

**Investigation of Top Drive Accident and Fatality
East Cameron Block 332,
Gulf of Mexico,
Off the Louisiana Coast
June 4, 1996**

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Investigation and Report

Authority

An accident that resulted in one fatality occurred on the platform rig Pride 951 located on Samedan Oil Corporation's Platform A, East Cameron Block 332, Lease OCS-G 9478 in the Gulf of Mexico, offshore the State of Louisiana, on June 4, 1996, at approximately 0330 hours. Pursuant to Section 208, Subsections 22 (d),(e), and (f), of the Outer Continental Shelf (OCS) Lands Act, as amended in 1978, and the Department of the Interior Regulations 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated June 21, 1996, the following MMS personnel were named to the investigative panel:

Frank Pausina, New Orleans, Louisiana (Chairman)

Michael Hebert, Lafayette, Louisiana

Johnny Serrette, Lafayette, Louisiana

Procedures

On the morning of June 4, 1996, Inspectors Johnny Serrette and Tom Basey of the MMS Lafayette District Office visited the scene of the accident, thereby initiating MMS's investigation of the incident.

On June 24, 1996, Johnny Serrette witnessed the function testing of the top drive. On August 14, 1996, the members of the panel witnessed the disassembling of the top drive.

A formal hearing was conducted by the panel on August 22, 1996, at the MMS offices in New Orleans, Louisiana, during which the following individuals were questioned:

David DeSoto, Pride Offshore

Michael Solet, Pride Offshore

Bruce Patterson, Maritime Hydraulics U.S. Inc.

Harry Miller, Eagle Consulting

The panel was also provided with a transcript of statements from individuals who were on the platform at the time of the accident. The statements were taken on June 5, 1996, by a representative of Pride Offshore.

The panel members met at various times throughout the investigative effort and, after having considered all of the information available, produced this report.

It should also be noted that mutual investigative findings were liberally shared between the panel and representatives of the United States Coast Guard, who were also investigating the accident.

Introduction

Background

Lease OCS-G 9478 covers approximately 5,000 acres and is located in East Cameron Area Block 332, Gulf of Mexico, off the Louisiana coast. (For lease location, see Attachment 1.) The lease was issued effective May 1, 1988. The original lessees were CNG Producing Company (50%) and Union Texas Petroleum Corporation (50%). The lessees at the time of the accident were Samedan Oil Corporation (88%) and Continental Land & Fur Co., Inc. (12%). From July 15, 1993, through the time of the accident, the designated operator of the lease was Samedan Oil Corporation.

The accident occurred on the Pride Offshore 951 drilling rig. The rig is a self-contained platform rig that was placed on the aforementioned Platform A for drilling and completion operations. At the time of the accident the rig was engaged in reaming operations in preparation for the running of casing in Well A-11.

Brief Description of Accident

At approximately 0330 hours on June 4, 1996, during reaming operations, the driller was in the process of breaking out the top drive at the rig floor. After having set the speed and rotation controls, the driller began to increase torque. As torque was increased, the elevator links, which were tilted out as a result of the position of the top drive unit, began to rotate counterclockwise. The driller, in attempting to stop the rotation of the elevator links, overcompensated by turning the rotation control knob past the neutral setting to the clockwise position. As a result, the elevator links and attached elevator reversed direction, struck the driller, and fatally pinned the driller as well as the drilling console against the draw works.

Findings

Basic Top Drive Mechanics

For schematics of the portable top drive unit involved in the accident, see Attachments 2 and 3; for pictures of the top drive unit, see Attachment 4. When the torque arrestor is activated, i.e., locked onto the drill pipe, and the top drive shaft is made up to or broken out of the pipe, the entire pipehandler assembly, which includes the arrestor, the elevator links, and the elevator will tend to rotate in the same direction as the shaft. The rotation will tend to occur regardless of whether or not the elevator links are tilted. To prevent such a rotation during makeup or breakout, a spring loaded/hydraulically released pin (hydraulic pin), which is attached to the rotation head of the body of the top drive, seeks to engage the toothed lower flange of the pipehandler assembly. (For pictures of the hydraulic pin and housing, see Attachment 5.) When the hydraulic pin successfully engages the toothed flange, the elevator links will not rotate during makeup or breakout procedures. (For a picture of the hydraulic pin housing and lower flange teeth, see Attachment 6.) Conversely, when the hydraulic pin is not engaged, the elevator links will rotate during makeup and breakout procedures.

Hydraulic Pin Control

The hydraulic pin is disengaged by the use of the rotation lever, which is located in the pipehandler control section of the driller's control panel. (For a schematic and picture of the driller's control panel, see Attachments 7 and 8, respectively.) When the lever is moved to the clockwise or counterclockwise position, the hydraulic pin is hydraulically disengaged from the toothed lower flange of the pipehandler assembly. In continuing to hold the lever, the links are then rotated to the desired position by a hydraulic motor. When the lever is released, the lever springs back to the neutral or center position, the motor disengages, the links cease to rotate, and the hydraulic pin is released to spring

forward to engage the teeth of the lower flange. If the hydraulic pin does not engage, the lever is manipulated until engagement occurs. Hearing testimony revealed that it is “normal” that such manipulation is required.

When the hydraulic pin is not engaged, an indicator protrudes from the housing of the pin’s controlling mechanism. (For pictures of the hydraulic pin housing with and without the protruding indicator, see Attachment 9.) The appearance of the indicator is the sole means by which a determination can be made as to whether or not the pin is engaged. If the torque arrestor is activated and visual confirmation of the hydraulic pin indicator cannot be confirmed, uncertainty exists as to whether or not the elevator links will rotate when the top drive motors are engaged for makeup or breakout purposes.

Another method by which the pin can be disengaged is through the use of the torque arrestor lever. When the lever, which is located immediately to the left of the rotation lever on the driller’s control panel, is moved to the Rotation Lock Open position, the pin is hydraulically disengaged from the lower flange. In that position the torque arrestors are not activated. Unlike the rotation lever, the torque arrestor lever does not spring back to the neutral or off position.

**Elevator Link
Rotation Cessation**

If, during a breakout process, the elevator links begin to rotate, the five actions that can be taken at the driller’s control panel that will stop the links from rotating are as follows:

1. Reduce the torque limit setting to zero.

2. Reduce the speed setting to zero.
3. Set the rotation to zero.
4. Push the stop button, which is clearly colored red.
5. Pull the torque arrestor lever down to the off position.

However, only the use of the rotation knob could have caused a reversal in the direction of the rotation of the links, which resulted in the fatality. Hearing testimony indicated that in turning the knob there is a “small hesitation” at the zero position and that “if you worked it enough, you would feel it.”

