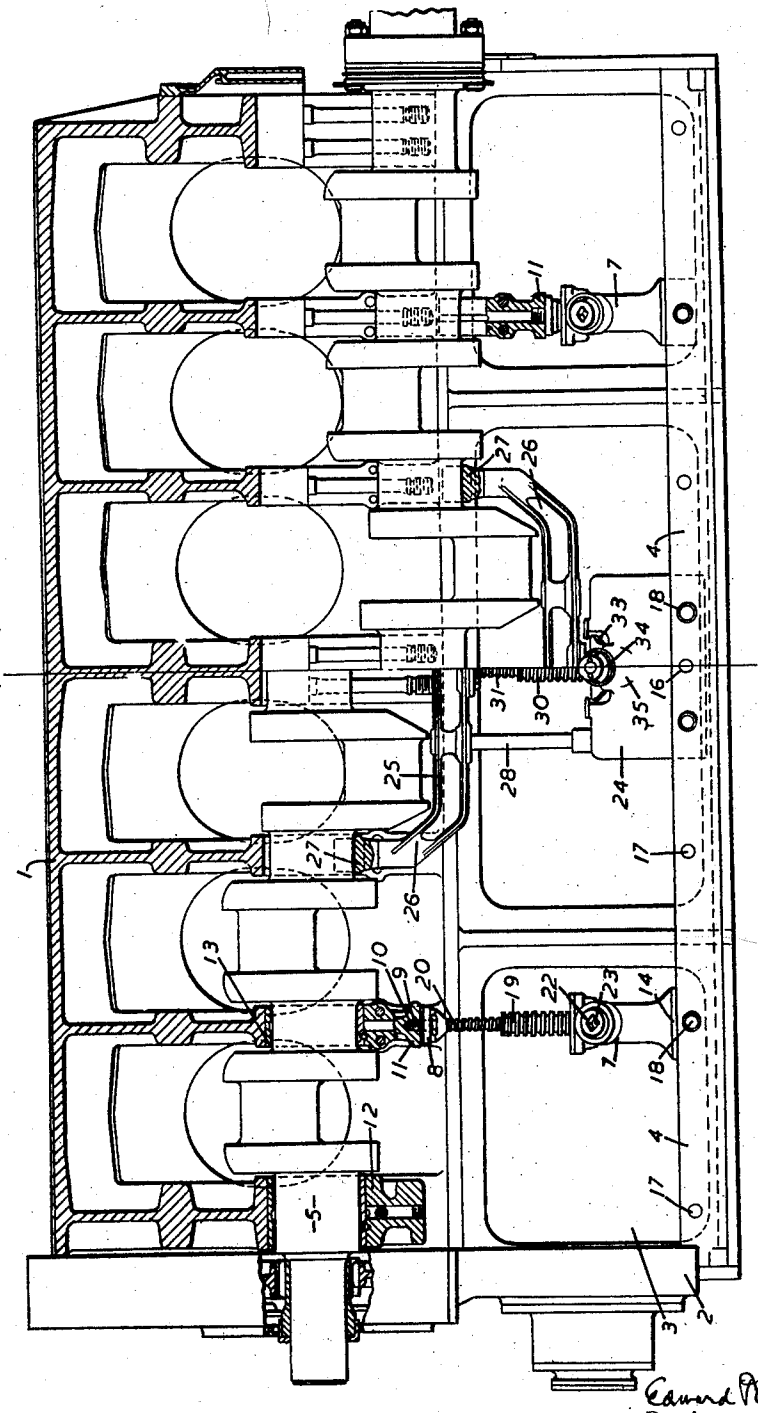
Aug. 22, 1950 E. P. PAXMAN 2,519,697

MEANS APPLICABLE TO INTERNAL-COMBUSTION ENGINES TO FACILITATE INSPECTION AND REPAIR

Filed June 20, 1946 3 Sheets-Sheet 1

FIG. 1.



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FIG.2.

