THE PROTECTION OF THE PROPELLERS BLADES SURFACES BY THE SHOT PEENING

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ABSTRACT:

This paper defines one concept to be used for reinforcement of Propellers surfaces. During construction and assembly of ships in shipyards, this question always is presented. In the most early phase of design and mechanical calculation of propeller and ships diagrams speeds comes the question, to avoide undesirble phenomenon - streaming of water what can cause cavitation. Many investigation and testing of propellers model in Institutes basins are arranged and organized to find optimal shape to have minimal water resistance and adequate trust force for ship moving. Shot Peening is one method and concept for increasing of Compressive stresses trust surfaces of propellers blades.

KEY WORDS:

Blades of Propeller, Surface, Trust, Ships, diagrame of Ships speeds, construction, mechanical Calculation, streaming of water Cavitation, Models, basins, water resistance, Force for Ship moving, Compressive stresses.

Protection of Blade Surfaces by Shot Peening

Propeller designs are based on theoretical calculations and small model analyses. Theoretical considerations and the results of testing complement one another. It is not possible to manufacture propellers today without taking these factors into account. There is no uniform theory on the acting of ship propellers - there are various ways of approaching this problem depending on the specific technical requirements or the task in hand.

The calculation of speed and pressure on the blade surface is the main factor in the final dimensioning of the propeller. The surfaces of the propeller blades should be designed so as to offer minimal friction resistance.

Ideal smoothness of blade surface is dificult to achieve in practice, however. It is well known that ideal smoothness offers minimal resistance to streaming water. But there are many other vital factors that have to be considered in addition to ideal smoothness, minimal roughness and consequently resistance.

Figs. 2 and 3 show two mobile platforms (2, Fig.2), with a round steel fixed guide shaft (3) and a driving gear (5) with vertical shaft (6) with two normal bearings. A toothed bar (8) is provided, along with two conic gears (9, 10) and bearing (13) with fixed supports. Only the drive unit is shown. There are two important gears on the horizontal shaft (14, 25). A stiffening piece (1) is provided to prevent the toothed bar from bending. A shaft bracket (4) is attached to the mobile platform (2). The electric motor (16) transmits motive power via the coupling (12). Power for the drive unit is forward and reverse with three speeds as required for shot peening. It is easy to perform shot peening on propellers with a diameter of up to 1 - 1,5 m. However, for larger propellers it is necessary to use comprehensive software. The lubricating system (17) must ensure that the mobile platform (2) can move on the supporting beam (8, Fig.3). The system is very easy to repair. First, the unit must be disassembled from the electric motor by dismantling the coupling (12). This device can be made of plastic or aluminium materials and provided with suction pipes for easily removing dust created by the impact of shot blasting on the face of the blades. By removing dust in this way it is possible to keep the whole plant clean. A certain amount of dust can impair normal operation.

Fig. 4 presents a section from Fig. 3. The covering platform on the section B-B serves to keep the head joint in a fixed position during shot peening operations. Section D-D shows the wheel for the rolling of the vertical beam on the lower part of the frame.

For large propellers (dia. over 1,5 m) a manufacturing area accessible to overhead or mobile cranes must be provided int he workshop.

Key details of the system are presented in Fig. 5, which shows contact between the gear and the toothed bar.

As the toothed bar is fixed, the mobile platform with all the equipment moves along the supporting bar. Dust must be cleaned and removed by suction pipes or ventilation systems with fans.

SHOT PEENING OF PROPELLERS

Cavitation is very well-known natural phenomenon with water streaming. This is not the place to discuss how cavitation occurs. Cavitation affects some parts of propeller blades as a result of different pressures and velocities around them. As a consequence, metallic substances of the blades suffer from erosion. This poses a serious danger to the whole body of the propeller. Cavitation can also occur on some attachments to the hull while the ship is en route. Designers and calculators of ship speeds aim to create one system for moving ad streaming water along the length of the full to avoid cavitation an erosion of metallic components. Here the speed of the propeller in re/mins is a vital parameter. Stiffening or hardening of metallic surfaces obviously reduces the risk of cavitation.

Shot peening is one way of providing better surfaces. It is usual for same areas of the propellers to be particularly susceptible to attacks of cavitation. These areas are locatedat approximately 0,7 R-0,8 R, where R is radius from the propeller centre, as indicated in Fig. 1.