Basic Makeup and Breakout Procedures

According to the hearing testimony, at the time of the accident, the following procedures were followed during the reaming operation from the making up of the top drive to the pipe in the derrick to the breaking out of the top drive from the pipe in the slips.

Makeup

1. After securing with the elevator a stand of drill pipe, which consists of three 30-foot joints of pipe, the stand is stabbed into the drill pipe that is hanging in the slips at the rig floor’s rotary. The pipe-to-pipe and top drive-to-pipe connections are first made using the top drive, i.e., everything is first screwed together using the top drive motors. It should be noted that prior to securing the stand, the elevator links were rotated so that the elevator would open to the stand.
2. The pipe-to-pipe connection is then tightened using tongs prior to the top drive-to-pipe connection being tightened using the torque arrestors and top drive motors.

3. At a point during the reaming operation, the elevator links are tilted out to allow the top drive to continue farther down toward the rig floor. Since the links are to be tilted out toward the V-door, the links have to be rotated prior to tilting. The rotation is necessary because the orientation of the links at the time the tilting is required is the same as it was when the stand was secured, which is not in the direction of the V-door.
4. The slips are then set. At this point the driller's control panel is within the sweep area of the tilted elevator links should the links rotate. (For a simplified schematic of the rig floor with tilted links, see Attachment 10.)

Breakout

5. The pump is turned off, the top drive blowout preventer is closed, and the torque arrestors are activated.
6. The rotation knob is set to counterclockwise, the speed is set, and torque is applied until the top drive shaft is broken out of the pipe.

Preliminary Activities

On June 3, 1996, the top drive, which was a replacement drive, was installed by a Maritime Hydraulics U.S., Inc. Service Technician with the assistance of a Pride driller, who will henceforth be referred to as Operator 1. The top drive was operated from the same driller's control panel and did not differ significantly from the previous unit. After installation, the top drive was function tested by the Maritime Technician and Operator 1 with no indication that it was operating improperly. No problem with the hydraulic pin was observed. During the hearing, the Maritime Technician said that during the function testing he emphasized that the hydraulic pin be engaged prior to

“doing any operations” and that the elevator links should not be “out when they broke out the pipe.” Operator 1 and Samedan’s contract representative, who was present toward the end of the function test, indicated at the hearing that no special instructions or warnings were issued by the technician.

On the day before the accident, Operator 1's shift began at 1800 hours. From 1800 hours to approximately 2400 hours, Operator 1 ran from “60 to 70” stands of pipe in a reaming operation in preparation for the running of casing. During that time, no rotation of the elevator links was observed during makeup or breakout operations.

Prior to going to lunch at approximately 2400 hours, Operator 1 demonstrated the use of the top drive to another Pride employee, henceforth referred to as Operator 2, and then observed Operator 2 “make a connection and ream it up.” At some time prior to 0100 hours, Operator 1 returned from lunch. During the time Operator 1 was at lunch, Operator 2 ran from 10 to 20 stands under the observation of the toolpusher and the company representative. Upon returning, Operator 1 was not notified of any irregularities associated with Operator 2's operation of the top drive. From the time Operator 1 returned from lunch to approximately 0130 hours, Operator 1 resumed operation of the top drive, during which time Operator 2 was working on the No. 1 mud pump.

At approximately 0130 hours, Operator 2, under the supervision of Operator 1, resumed operation of the top drive until approximately 0330 hours at which time Operator 2 was fatally injured. From 0130 hours to 0330 hours Operator 2 ran from 10 to 20 stands.

Operator 1 stated that Operator 2 followed the same procedures that he had during the period that he observed Operator 2's operation of the top drive.

From the observations of all those present on the rig floor during the time that Operator 2 operated the top drive, there was no indication that Operator 2 operated the top drive in a manner different from that of Operator 1. Also, there was no indication prior to the accident that the top drive malfunctioned in any manner.

Experience and Training

Operator 1 said that Operator 2 “was supposed to be the driller to start with, so just give him the extra training.” Operator 1 indicated that Pride management understood that on-the-job training on the top drive would be part of Operator 2's duties.

Written correspondence from Pride to the investigative panel indicated that Operator 2 worked with a Maritime top drive from November 3, 1995, through December 16, 1995. Operator 1 stated that during that time he was satisfied with Operator 2's performance. The written correspondence also stated Operator 2 “ran the top drive every day of that hitch prior to his accident.”

Operator 2 successfully completed an approved MMS course titled “Drilling-Well Completion/Well Work Over.”

Accident

Operator 1 stated in the hearing that at 0330 hours he was standing immediately behind and to the left of Operator 2, the hydraulic pin appeared to be engaged, and that Operator 2 appeared to look up at the pin in an effort to determine if it was engaged.

With the top drive at the rig floor, Operator 2 who, according to Operator 1, was seemingly satisfied with the pin position, then began the breakout procedure. He activated the torque arrestor, set the rotation knob to reverse, i.e., counterclockwise, set the speed, and began inducing torque. After observing that the tilted elevator links began to rotate counterclockwise, Operator 1 shouted to Operator 2 to “stop it.” He observed Operator 2 place his hand on the rotation knob in an effort to stop the rotation. The links were then noticed to suddenly stop rotating and then quickly begin rotating in a clockwise direction. The elevator then struck Operator 2, fatally pinning him against the draw works.

The company representative, who was on the rig floor at the time of the accident, said that immediately prior to the accident he heard a “very fast” clicking noise coming from the top drive during the time that the elevator links were rotating. He stated that he believed the noise was the result of the disengaged hydraulic pin striking the rotating teeth of the lower flange. He further stated that the noise was very loud and that he believed everyone on the rig floor heard the noise. Operator 1 said that he heard no unusual noise at the time of the accident. (For a picture of the accident scene, see Attachment 11; for a simplified schematic depicting the sequential rotation of the elevator links, see Attachment 12.)

Top Drive Function Test, Disassembling, and Observations The test and the disassembling of the top drive did not reveal any significant operational problems. However, during an examination of the top drive it was discovered that the hydraulic pin was slightly bent and the edges of the lower flange teeth were worn. (For pictures of the bent hydraulic pin and worn teeth, see Attachment 13.)

Conclusions

Cause

The Pride employee, referred to in this report as Operator 2, in attempting to stop the counterclockwise rotation of the tilted links and elevator, accidentally turned the rotation knob past neutral to the clockwise position, thereby causing the links and elevator to suddenly reverse direction and fatally pin Operator 2 as well as the control panel against the draw works.