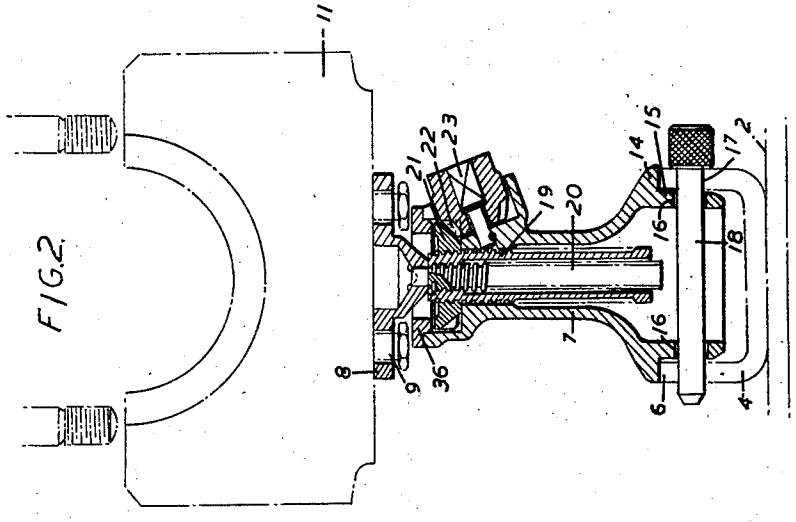
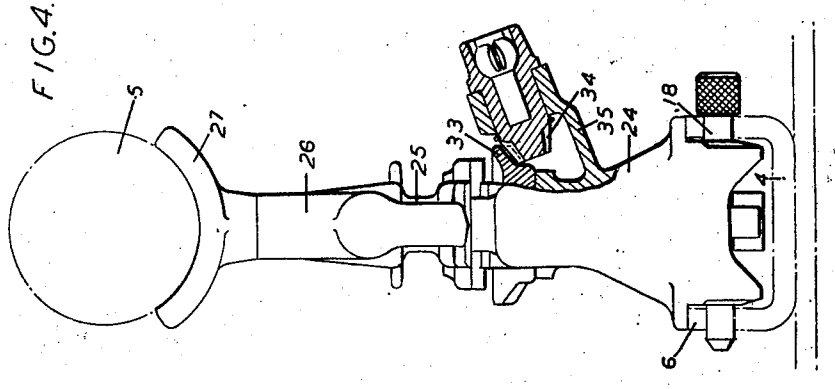


FIG.4.



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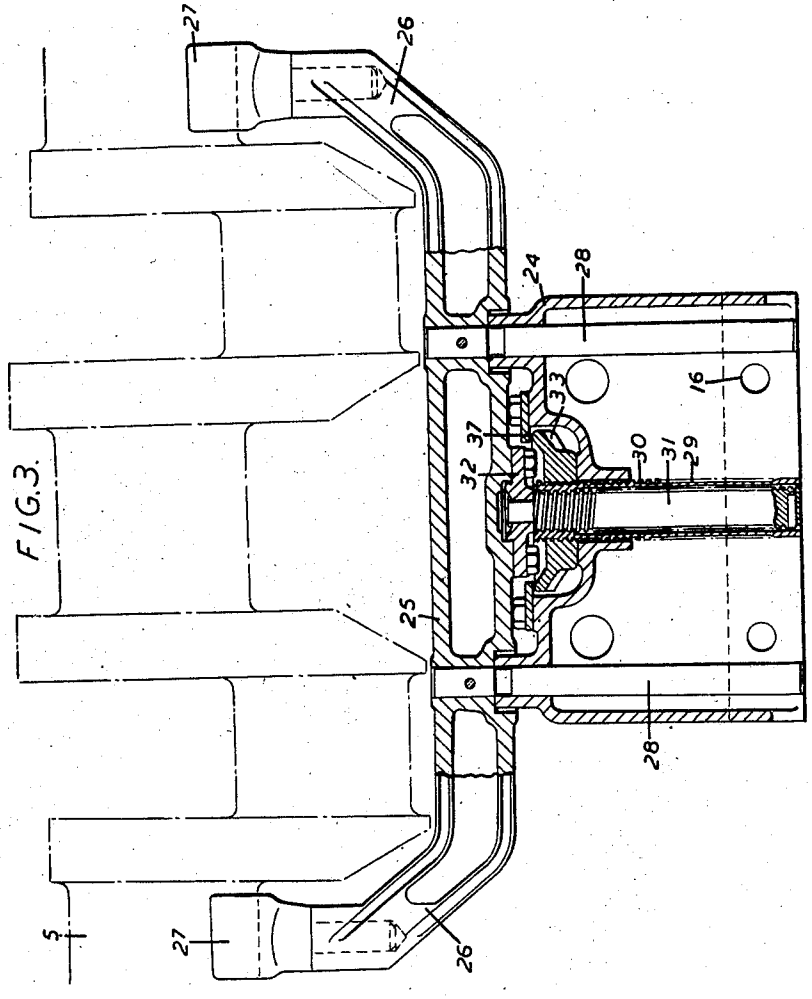