Figs. 2 und 3 show how a shot peening system works. Fig. 3 shows the propeller's body in a vertical position with the faces of 4 blades for shot peening treatment. The frame is made of normal carbon steel and can be assembled by being welded or bolted together. Two supporting bars (8) are connected by bolts over a vertical plate (10). Wheels for moving to the left or right on the wearing plate (11) are provided on the lower part of the frame (14) at the end. The toothed bar (7, 15) is attached on the upper plate for moving the electric motors (1) with their gearcases (2). The gearcases (2) for the electric motors are fixed on the mobile platform, which moves on bowl wheels (up/down). A crucial point to note is that the upper electric motor with its assembly moves on the vertical supporting bar (8) left to right. The electric motors with gearcases are mounted on the toothed bar (7, 15) for moving. A fixed head with nozzles is provided on the upper plate (16) for shot peening. Two flexible pipes for shots and compressed air via jets cover all faces indicated for shot

peening. The round steel guide (9) is for precise positioning and is usually lubricated. The electric motors are guided by the plate with hole (4) and are connected with high voltage cables (18) for flexible movement. Both electric motors can be programmed to move up/down, left/right.

Lubrication and cleaning must be checked before operation. The electrical equipment has voltage - reversal plugging control, reversing contactor, electrically interlocked plugging relay, accelerating relay and accelerating contactors with acceleration controlled by a master switch. All this assembly prevents from high curent causing excessive shock to mechanical parts. It is necessary to know when the power is interrupted by opening of the main power supply switch due to low voltage or overload relay tripping. The master switch must be returned to neutral position before the low voltage relay can close and the control panel becomes operative. The reversing contactors are interlocked mechanically and electrically.

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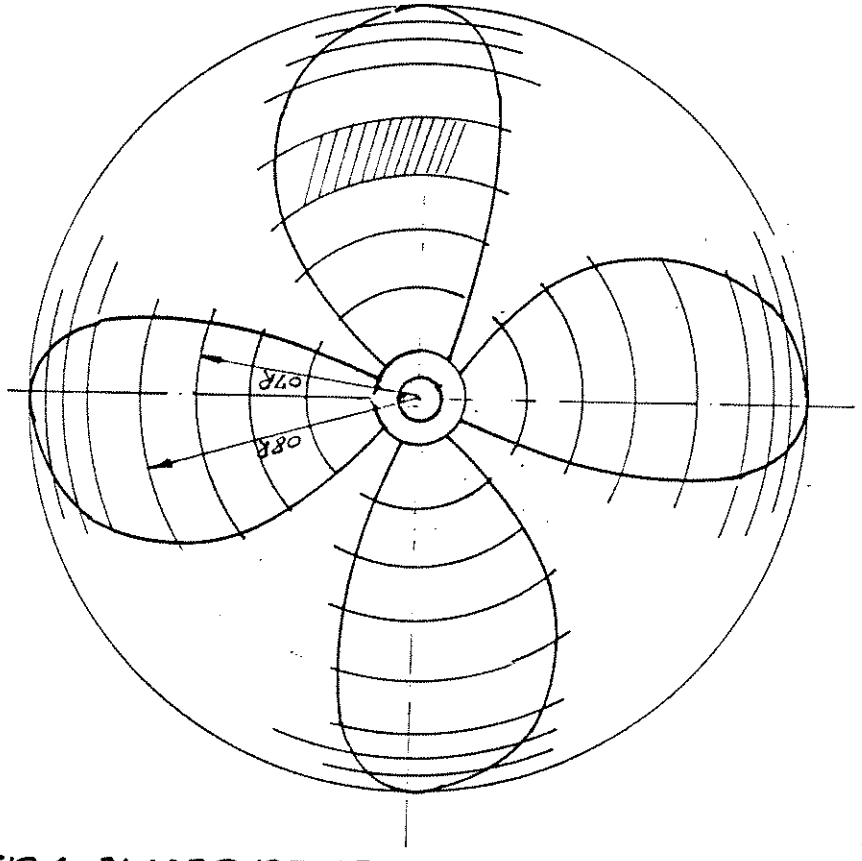