Contributing Causes The contributing causes of the accident are as follows:

1. Prior to inducing torque for the final breakout attempt and after apparently attempting to confirm visually whether or not the hydraulic pin was engaged in the toothed lower flange, Operator 2 either:
 - a. Mistakenly perceived the pin to be engaged, or
 - b. Assumed that the pin was engaged, while not being able to determine conclusively whether or not the pin was actually engaged.
2. At some point during the reaming operation, the links were rotated toward the V-door and then tilted to allow the top drive to go farther down. The rotation lever, which is used to rotate the links, initially disengaged the pin and then rotated the links. After the rotation of the links, the pin did not successively reengage. Since the torque arrestors were not activated from the time of the previous makeup until the application of torque in the final breakout sequence attempt, there would have been no rotation of the links. Therefore, in addition to the indicator protruding from the pin housing, there was no other indication prior to the final breakout attempt that the pin was not engaged.

3. The driller's control panel was located within the sweep area of the tilted elevator links when the top drive was positioned near the rig floor.
4. There was no protective shield to prevent the tilted links and attached elevator *from coming into contact with the driller's control panel.*
5. The links and elevator are capable of rotating when the torque arrestor is activated, the top drive motors are engaged, and the hydraulic pin is not engaged in the toothed lower flange of the pipehandler assembly.

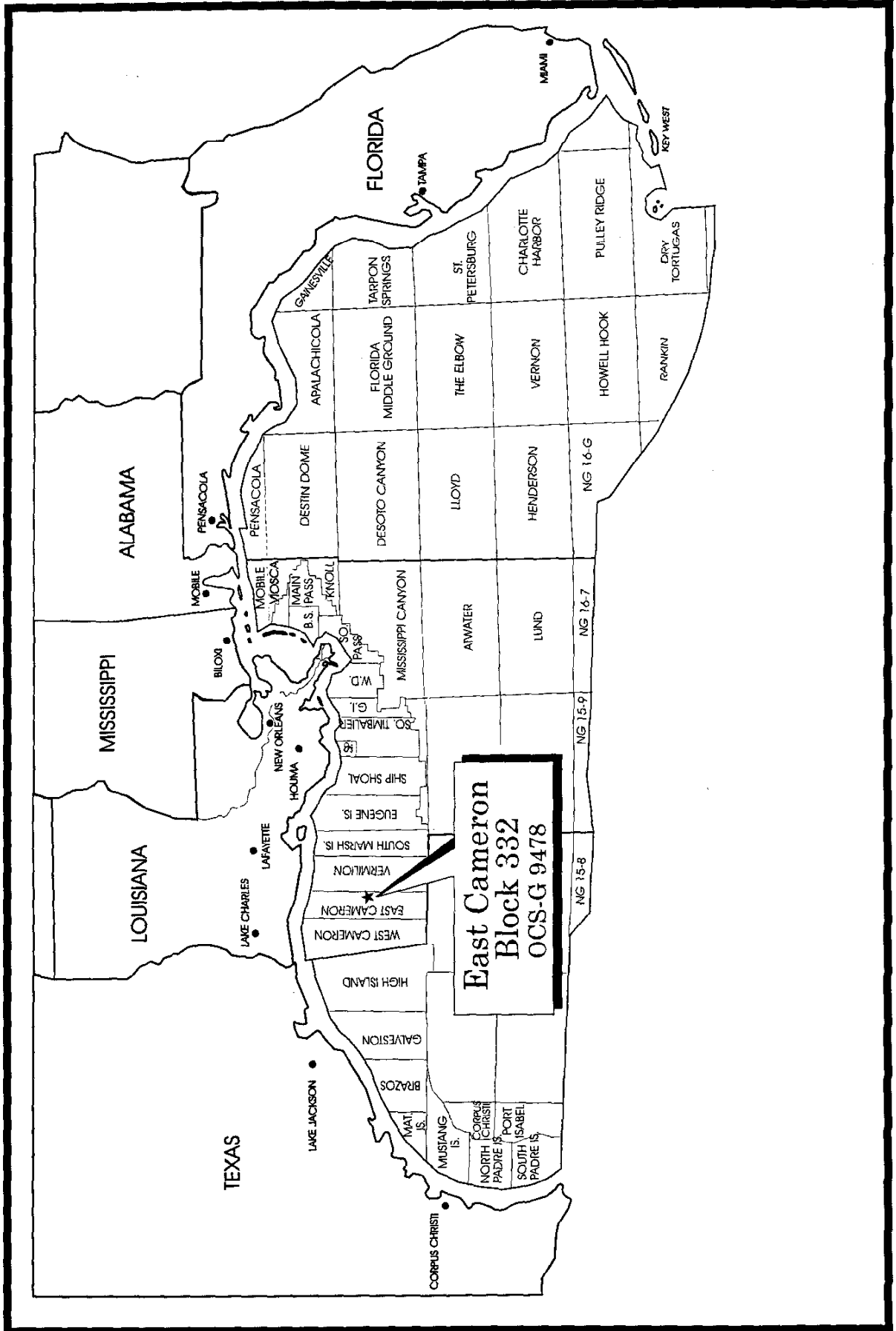
**Possible
Contributing Causes**

1. It is possible that, because of the time of day during which the accident occurred, it was difficult for Operator 2 to determine whether or not the indicator was protruding from the hydraulic pin housing.
2. It is possible that Operator 2's training preparation was insufficient with respect to the contingency of stopping the rotation of the elevator links of the top drive involved in this accident. Pertinent to this possibility is the fact that the use of the *rotation knob to stop the rotation of the links*, which is the only method that could have caused the reverse rotation, was described in a hearing statement by Operator 1, who was Operator 2's supervisor, as the method that he also would have used in such a situation.