FIG. 3.

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Patented Aug. 22, 1950 2,519,697

UNITED STATES PATENT OFFICE

2,519,697

MEANS APPLICABLE TO INTERNAL-COMBUSTION ENGINES TO FACILITATE INSPECTION AND REPAIR

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Application June 20, 1946, Serial No. 678,010
In Great Britain December 11, 1944

8 Claims. (Cl. 121—194)

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This invention relates to internal combustion engines and has for its object to provide improved means applicable to such engines for enabling a crank shaft to be lowered away from its normal operative position for inspection or repair purposes. The invention is designed more particularly for application to engines operating in confined spaces such as in ships and enables repairs and adjustments to be effected which might otherwise entail the complete dismantling of an engine.

According to the present invention means are provided applicable to an internal combustion engine for enabling the crank shaft to be lowered from and restored to operative position, said means comprising a jack or jacks and an adjustable cradle by means of which the crank shaft is supported while the end bearings are removed, the said cradle being thereafter operable to lower the crank shaft to a position wherein access can be gained to it.

Reference will now be made to the accompanying drawings which illustrate an engine provided with means according to the invention and in which—

Fig. 1 is a fragmentary view of an engine crank case with a crank shaft in two positions and the lowering and lifting means applied to said crank shaft,

Fig. 2 is a sectional elevation of one of the jacks employed, this view being taken in a plane at right angles to Fig. 1,

Fig. 3 is a sectional elevation of the cradle used for lowering and lifting the crank shaft, and

Fig. 4 is an end view, partly in section, of the cradle shown in Figs. 1 and 3.

Referring first to Fig. 1, 1 indicates the crank case of a multi-cylinder internal combustion engine, which may, for example, be of the general character described and illustrated in prior Patent No. 2,429,105, granted October 14, 1947, which is provided with means to enable the crank shaft to be lowered a substantial distance below its normal operative position for the purposes of inspection or repair. To provide space for this lowering operation, the engine is mounted upon an under-bed 2 upon which the ordinary crank case 1 is fixed and which includes a number of inspection doors 3 in its sides. A central channel-shaped guide, rail or like support 4 (Fig. 2) extends throughout the length of the said under-bed in a position vertically beneath the crank shaft 5, the arrangement of the said channel guide being such that its sides 6 project upward-

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ly with its base fixed to the base of the under-bed.

The means for lowering the crank shaft consist of devices embodying screw jacks and they comprise first means for removing the main bearing caps and lower halves of the crank bearings and secondly means for supporting the crank shaft while the main bearings are removed and thereafter for lowering the crank shaft into the under-bed.

As a preliminary operation, the big ends of the connecting rods are disconnected from the crank shaft 5 and either removed altogether or temporarily secured in positions free from the crank shaft.