FIG. 1. BLADE SURFACES OF PROPELLER FOR SHOT PEENING TREATMENT AGAINST CAVITATION

1 STIFFENING PIECE
2 MOBILE PLATFORM
3 GUIDE SHAFT FIXED
4 SHAFT BRACKET
5 GEAR DRIVING
6 VERTICAL SHAFT
7 BEARINGS
8 TOOTHED BAR

9 CONIC GEAR
10 CONIC GEAR
11 BEARINGS
12 COUPLING
13 BEARING
14 SECOND GEAR
15 DRIVING GEAR
16 ELECTRIC MOTOR

17 LUBRICATING SYSTEM

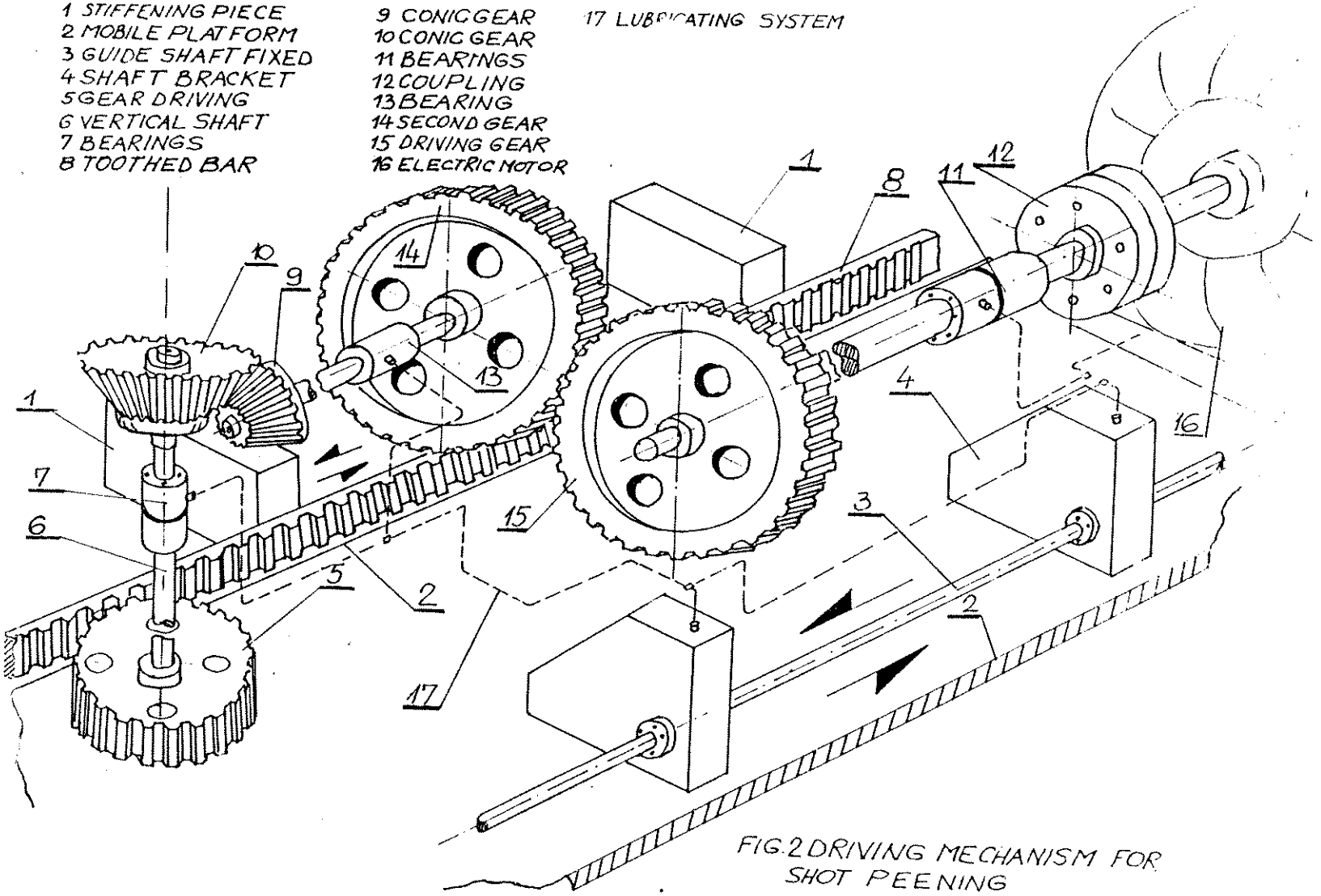

FIG. 2 DRIVING MECHANISM FOR SHOT PEENING