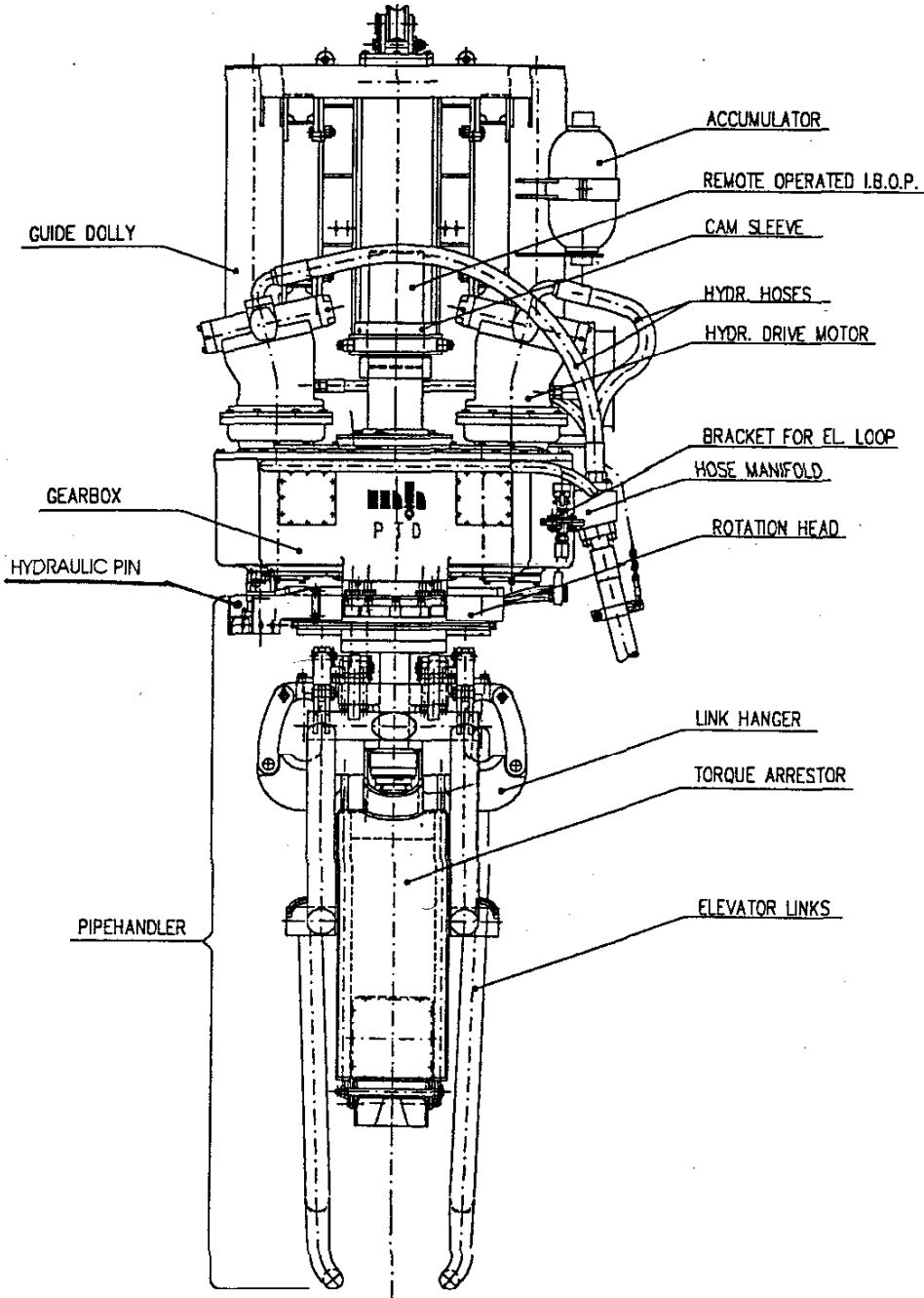
Recommendations

The MMS should issue a Safety Alert recommending that caution be exercised when using the type of top drive for which it is physically possible for the elevator links to rotate when the torque arrestors are activated and the top drive shaft is being made up to or broken out of the drill pipe. Specifically, the Alert should recommend to lessees, operators, and contractors that:

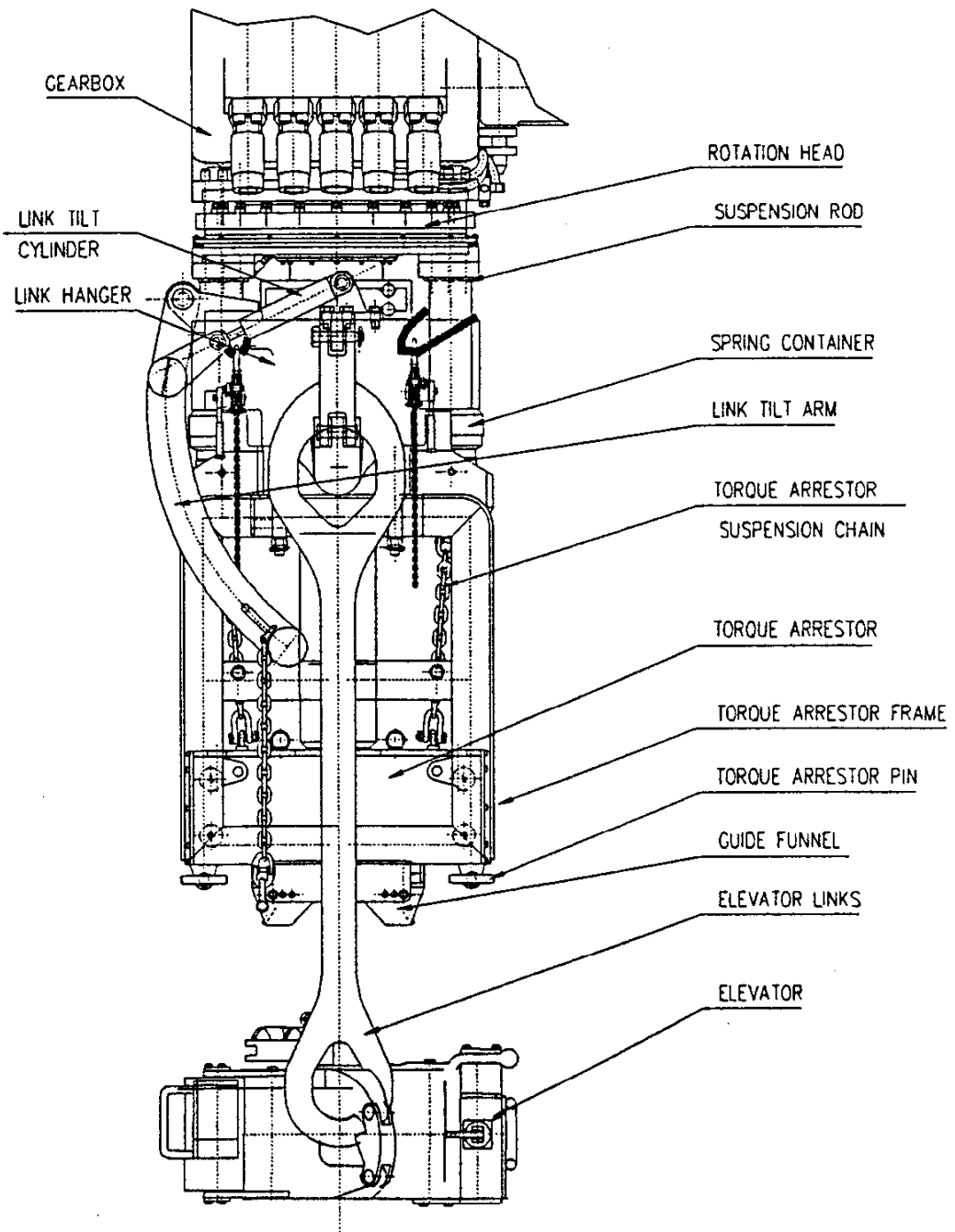
1. Operations personnel be made aware of the ability of the elevator links to rotate when the hydraulic pin is not engaged, the torque arrestor is activated, and torque is applied;
2. A safe procedure for stopping the rotation of tilted elevator links, should such a rotation be undesirable and/or unintentional, be incorporated into a prescribed operational procedures statement and be made incumbent upon operations personnel;
3. Every practical precaution be taken to shield the drilling control panel from tilted rotating elevator links; and
4. Consideration be given to the redesigning of the driller's control panel to accommodate an indicator that would conspicuously signal the disengagement of the hydraulic pin.