The said guide channel 4 is adapted to support jacks 7 conveniently of the telescopic type whose heads are constructed with flanges 8 through which pass bolts 9 adapted to engage tapped sockets 10 formed in the inter-crank bearing caps 11 which can thereby be detached from their operative positions while the crank shaft is still supported by the end bearings 12 and the end plates of the engine housing. In order that the jacks can be securely positioned beneath the bearings 13 and temporarily secured in their operative positions the base 14 of each jack is constructed to seat upon the edges 6 of the channel 4 with a lower extension 15 projecting into said channel. The jack is adjusted in position along the channel until perforations 16 in its base coincide with perforations 17 in the channel and a securing pin or bolt 18 is then passed through all the perforations to lock the jack in position vertically beneath the bearing component which is to be removed. The jack (Fig. 2) includes a screw threaded sleeve 19 engaging internally a screw threaded rod 20 the head of which carries the flange 8. Surrounding and engaging the sleeve 19 is a bevel wheel 21 adapted to be driven by a bevel pinion 22 operated by means inserted in a socket 23 from the exterior of the crank case or under-bed. The top of the jack casing 7 carries an annular retaining plate 36 to prevent the bevel wheel 21 from moving axially. When the bearing caps have been detached by engaging them with the jacks and lowering the jacks, both bearing components 11 and jacks 7 are removed altogether.

After the bearing caps and the lower halves 11 of the main bearings have been removed, the upper halves 13 of the main bearings can also be removed by rotating the shaft in such a way that the half bearings turn with the shaft. The crank shaft 5 is then adapted to be supported by

a cradle (see Figs. 3 and 4) which comprises a body portion **24** movably mounted upon the said channel guide **4** but adapted to be locked thereto when in operative position by pins **18** similar to those used for the jacks already described. Supported above the body **24** is the cradle proper **25** which extends lengthwise of the engine and has upwardly directed arms **26** terminating in curved supports **27** (Fig. 4) adapted to seat beneath two portions of the crank shaft **5**. The cradle is supported on vertical guide pins **28** slidably mounted in the said body **24** and in the centre of the said body is a screw jack **29**, preferably of the telescopic type to give sufficient lift. The jack **29** includes an externally and internally screw-threaded sleeve **30** engaging a screw-threaded rod **31** the head of which carries a flange **32** adapted to be bolted to the mid-portion of the cradle **25**. Surrounding and engaging the sleeve **30** is a bevel-wheel adapted to be operated by a bevel pinion **34** mounted in a fixed socket **35** forming part of the jack housing and adapted to be operated by means inserted from the exterior of the crank case or under-bed. To prevent axial movement of the bevel-wheel **33** an annular retaining plate **37** is fixed to the top of the body **24**.

When the cradle **25** is operated to bring its two arms **26** into operative positions engaging beneath central portions of the crank shaft, this shaft is thereby supported by said cradle so that the end bearings **12** and, if necessary, the end plates of an engine housing can be completely removed after the said crank shaft has been disengaged from a generator or any other unit which is ordinarily driven directly from it, the coupling member of the generator being supported when necessary by a jack-operated wedge or equivalent supporting device. When the crank shaft has been completely freed from engagement with other units in the manner described and its end bearings have been removed, the screw jack **29** which supports the cradle **25** can be operated to lower the cradle which thereby descends, taking with it the crank shaft which is then supported only by the said cradle.

Owing to the widely spaced positions of the ends of the two arms **26** of the cradle, the crank shaft **5** is supported in a stable manner and by the complete operation of the jack which is mounted within the body supporting the cradle, the cradle **25** and crank shaft are lowered from the left hand position shown in Fig. 1 to the right hand position shown in the same figure wherein the cradle lies within the under-bed and the crank shaft is readily accessible through the sides of the under-bed for inspection and any necessary repair. In this manner complete access can be obtained to the crank shaft without the necessity for disturbing in any way the cylinders, the cylinder heads and other engine components.