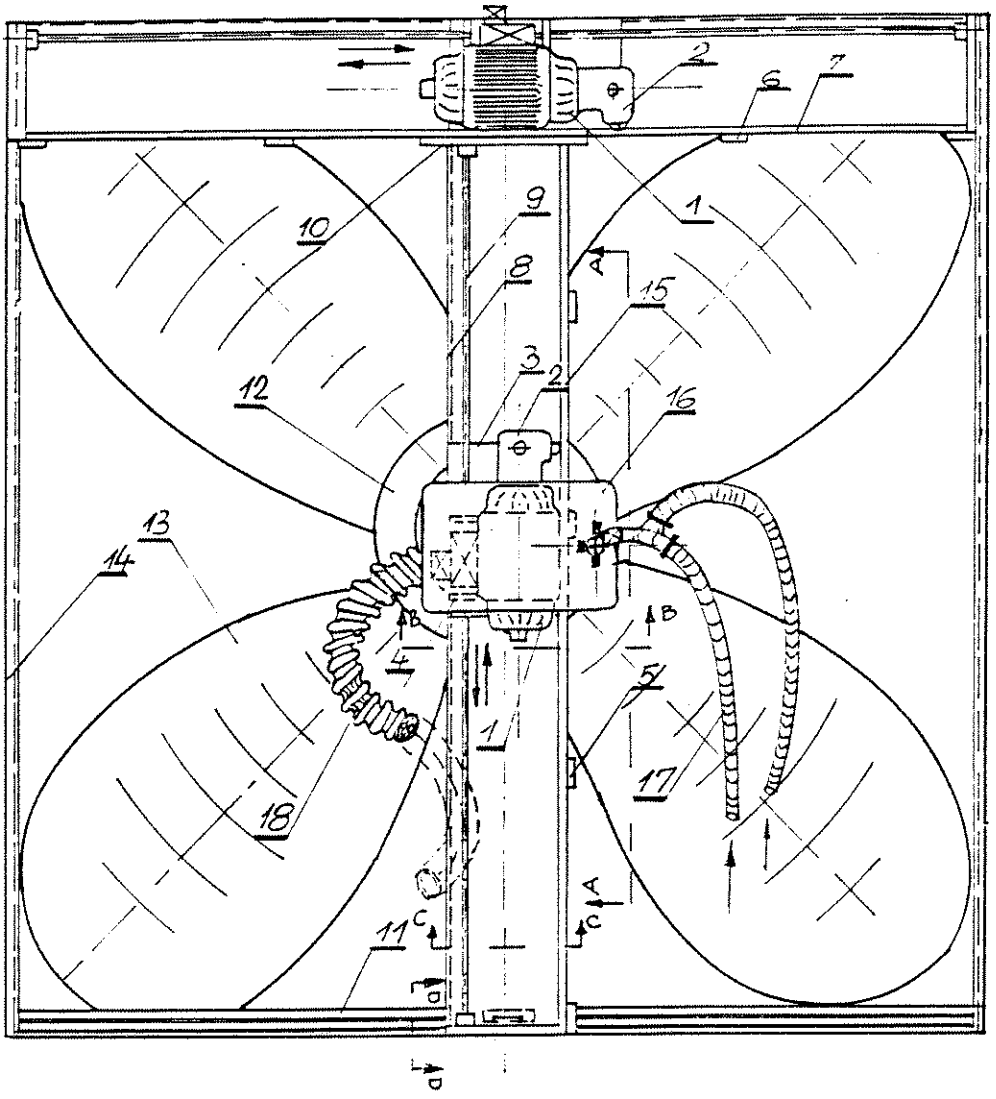

FIG 3. CONSTRUCTION FOR PROPELLERS SHOT PEENING

1 ELECTRIC MOTOR
2 GEAR CASE
3 LOWER STEEL PLATE
4 PLATE WITH HOLE
5 STIFFENING
6 STIFFENING
7 TOOTHED BAR
8 SUPPORTING BAR
9 GUIDE
10 VERTICAL PLATE
11 WEARING PLATE
12 ROUND PIECE OF PROPELLER
13 BLADE OF PROPELLER
14 FRAME OF DEVICE
15 TOOTHED BAR
16 UPPER PLATE
17 ELASTIC PIPE FOR PROCESSING
18 CONDUIT PIPE FOR CABLES