Location of Lease OCS-G 9478, East Cameron Block 332

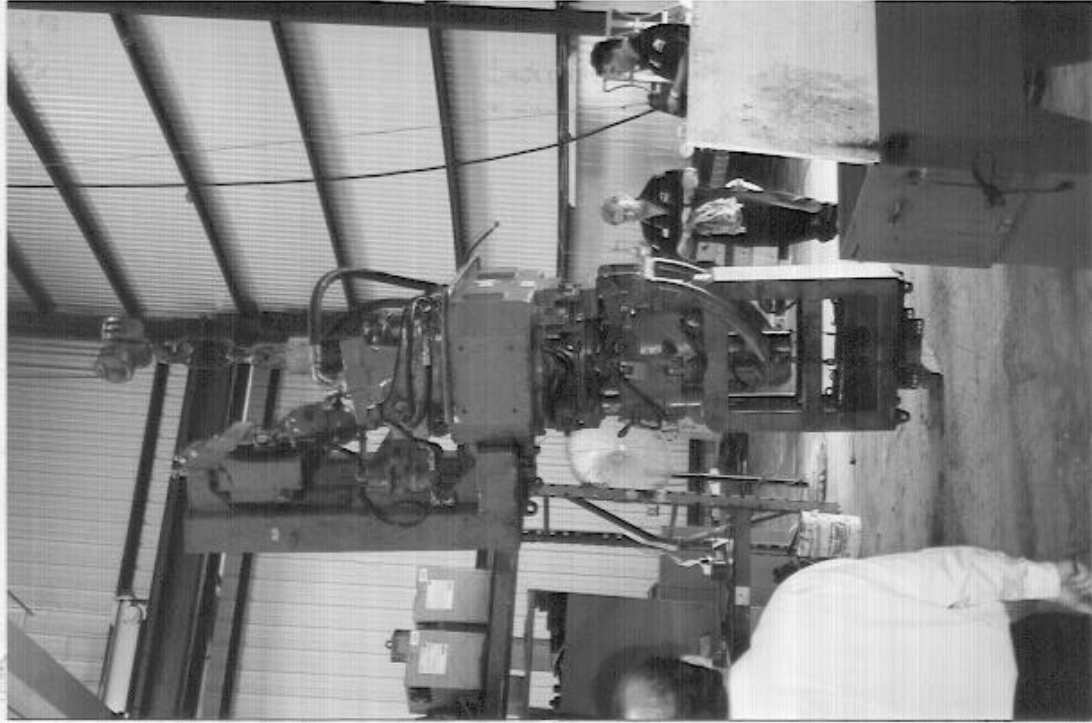


Schematic of Top Drive Unit (Without Elevator)