When the necessary inspection or adjustment of the crank shaft **5** is completed, the screw jack **29** which operates the cradle **25** is actuated in the reverse direction to lift the cradle and crank shaft which is thereby restored to its normal or operative position that is, the upper or left hand position shown in Fig. 1, in which it is automatically brought into engagement with the upper halves of the crank shaft bearings. The main bearings and, where necessary, the end plates, are thereafter restored to position so that the cradle **25** can be lowered out of engagement with the crank shaft into its inoperative position.

The lower halves **11** of the crank shaft bearings and the bearing caps are thereafter restored by means of the screw jacks **7**, already described which are then disconnected from the said bearings and removed altogether. The cradle **25** can, if necessary, be entirely removed from the engine under-bed but the channel guide **4** remains a permanent fixture therein so that whenever required the cradle and the supplementary jacks can be quickly and accurately positioned beneath the crank shaft to carry out the operations already described. Alternatively, the said channel guide **4** may be constituted as a detachable component.

I claim:

1. Means applicable to a multi-cylinder internal combustion engine for enabling the crank shaft to be lowered from and restored to its operative position, said means comprising an underbed upon which the crank case of the engine is fixed and which is provided with inspection doors, jacks supported from said underbed and arranged for the removal of the lower portions of the intermediate crank shaft bearings, an adjustable cradle also supported from said underbed by means of which the crank shaft is supported while its end bearings are removed, and means for operating the cradle to lower the crank shaft to a position where it is accessible through the inspection doors of the underbed.

2. Means as defined in claim 1, including a rail mounted in fixed position in said underbed and extending longitudinally of and directly beneath the crank shaft and engageable by the bases of said jacks for positioning and supporting them relatively to the crank shaft bearings.

3. Means as defined in claim 1, including a base for supporting said cradle, and a channel shaped rail mounted in fixed position in said underbed and extending longitudinally of and directly beneath the crank shaft, said rail having upwardly projecting longitudinal flanges in which the bases of said jackets and cradle are positioned.

4. Means as defined in claim 1, including a base for supporting said cradle, and a channel shaped rail mounted in fixed position in said underbed and extending longitudinally of and directly beneath the crank shaft, said rail having upwardly projecting longitudinal flanges between which the bases of said jacks and cradle are confined laterally of the rail, and pins insertible transversely in the rail and engageable with the bases of the jacks and cradle for securing the jacks and cradle from movement longitudinally of the rail.

5. Means as defined in claim 1, wherein said jacks have actuating means therefor accessible for operation from the exterior of said underbed through the inspection doors therein.

6. The combination of an underbed on which the crank case of a multi-cylinder internal combustion engine is adapted to be mounted and having inspection openings in the sides thereof, a rail mounted in fixed position in the underbed and positioned to extend longitudinally of and beneath a crank shaft in the crank case, and a pair of jacks mounted on the rail and having means for attaching them respectively to the lower portions of intermediate main bearings of the crank shaft, said jacks having actuating means accessible for operation through the inspection openings of the underbed to detach the lower portions of said intermediate bearings from the crank shaft.

7. The combination of a crank case of a multi-cylinder internal combustion engine having a crank shaft and main bearings therefor, an underbed on which the crank case is mounted in fixed position and having inspection openings in the sides thereof, a rail secured in fixed position in the underbed and extending longitudinally of and beneath the crank shaft, a cradle having a base portion mounted on said rail and having an upper portion having arms engageable with intermediate portions of the crank shaft to support the shaft, and means for lowering the cradle arms to thereby lower the crank shaft.

8. The combination of a crank case of a multi-cylinder internal combustion engine having a crank shaft and main bearings therefor, an underbed on which the crank case is mounted in fixed position and having inspection openings in its sides, a rail secured in fixed position in the underbed and extending longitudinally thereof beneath the crank shaft, a pair of jacks mounted on the rail and operative to detach the lower portions of intermediate main crank shaft bearings, and a cradle mounted on the rail and having means for raising it into engagement with intermediate portions of the crank shaft to support it while the end main bearings of the crank shaft are removed, the cradle being operable to lower the crank shaft into a position where it is accessible through the inspection openings in the sides of the underbed.

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