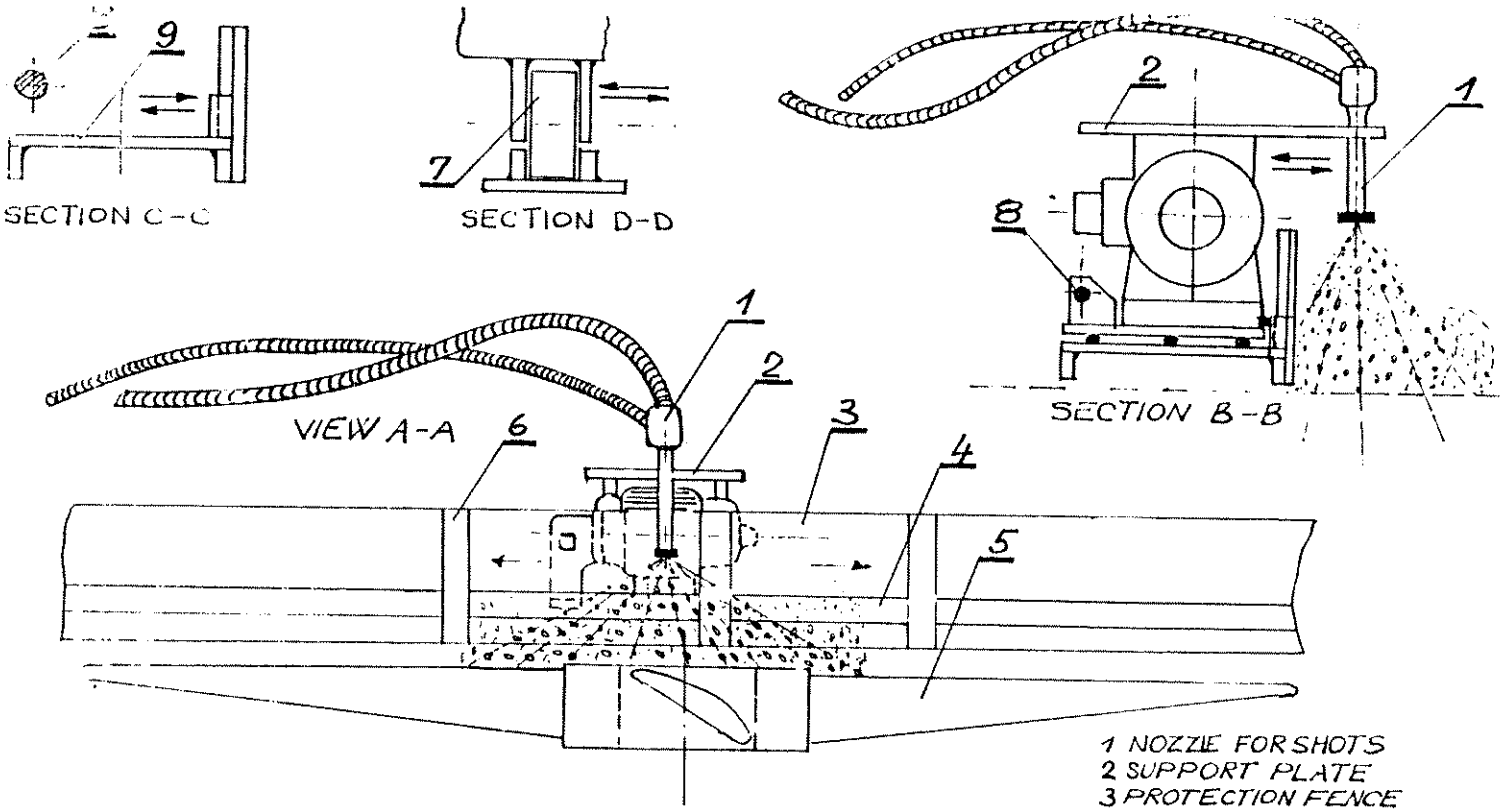

FIG 4. DETAILS OF CONSTRUCTION FOR SHOT PEENING OF PROPELLERS

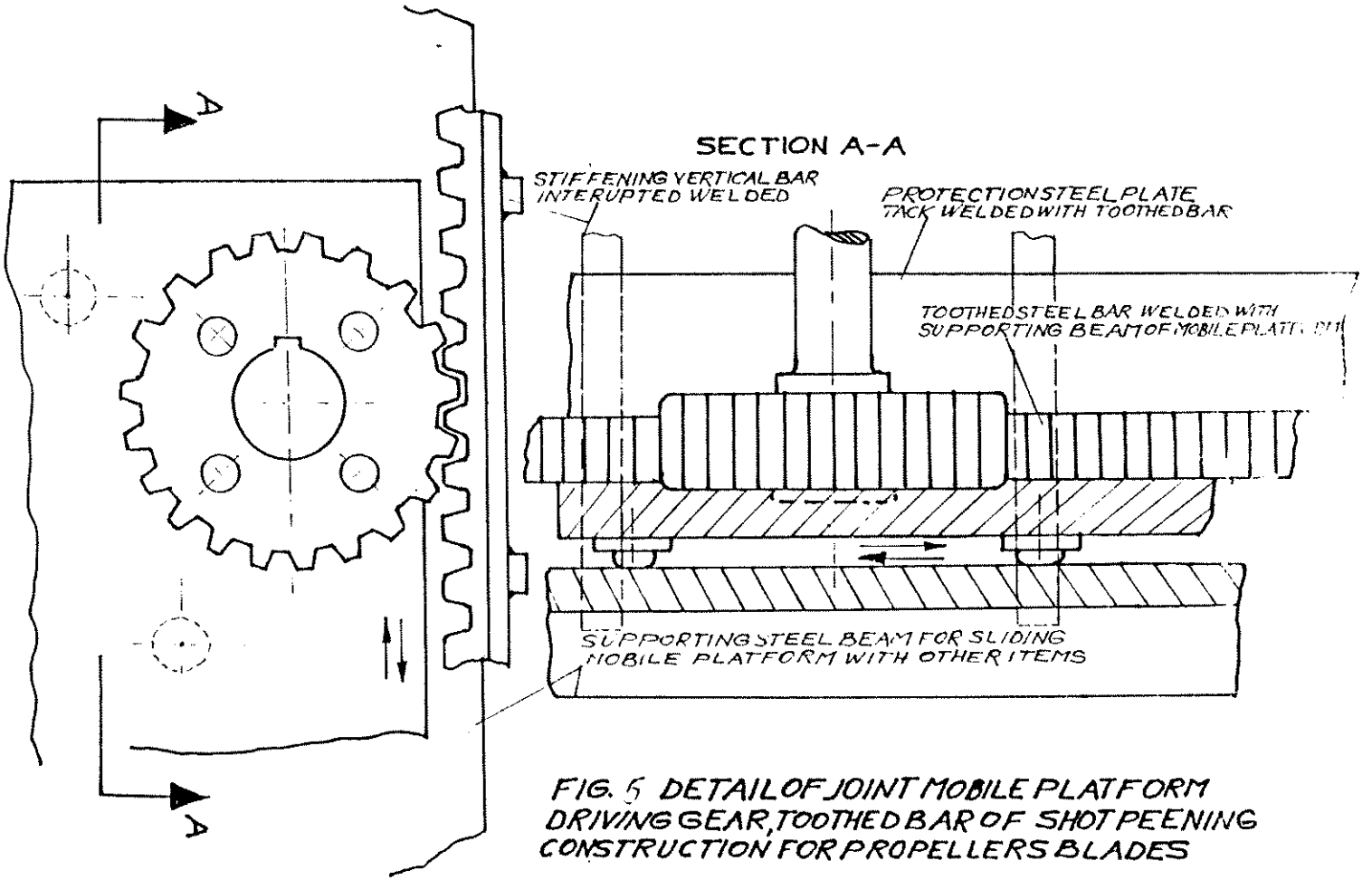

FIG. 5 DETAIL OF JOINT MOBILE PLATFORM DRIVING GEAR, TOOTHED BAR OF SHOT PEENING CONSTRUCTION FOR PROPELLERS BLADES