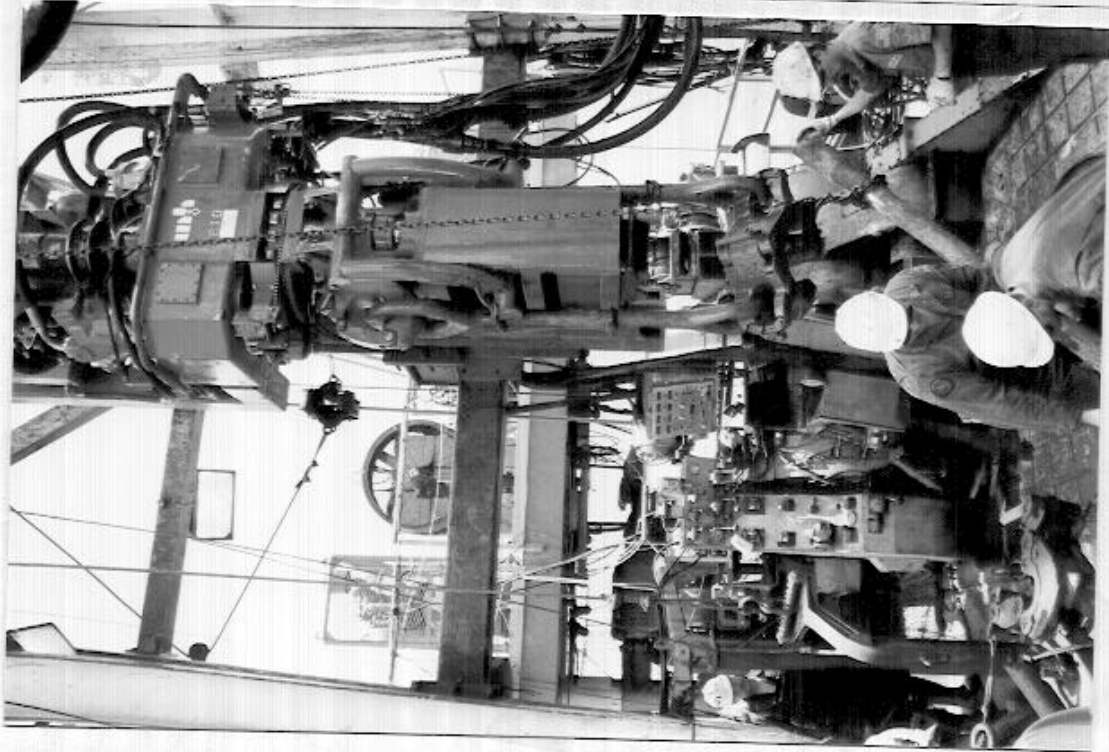
Schematic of Top Drive Unit

Photo 2



Top Drive at Maritime Facility

Photo 2



Top Drive at Accident Scene

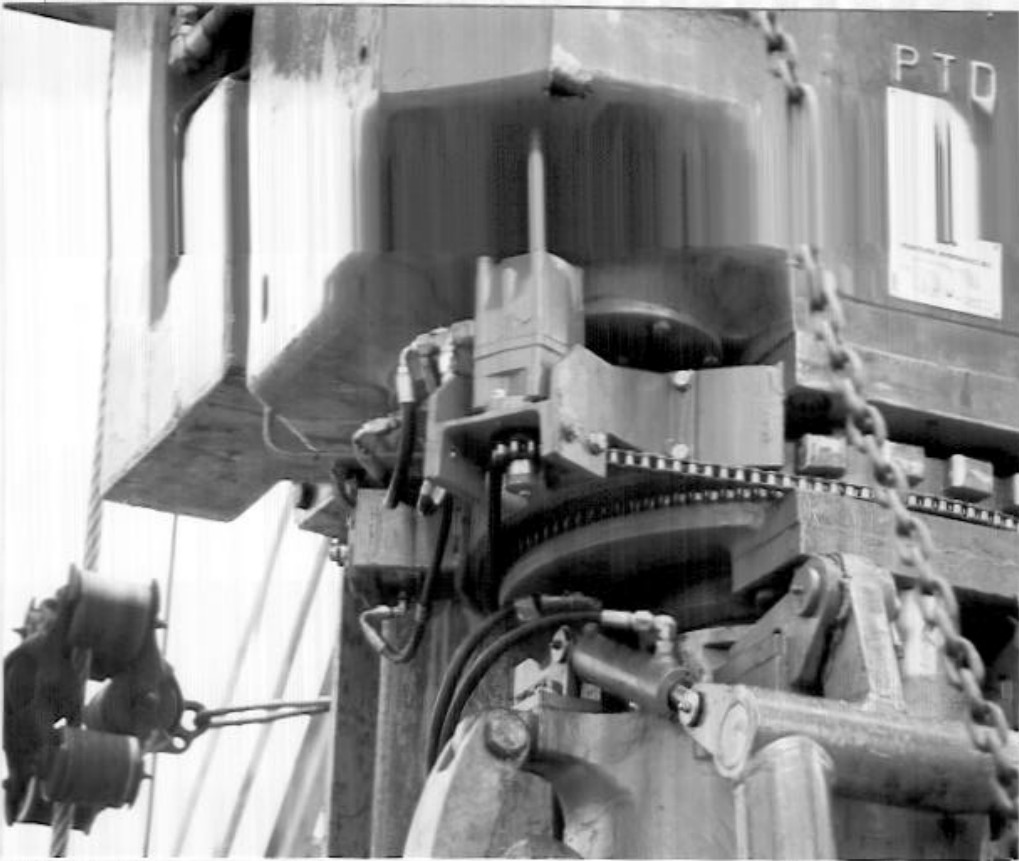


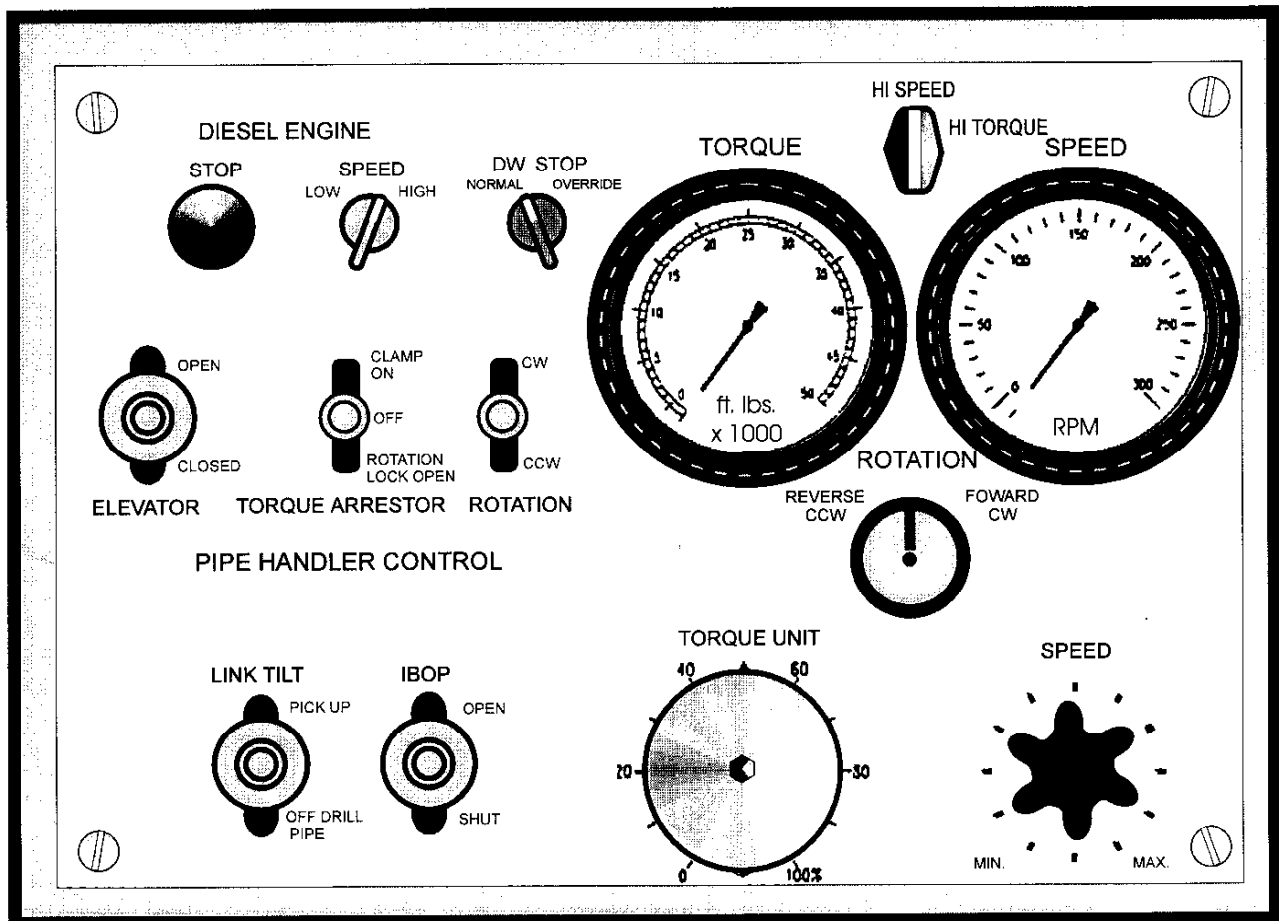
Hydraulic Pin and Housing



Hydraulic Pin and Housing

Photo 5





Schematic of Driller's Control Panel



Driller's Control Panel After Accident

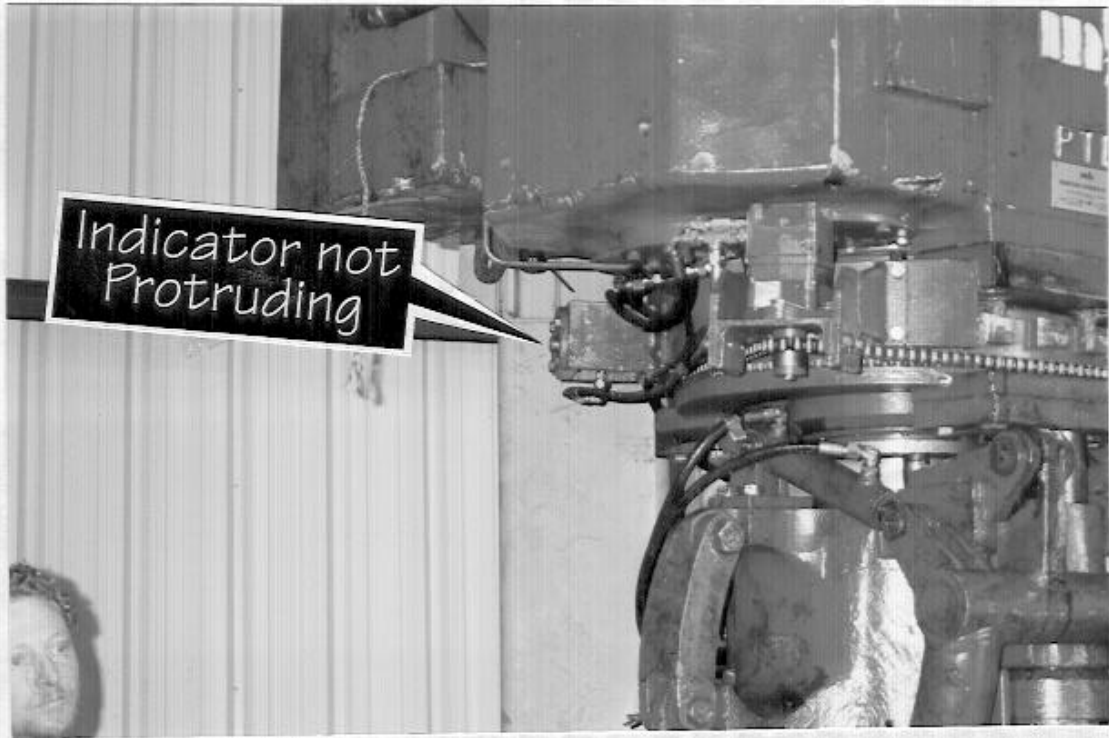


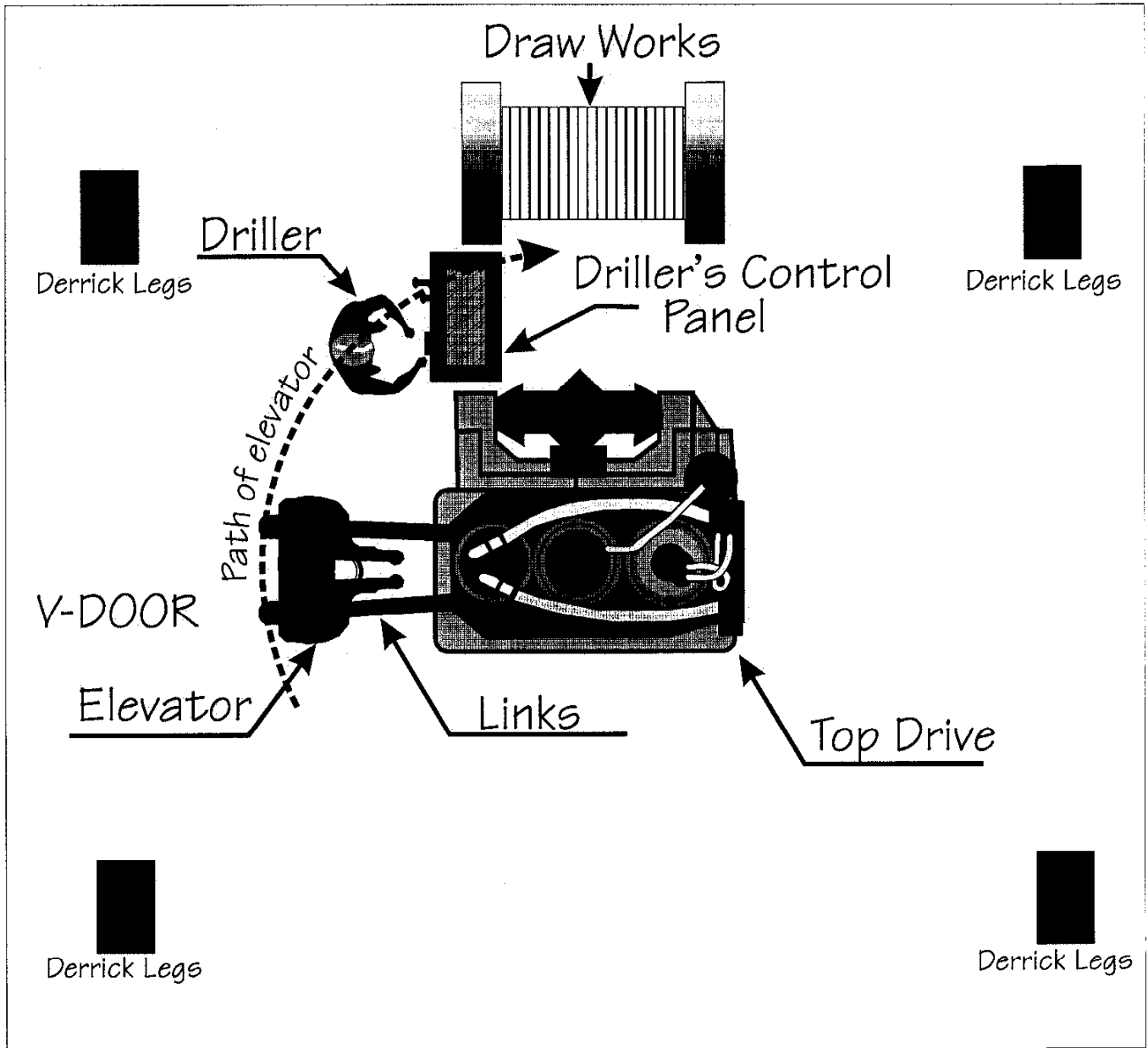
Photo 1

PIN ENGAGED — INDICATOR NOT PROTRUDING

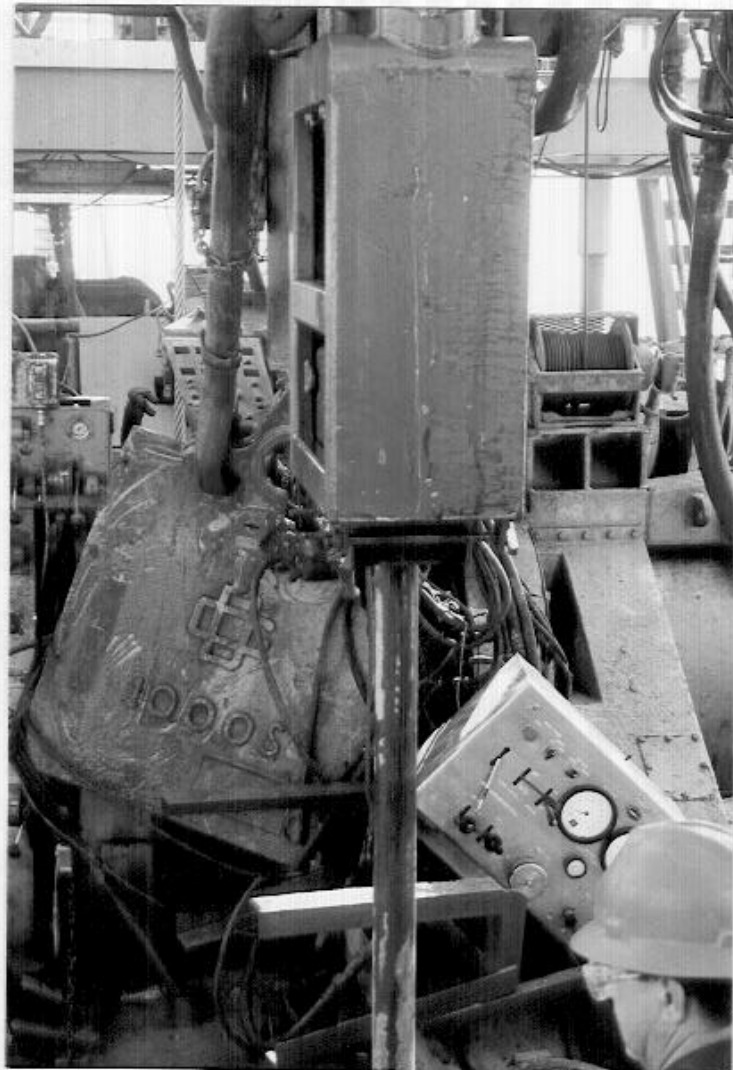


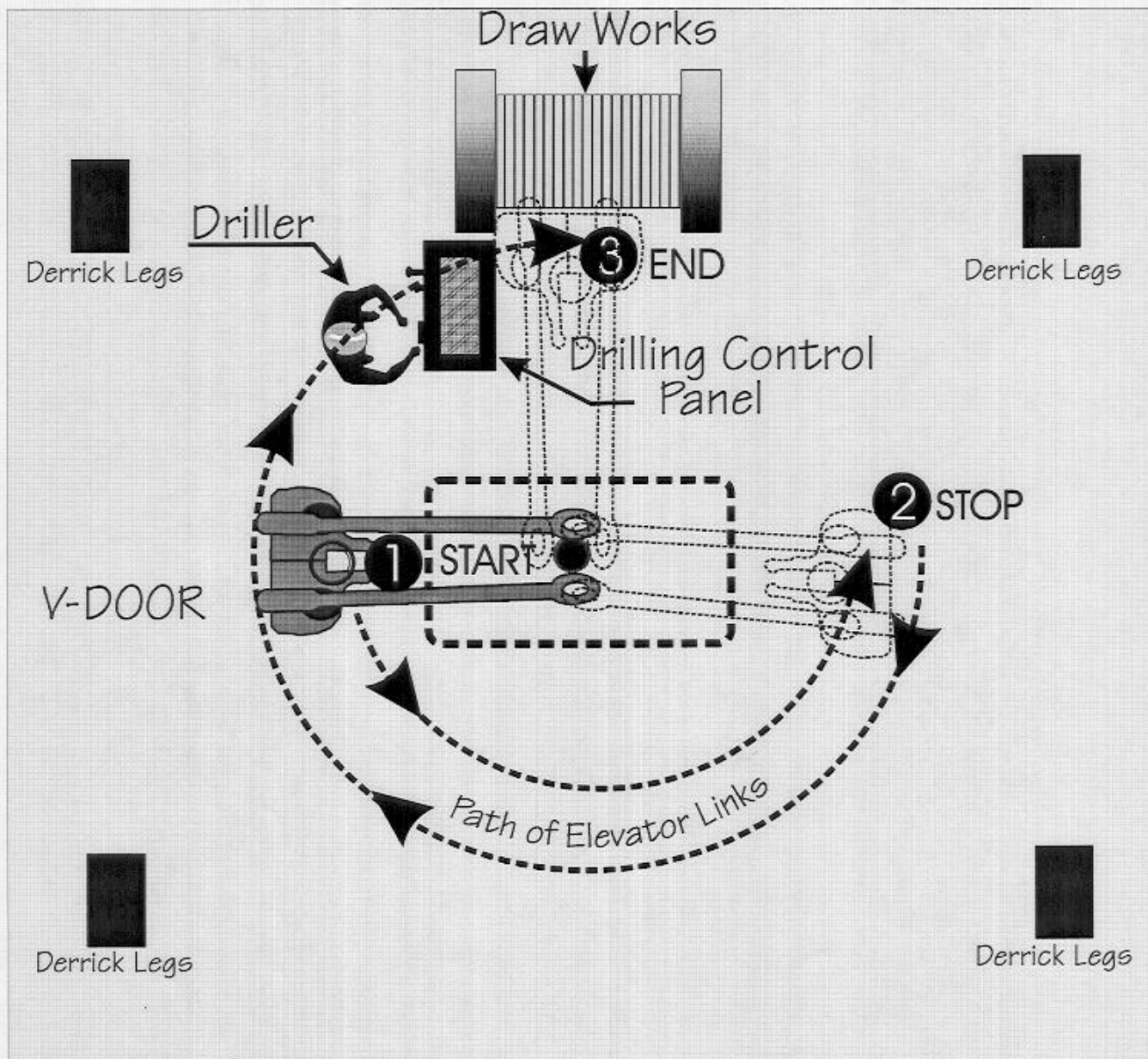
Photo 2

PIN DISENGAGED — INDICATOR PROTRUDING



Simplified schematic of rig floor (Not to Scale)





Simplified schematic of sequential rotation of links (Not to Scale)



Slightly Bent Hydraulic Pin



Worn Teeth on Lower Flange